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## Dates of Publication

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I. On the Quails and Hemipodii of India. By Lieut.-Colonel William Henry Sykes, F.R.S., L.S., G.S. & Z.S.

Communicated April 14, 1835.

I COULD wish that the amateur naturalist, with his specimen in his hand, might always be able to refer it, without much difficulty, to its family, its genus, and its species; but am afraid that, in very many instances, generic characters are not yet sufficiently exact, clear, defined, and satisfactory, to enable him to do so with the requisite ease. In these cases of difficulty, it is probable that there has been an unqualified generalization in establishing generic characters from a single specimen which furnished the type, or at the most from two or three species. But our rapidly increasing knowledge of the affinities, habits, and organization of animals will very probably enable naturalists, at no distant period, to give that precision to generic characters which will admit of the object I have contemplated being realized.

The early ornithologists (and in this they have generally been followed by those of more recent date) adopted external characters—form for generic, and plumage for specific, distinctions—as the chief guides to arrangement and identity: and in the majority of instances, these appreciable data have established legitimate distinctions which a subsequent knowledge of habits and organization has confirmed. Of the truth of this, Mr. Vigors's able arrangement of the groups of birds from external organs and form bears ample testimony. But still, in my experience, I found external characters not altogether sufficient when collating species which were not the types of the genus. I instance the family of the Tetraonidae. It appeared to me that some generalizations were too sweeping; the form and habits of the typical species seemed to be made too sub-
stantive, and required to be put forth with certain explanations, or exceptions, or limitations. They might be quite true (indeed for the most part were so) with respect to the typical species, and possibly to a few others of the genus; but were not so to the remaining species, whose deviations in the form of the bill, wing, &c., might not only be appreciable, but be so marked as to justify, in the eyes of rigid systematists, their removal into distinct genera: but which removal, nevertheless, the habits and natural affinities of the birds would not authorize. Some of the Quails I am about to describe afford a conclusive instance of this difficulty: and other instances will appear in the following preliminary observations which I deem it necessary to make in justification of the arrangement I have adopted.

If it be asked, what characters justify the union of animals into genera, and what characters should separate them? I reply, that the question necessarily embraces so wide a field of inquiry, that it cannot come within the contemplated limits of this paper: but, for the sake of illustration, I shall offer a few comments, which, if they do no more, will at least show that exceptions have some weight; and these I shall take chiefly from the Tetraonidae.

If the form alone of the bill is to unite birds, then would some species of Francolins, Partridges, and Quails afford one common type, while other species of these genera would be widely separated. The birds I designate as Coturnix Argoondah and Cot. Pentah would belong to a different genus from Cot. dactylisonans and Cot. textilis, and Cot. erythrorhyncha would stand alone. On this character, Pterocles would probably be removed from the family of Tetraonidae, to an intermediate station between it and Columbidae. If the form, and number, and size of the toes and nails be our guides, then would Hemipodius and Cryptonyx have the most appreciable characters in Tetraonidae: but these might suggest the removal of the former into the family Struthionidae and genus Otis; and, indeed, the similarity of the tongue and ceca, and the habits of the Hemipodii and Bustards would partly authorize the change. But so little does the presence or absence of a hind toe influence form, habits, organization, and affinities as a general rule, that I found it absolutely necessary to class Charadrius bilobus and Vanellus Goensis in the genus Vanellus, the former having four toes, the latter only three. There is also no natural affinity between the Bustards and some of the smaller Plovers, particularly Charadrius Philippensis, both with three toes; yet there is a very close affinity between the latter and the Sandpiper (Totonus) a four-toed bird.

Brisson made the combined characters of bill and feet his elements of classification. He says, "Les pattes et les becs sont les parties que j'ai choisies pour établir les caractères. Le nombre des doigts, &c." He has twenty-six orders, and his characters, for the most part, produce natural associations: but there are some genera in juxtaposition that have little or no natural affinity, such as Jacana and Rallus; Ciconia and Tringa. Vanellus is removed from the Plovers; Otis and Himantopus are associated; and the system would place Hemipodius near Ostralega: it approximates Parus and Alauda;
and places _Bucco_ and _Cuculus_ in adjoining sections. The _Woodpeckers_ and _Parrots_ are in the same order, and removed only a few sections from each other, although having only one common characteristic, the arrangement of the toes.

M. Temminck considers that the form of the wing, whether sharp or rounded, is sufficiently valid to characterize a genus; and he gives the following dictum to distinguish _Quails_ from _Partridges_ generically. "J’indiquerai préalablement le moyen le plus sur pour distinguer une caille d’une perdrix. Ce caractère marquant est pris de la forme des ailes. Tous les oiseaux qui composent le genre perdix ont les trois rémiges extérieures les plus courtes et également étagées entre elles, et la quatrième et cinquième les plus longues: tandis que chez toutes les espèces qui forment le genre coturnix c’est la première ou la remige extérieure qui est la plus longue. J’ai trouvé ce caractère invariable dans toutes les espèces."  

Vieillot similarly says, "Les cailles se distinguent spécialement de tous les précédents [Collins and Partridges] par la forme des ailes, et de la queue." But, in giving characteristics of the family _Gallinacei_, he says, "Tous, à l’exception des Gangas et de l’Hétérocéite, ont le port lourd, les ailes courtes et arrondies."

With respect to another distinguishing external character of the _Quails_, M. Temminck says that they have "les pieds à tarses lisses, sans éperons ou la moindre apparence de tubercule calleux." The males of my specimens, designated by me _Cot. Argoondah_ and _Cot. Pentah_, are furnished with distinct tubercles; and the varieties of the same two species, one variety from the Himalayan mountains, and the other from the neighbourhood of Madras, equally have them. With the greatest respect for M. Temminck’s judgement, I would submit to him that his generic characters separate from _Coturnix_ three of the species of _Quails_ described in the following pages; two of them having the rounded wing and tubercles of _Partridges_, but a much higher bill, while the third differs only from his _Coturnix_ in the rounded wing: birds, therefore, which all sportsmen unhesitatingly pronounce to be _Quails_, would be otherwise designated by naturalists, in consequence of variations in characters which do not modify their form or organization.

I doubt whether the true objects of science, and the due extension of natural knowledge amongst the non-scientific part of the community, are likely to be promoted by the multiplication of genera consequent on the above distinctions, and less so by the multiplication of species, when it is possible to avoid it. I would, therefore, always, where it could be done in other genera, as in the case of my _Quails_, instead of forming new genera to meet the deviations from the type, throw the species into sections, A, B, C, characterized "with rounded wing, and tubercles," "with rounded wing, no tubercles," &c.

If we look to habits and manners to afford us generic or specific characters, we should

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1 Pig. et Gall., tom. iii. p. 461.  
2 Gal. des Ois., tom. ii. p. 46.  
3 Ibid., tom. ii. p. 1.  
4 Pig. et Gall., tom. iii. p. 468.  
5 In the possession of the Zoological Society.
be careful to point out exceptions and limitations. M. Temminck, in his preliminary observations on the true Tetraonæ, says, "Ils diffèrent en cela des francolins, des colins, et des cailles qui sont oiseaux voyageurs." Again he says, "Les cailles vivent la plupart du temps solitaires; les jeunes se separent desqu'ils se sentent n'avoir plus besoin de la protection des parens; mais un même instinct les réunit subitement en association nombreuse, ce qui a lieu vers le temps de leur migration." These observations are applicable to a single species, Cot. dactylisonans, and with limitation even to this single species. I have compared the common Quail of Europe with specimens from China, from several parts of India, and from the Cape of Good Hope, and am clearly of opinion that they all belong to the same species; and others have thought the same before me. The only differences I could discover were in the transverse marks on the throat being more or less distinct, the minute spots on the breast more or less numerous, and the colours of the back of the Chinese Quail being brighter than in the other specimens. Numerous specimens varied also a little in size, as is the case equally in European individuals; yet this species, which is migratory in Europe, and which visits the coasts of France and Italy in such incredible numbers, M. Temminck admits to be stationary in the Isle of Roben at the Cape; and I can testify, from more than twenty-two years' residence in India, that it is found at all times in Dukhun and Goorjat: it is probable that it is also stationary in China. With respect to other species of Quails, we have not any satisfactory accounts that they are migratory; for though M. Temminck, on the authority, I believe, of Sonnerat, says that Cot. perlata, a native of Madagascar, goes to the eastern shores of Africa, yet as so little of the bird is known that the female remains to be described, it is not unfair to infer that the account of its habits is problematical. As far as my knowledge extends, none of the Quails described in the following pages are migratory from India.

With respect to other habits of Quails, M. Temminck says, "Les cailles vivent la plupart du temps solitaires." Again, "Les cailles sont des oiseaux peu sociables; le mâle après avoir fécondé la femelle s'en éloigne pour toujours." And further he says, "Hormis le temps de l'accouplement ou du voyage on voit rarement deux cailles réunies dans un même endroit." Unquestionably the above-described habits, together with M. Temminck's account of the monogamous character of Quails, are correctly applicable to the species Cot. dactylisonans; but my observation would not justify me in saying that they are applicable to the species textilis, Argoondah, Pendent, and erythrorhyncha, the last three of which are certainly always gregarious, and I fully believe polygamous. Even with respect to the first-mentioned species, the statement must be received cum grano salis: for it is notorious to all sportsmen in India, that when one Quail is flushed, a second is within a few paces; and as I have known thirty brace of Cot. textilis killed for a wager in one field of Phaseolus Max, within an hour and a half, it might hence

1 tom. iii. p. 106.  2 pp. 107, 108.  3 p. 107.  4 p. 464.  5 p. 108.
be inferred that it also is gregarious. There is at all times some risk of misconception in propounding generic characters from habits and manners when we have not a familiar acquaintance with the whole of the species.

M. Temminck says, "Les véritables perdrix n'habitent jamais les forêts, ils ne se perchent point habituellement."\(^1\) Again, "Toutes les espèces de perdrix francolins, sur lesquelles je suis parvenu à rassembler des notices sûres, vivent dans les forêts le long des rivières, se perchent sur les arbres durant le jour, et toujours pendant la nuit."\(^2\) And again, "Les tarses des males sont munis de deux ou d'un seul éperon."\(^3\)

In India the most common game bird in the country is designated, in books, a Francolin; that is to say, the Francolinus Ponticerianus. The males have spurs, and the bird sometimes perches on trees or bushes during the day, and frequently, if not commonly, during the night: yet it never inhabits forests, but almost exclusively gardens and cultivated lands; and has the form, air, and (with the exceptions above mentioned) the habits and manners, of the common English Partridge, Perdix cinerea. It is known only as a Partridge; and to call it by any other name to sportsmen in India would be looked upon as puerile pedantry. A living specimen now in the Gardens of the Zoological Society affords European naturalists an opportunity of satisfying themselves how little the bird has the air of a true Francolin.

Plumage, which can have little influence in generic distinctions, is of primary importance as a specific character; yet, used without mature consideration and a sound judgement, it greatly tends to the multiplication of fictitious species, and the consequent promulgation of error. I have long thought, and daily experience tends to confirm my opinion, that the researches of present and future naturalists will deprive discoverers of many of their honours in establishing new species of birds; myself, I feel satisfied, amongst others. Ignorant of the difference of plumage between individuals consequent upon sex, upon nonage, and upon annual changes connected with productive development, books abound with descriptions of supposed new birds which will ultimately merge into previously known species. Mr. Stephens somewhere mentions that the same bird is described under four different names in Dr. Latham's extensive work. But although plumage cannot supply generic characters, yet the experienced naturalist detects affinities in the extension or prevalence of particular colours or marks: for instance, the dagger-shaped stripe down the shaft of the back-feathers of the common Quail is found in Cot. textilis and in the New Zealand Quail\(^4\); in the Cot. excalactoria it is narrowed to a mere line; and it is traceable in their congener the Colin of America; in both species of the Cape Partridge it is broad and distinct, and there is a family plumage in the breast-feathers of these birds in a broad longitudinal white stripe down the shaft, which exactly corresponds with the markings of the Jungle Hen of India: the males have spurs like Francolins, but they have not their air. Characteristic family

\(^1\) p. 292.  \(^2\) p. 292.  \(^3\) p. 299.  \(^4\) New species.
plumage is seen in the Woodpeckers, although the species are from widely separated countries; and the Toucans are also remarkable for prevailing colours.

The above reflections originated in experiencing difficulties in the arrangement of my Birds of the Tetraonidae,—difficulties which I have shown that even M. Temminck's able elucidation of this family did not enable me to overcome. Naturalists are under great obligations to this distinguished person for the views he has promulgated in different branches of zoology; but with his acute mind and candour he cannot fail to admit that our daily increasing knowledge will produce trifling modifications in those views, rendering them more defined, perspicuous, and conclusive. I will endeavour to illustrate this in some short notices of the genera of his family Tetrao, which appears to afford proof of the truth of the observations of the Rev. L. Jenyns, in his remarks on genera and subgenera¹, that in raising subgenera to the rank of genera, sufficient attention should be paid to the necessity for the different groups having an equivalent or equal value.

In M. Temminck's family Tetrao, Coturnix is made as substantive a genus as Perdix²: yet, setting aside difference of size and some trifling differences of habits in some of the species of Quails, I do not know any positive and technical characters applicable to all the species, by which they may be distinguished from the Partridges; yet the eye will do at once that in which language fails. The Francolins again are not generically separated from the Partridges: yet they have characters (excluding the Francolinus Ponticerianus, which is decidedly a Partridge, although it does occasionally perch and has spurs), in their slenderer form, longer legs and tail, and particularly in their habits, which afford distinctions I think more legitimate than those used to separate Coturnix from Perdix. Lagopus has been separated from Tetrao by Ray, Vieillot, and Dr. Leach; but M. Temminck barely sections it from the latter genus.

Pterocles is a valid genus; but from its form, habits, and partly from its organization, I am strongly induced to believe that its natural position is between the Ptarmigans and Pigeons proper. The Heteroclite, it appears to me, will prove a species of Pterocles, with hirsute feet and toes arising from the climate it inhabits. M. Temminck only sections the Colins of the New World from the Partridges; but with the exception of the Ortyx Temminckii (Perdix cristata, Lath.), which has the air and size of a genuine Quail, I agree with Mr. Stephens, who has established the genus Ortyx, that it has a just claim to the distinction. The genera Cryptonyx, Tinamus, and Hemipodius, have characters too marked to render questionable their separation from the ancient genus Tetrao; but to me it appears matter of doubt whether the last genus, from its form, manners, and habits, might not merge into the genus Otis; or at least might be removed to the family Struthionide, and be placed immediately after Otis. Of the genus Hemipodius it will be necessary to say a few words.

M. Temminck commences his notice of it with a sentence which is likely to give a

¹ Proceedings of the British Association in 1833, p. 441.
² In his 'Manuel d'Ornithologie,' however, it is deprived of its honours.
wrong impression of the size of the birds constituting the genus. He says, "Ces pigmes parmi les oiseaux qui composent l'ordre des Gallinacés." These pygmies, however, by his own measurements of Hem. nigrifrons, pugnax, nigricollis, thoracicus, tachydromus, and lunatus, are about the size of Cot. textilis, and two inches larger than the Chinese Quail, Cot. exsaffactoria. My new species, Hem. Taigoor, is also as large as Cot. textilis; and the smallest of the genus, I believe, Hem. maculosus, is larger than the Chinese Quail. With respect to their habits and manners, M. Temminck says they are polygamous, and live in sterile lands and amongst herbage, and on the borders of deserts: that they prefer running to flying; and prefer to either, concealment in a tuft of grass, to escape pursuit: that they live principally on insects; and rarely touch minute seeds, and never grains.

These details are not exactly characteristic of the species that came under my observation, namely, Hem. pugnax, Taigoor, and Dussumieri: the first two species frequent cultivated lands, affecting the localities of Cot. textilis; and the last, the thick grass wastes which the Otis fulva delights in: it is also met with in fields. If polygamous, a male and several females should have been found together; but the first two species were generally solitary when flushed, or at most in pairs, and Hem. Dussumieri always solitary. With respect to food, black Ants and minute coleopterous insects and grass seeds were found in the stomach of several individuals of the first two species, and white maggots, minute insects, and seeds of the Panicum Italicum in the stomach of individuals of Hem. Dussumieri. This last species certainly prefers concealment to flight; but Hem. pugnax and Taigoor take to wing, although not very readily.

Not having been quite satisfied that external characters had enabled me to form a just and precise estimate of generic and specific differences, I sought in internal organization, and in the form of the tongue and the colour of the irides, for additional guides and evidences of affinities or dissimilarities; inferring that, although similar internal organization, in its functionary results, might not absolutely regulate external form and habits, yet with similar form, or nearly similar form, trifling differences in the organs would be indicative of differences of habits, and would thus probably manifest the proximate or remote relation in which the individual stood to the type of the group.

The stomach, the cæca, the proportional length of the cæca to the intestine, the proportional length of the intestine to the body, the tongue, and the colour of the irides, were the principal matters to which I turned my attention; but I did not overlook the other organs. My examination extended through one hundred and ninety-eight species of animals, and in most of the species several individuals had the internal appearances carefully recorded: slight sketches were also made of the cæca and tongue, and of any peculiarities in the other organs; and the colour of the irides was drawn.

It would lead me into too wide a field to give in the present paper the general, much

1 Pig. et Gall. tom. iii. p. 605.
less the detailed, result of my inquiries; and it must suffice to say that I quickly
found the tongue and the ceca of considerable importance in indicating affinities or
dissimilarities between genera. As an instance I may point out the Ciconia leucoce-
phala, which at this moment stands in ornithological works of the highest authority, as
an Ardea, but which its short tongue at once separated from that genus: and its double
short or rudimentary ceca, instead of a single short cecum, and the remarkable colour
of its iris contrasted with the prevailing yellow colour in the Herons, afforded further
proof of its distinction.

To be brief, and yet to afford sufficient evidence of my views connected with the
subject of the present paper, I have put into a tabular form some of the characters of
the Tetraonidae, which I consider likely to assist to give precision in the formation of
generic characters; and I have added those of a Dove and a Pigeon, for the sake of
comparison with the organs of Pterocles exustus. The very close resemblance in the
form of the tongue, the ceca, the proportional length of the intestines and ceca, and
the colour of the irides in the birds whose affinities are very close, is remarkable,
although there are some differences in the form of their bills. The Quails, the Par-
tridges, and the Francolinus Ponticerianus, have such trifling variations that the organs
noticed may be considered almost identical. When we proceed to the three-toed Hemi-
podii, we find with similar tongue and ceca, a more elongated form of bill, and a dif-
ferently coloured iris: the tongue and ceca indicate similar habits with the Quails and
Partridges; but the colour of the irides, the form of the bill, and the three toes, mani-
fest generic distinctions. Although I possessed many specimens of the Francolinus
spadiceus alive, and no doubt subjected them to the usual examinations, I observe that,
by some chance, the sketch of the ceca and the proportional lengths of the intestines
are omitted in my note-book. I cannot therefore, at this period of time, say whether
they correspond with the figure and measurements of those organs in the Partridges and
Quails; but as the real Francolin differs from them in habits, it is probable that there
is sufficient difference in the proportions if not in the form of the organs to establish a
generic distinction.

Applying the test of all the above characters to Pterocles exustus, it is apparent that
it has the aspect, the tongue, and almost the bill, with the air and flight of a Pigeon;
and I observe, pigeon-like, that there is not, in my notes, any mention of a gall-
bbladder. But when we compare the remaining organs with those of Columba tigrina
or Columba Enas, we find that it has the ceca and iris of the birds of the Partridge
family; but the intestine and ceca are proportionally a good deal longer than in those
birds: it may be considered, therefore, intermediate between the Tetraonidae and Co-
lumbida. I may point out that, with the same form of bill and tongue, the Doves differ
from the Columba Enas in being totally destitute of ceca, the latter having rudimentary
ceca; and it is worthy of inquiry to ascertain whether this difference be constant be-
tween the Doves and Pigeons proper.
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<tr>
<td>Coturnix Peatah</td>
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<tr>
<td>Coturnix erythorhyncha</td>
<td></td>
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<td>2.6 to 2.7</td>
<td>7.64 to 7.94</td>
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<td>Hemipodius pugnax</td>
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<td>Hemipodius Taigoor</td>
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<tr>
<td>Name</td>
<td>Tongue</td>
<td>Ceca</td>
<td>Proportional length of intestine to body</td>
<td>Proportional length of intestine to ceca</td>
<td>Iris</td>
<td>Bill</td>
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<tr>
<td><em>Hemipodius Dussunieri</em></td>
<td><img src="image1" alt="Tongue" /></td>
<td><img src="image2" alt="Ceca" /></td>
<td>1.99 to 2.00</td>
<td>7.27 to 8.5</td>
<td><img src="image3" alt="Iris" /></td>
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<td><img src="image5" alt="Tongue" /></td>
<td><img src="image6" alt="Ceca" /></td>
<td>2.93 to 3.0</td>
<td>5.37 to 6.08</td>
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<td><em>Francolinus Ponticerianus</em></td>
<td><img src="image9" alt="Tongue" /></td>
<td><img src="image10" alt="Ceca" /></td>
<td>1.94 to 2.00</td>
<td>5.63 to 6.25</td>
<td><img src="image11" alt="Iris" /></td>
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<td><img src="image14" alt="Ceca" /></td>
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<td><img src="image15" alt="Iris" /></td>
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<td><img src="image17" alt="Tongue" /></td>
<td><img src="image18" alt="Ceca" /></td>
<td>None, or mere specks,</td>
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<td><img src="image22" alt="Ceca" /></td>
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<td><img src="image26" alt="Ceca" /></td>
<td>None, or mere specks,</td>
<td>2.0 to 2.13</td>
<td>2.27 to 3.27</td>
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Having in this paper ventured to call attention to some of the desiderata in the generic characters of part of the Tetraonidae, and having ventured to suggest the use of internal organization, as auxiliary to their formation, I will conclude with the assertion, that neither external nor internal characters (excepting size) have enabled me to fix such precise generic distinctions (applicable to all the species) as shall satisfactorily separate the Quails from the Partridges proper; and that I am reduced to the necessity of believing, with Theophrastus, that they are indeed dwarf Partridges: but as this very character is permanent through all the species, for the convenience of research they may be left with the honours of a family name; and to link the different species of Quails in common ties I propose the following modifications of the generic character of Coturnix, throwing anomalous species into sections.

Ordo III. RASORES, Ill. (Gallinæ, Linn.)

Fam. Tetraonideæ, Leach. (Genus Tetrao, Linn.)

Genus Coturnix.

Rostrum forte, capite brevius; mandibula superiore arcuatâ.

Nares laterales, basales, membranâ arcuatâ semiclausæ, anticè implumes.

Pedes tetradactyli; digitis anticis membranâ usque ad articulum primum connexi.

Cauda brevis, rotundata, recumbens.

Obs. Magnitudine ut plurimum Perdicis cinereæ dimidium paullo superantes.

A. Mandibula superiore parum arcuatâ; alis acuminatis; tarsis muticis.

1. Coturnix dactylisonans, Mey.

Large gray Quail. Lohah and Lowah of the Mahrattas.

Although this species is well described by M. Temminck, I deem it necessary to put into an English dress some details respecting the Indian bird.

Bill short, brown, or blackish brown, sharp, wider than high, \( \frac{3}{8} \) to \( \frac{1}{2} \) inch long. Tongue fleshy, shortish, broad, but sharp-pointed. Legs pale or flesh-coloured. Tibia 1\( \frac{1}{2} \) inch. Tarsi 1 inch. Middle toe 1 inch. Nail \( \frac{1}{2} \) inch. Hind toe and nail \( \frac{1}{2} \) inch. Irides reddish brown or yellowish brown: in Shaw's 'Zoology' they are described as yellow. Head chocolate brown, with the feathers tipped reddish. There is a tawny or yellowish stripe over each eye, and a similar stripe down the centre of the crown. Ears reddish brown. Throat gray or tarnished white, but in old males there is a disposition

\footnote{1} Size, although very convenient to separate the Quails from the Partridges, cannot generally be admitted as an element in the formation of generic groups, otherwise the domestic Cat would belong to a different genus from the royal Tiger, and the Shetland Pony would be far removed from the colossal dray Horse.
to blackness under the chin: across the throat are two chocolate or black narrow bands (frequently interrupted in the middle) in a semicircular form, one originating near the gape, the other at the ears. Breast reddish, with one or two black specks on most of the feathers. Belly and vent reddish white. The long feathers of the flanks, under the wings, red chocolate, with a broad yellow stripe down the shaft, and some small blotches of black and yellow on the webs. Back, scapulars, back-neck, and rump, black or deep chocolate-brown, with a longitudinal dagger-shaped yellow stripe down the shaft of the chief feathers, and barred transversely with two or three very narrow yellowish bands. Wings brown or gray brown, with short narrow bars or dots of tawny on the outer web. Wing-coverts the same, with the addition of a thread-like yellow line down the shaft. Tail very short, and covered by the rump-feathers.

The female is larger than the male, and has the bars on the throat frequently obscure or wanting, and the specks on the breast are at times less numerous.

Nonage, and the different seasons of the year, produce slight variations in the plumage, but not to an extent to render doubtful for a moment the species of an individual. The black specks on the breast, I think, are more characteristic in general of the male than the female; but I have notes of several males shot in the valley of Sasswur, Poona Collectorate, totally destitute of specks, and some females had them.

The usual length of the female of this species, from the tip of the bill to the end of the tail, is 7 1/2 inches; but I have a female in my possession measuring 8 inches, inclusive of the tail of 2 inches, and in which bird the length from the tip of the bill to the end of the middle toe is 10 3/4 inches.

In five birds examined, the intestinal canal varied in length from 13 to 18 inches, the proportional length to the body ranging between 2·0 and 2·77 to 1. Duodenum wide. Colon from 1 1/2 to 2 inches. Ceca long and large, club-shaped, with a boss at the end, varying in length in different individuals only from 2 3/4 to 2 4/6 inches, full of green pulp. Liver of two fleshy lobes without fissures. Gall-bladder subreniform, full of deep black-green bile. Gizzard oval, compressed, the digastric muscles 3 1/2 inch thick. Spleen nearly globular, its greatest diameter being 7 1/2 inch.

Contents of the stomach, grass seeds, insects, much vegetable fibre, apparently the hairy calyces of Dolichos biflorus and the seeds of Phaseolus Aconitifolius. The species, indeed, appears omnivorous.

They are fond of tufts of grass round ponds, lakes, and in the neighbourhood of water-courses in cultivated lands, and irrigated young wheats. During the monsoon they are in pairs; and in October I have met with young broods unable to fly; the period of incubation, therefore, is during the rains (from June to October inclusive). I never found them congregated in numbers as if preparatory to emigration, and feel fully satisfied that the Bird does not at any season quit any part of India I have been in.
I have carefully examined and compared specimens from China, India, the Cape of Good Hope, and England, and must pronounce them, in spite of the extraordinary geographical range, to be one species, the differences between the specimens not being greater than are found amongst individuals from the same locality. The Indian Bird has the same cry of Pickering, or Peek-wheat-wheat, which, M. Temminck says, induced M. Meyer to give it the specific appellation of dactylisonans.

A matter of considerable historical interest is associated with this Bird, as there is the strongest ground for believing that it is the identical species, Tetrao Israelitarum, of whose instinct it pleased the Divinity to avail himself in supplying the famishing Israelites with food in the wilderness. Authors have differed with respect to the real nature of this food; Rudbeck asserting that it was a Flying Fish, and Ludolph that it was a Locust: but the 26th, 27th, 28th, and 29th verses of the 78th Psalm, determine it to have been a Bird. "He caused an east wind to blow in the heaven: and by his power he brought in the south wind. He rained flesh also upon them as dust, and feathered fowls [fowl of wing] like as the sand of the sea: and he let it fall in the midst of their camp, round about their habitations. So they did eat, and were well filled: for he gave them their own desire."

Bochart and Dr. Harris state that the Hebrew word used is Selav, in Arabic Selwee, or Selvai (a Quail), which is constantly rendered by the Septuagint ὀρτγωμέτρα, a large kind of Quail. Aristotle, indeed, calls the Rail (Rallus and Crex) Ortygometra: but on the whole it is to be inferred from Bochart that the Greeks used the word rather to indicate the size of the ὀρτγ than as descriptive of a different Bird; and Josephus considers ὀρτγωμέτρα and ὀρτγ synonymous, and states that Quails abound on the Gulf of the Red Sea; and we know that they abound in Egypt, Barbary, Asia Minor, and at certain seasons in Europe, at the present day.

There is another mode to connect the bird of Scripture with the Cot. dactylisonans, and this is readily done by the simple fact of its being the only species of Quail that migrates in multitudes; indeed we have not any satisfactory account that any other species of Quail is migratory. Aristotle mentions the habit; and Pliny states they sometimes alight on vessels in the Mediterranean and sink them! Belon found Quails alight in autumn on a vessel bound from Rhodes to Alexandria; they were passing from the north to the south, and had wheat in their craws. In the preceding spring, sailing from Zante to the Morea, he saw flights of Quails going from the south northwards. Buffon relates that M. le Commandant Godelun saw Quails constantly passing Malta during certain winds in May, and repassing in September; and that they flew by night. Tourne-

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1 Pig. et Gal. tom. iii. p. 501.
3 Natural History of the Bible, p. 317.
5 De Animalibus S. Scripturae.
6 Lib. iii. cap. i.
fort says that almost all the isles of the Archipelago are covered with them in certain times of the year. In the commencement of autumn such great quantities are captured in the isle of Capri near Naples, as in former times to afford the Bishop the chief part of his revenue; and he was called in consequence the Bishop of Quails. M. Temminck says that in spring such prodigious numbers of Quails alight on the western shores of the kingdom of Naples, about Nettuno, that 100,000 are taken in a day. They also arrive in spring in similar numbers on the shores of Provence so fatigued, that for the first days they allow themselves to be taken by hand. Sonnini states that they arrive in Egypt in September.

With these facts before us, considering the positive testimony of the Psalmist that the unexpected supply of food to the Israelites was a Bird, and that Bird, agreeably to the Septuagint and Josephus, a Quail,—that only one species of Quail migrates in prodigious numbers, and that species the subject of the present notice,—we are authorized to pronounce the Cot. dactylisonans to be the identical species with which the Israelites were fed. We have here proof of the perpetuation of an instinct through 3300 years, not pervading a whole species, but that part of a species existing within certain geographical limits; an instinct characterized by a peculiarity which modern observers have also noticed, of making their migratory flight by night. “And it came to pass, that at even the quails came up and covered the camp.” As might be expected, we see the most ancient and most noble of all historical works and natural history reflecting atesting lights on each other.

It is probable that these small defenceless birds fly only by night to avoid the attacks of birds of prey; in crossing seas they must of course continue their flight by night as well as by day. I am aware, however, from personal observation, that the Grus Orientalis, whose size secures it from the attacks of other Birds, also migrates during the night. M. Temminck thinks it probable that Quails emigrate for food rather than to enjoy a uniform climate; and in this opinion I coincide, as the great changes of temperature in India do not influence the movements of this species, food being abundant at all seasons.

I am not aware that this Bird is used for combats (although a species with tubercles is) in India; and it is not likely the people would warm their hands with it, as is said to be the case in China.

From some experience I consider Quails very heating food; and it is probable the French proverb, “Hot as a Quail,” may apply rather to its stimulating properties than to its animal heat.

1 1491 years before Christ.  
2 Query ‘night’?  
3 Exodus, xvi. 13.
2. Coturnix textilis, Temm.

This very handsome bird differs in some trifling respects from M. Temminck's description. Its medium size is a good deal smaller than the common Quail, although individuals frequently attain the magnitude of small specimens of the former. It varies in length, measuring from the tip of the bill over the crown to the end of the tail, inclusive of tail, from $6\frac{3}{6}$ to $7\frac{3}{6}$ inches; tail $1\frac{3}{6}$ to $1\frac{3}{6}$ inch. The colour of the bill differs in different individuals from a reddish horn colour to nearly black; length to the gape $\frac{3}{6}$ inch, depth at the nostril $\frac{3}{6}$ to $\frac{3}{6}$ inch. Irides dusky red or brown red.

The whole upper surface of the bird has a very close resemblance to Cot. dactylisonans, but the colours are generally brighter, and there are more feathers with yellow dagger-like stripes down the shafts. The under surface differs entirely from the common Quail; and, as I before mentioned, in some matters from M. Temminck's description. The chin and throat are pure white; the throat has two narrow semicircular black bands across it, and a broad longitudinal black band proceeds from the upper transverse band to the base of the lower mandible. The sides and fore part of the neck and the flanks are rufous. On the centre of the breast, in old males, there is a large patch of velvet black, which ramifies into a multitude of black stripes on the white belly and sides down to the vent. In younger males the black patch on the breast is small or broken into stripes.

The female differs in all the colours being less bright, in the absence of the longitudinal band under the chin, in the obscurity of the transverse bands, and in the black patch on the breast and stripes on the belly and flanks being broken into dots.

A friend, who is a sportsman and an amateur naturalist, has lately written to me from India, that he is satisfied that the Cot. textilis is the male of Cot. dactylisonans. As I possess both sexes of both species, it may be that my friend formed his opinion from finding specimens of females of Cot. textilis, resembling to a certain extent the female of Cot. dactylisonans; but they are always distinguishable by the inferior size of the female of Cot. textilis. The males of the two species cannot be mistaken for each other. I observe also, from a note in my journal, that the flesh of this species is brown, that of Cot. dactylisonans being white: this fact alone would indicate a specific difference.

In a male and a female examined, the intestinal canal was $11\frac{1}{2}$ inches long; the ceca club-shaped, $1\frac{3}{6}$ inch long; from the insertion of the ceca to the rectum $2\frac{3}{6}$ inches; the proportional lengths have been stated in the tabular view. The remaining organs were as in the other species.

Grass seeds, vegetable fibre, and other vegetable matter, apparently the calyces of different kinds of pulse, found in the stomach.

These birds are met with all over India, and I have seen specimens which were abso-
lutely identical from Bengal, Madras, and Dukhun. In the monsoon, which is the period of incubation, they are in pairs; but at other seasons they are frequently found in great numbers in the same localities. So abundant are the different species of *Quails* in Dukhun, that in April 1829, five hundred and seventeen brace were killed in nine days by four guns.

B. *Mandibulâ superiore parum arcuatâ; alis rotundatis; tarsi muticis.*

3. *Coturnix erythrorhyncha.*

Tab. I.

Cot. suprâ saturât brunea, infrâ dilutât castanea, nigro (prâter ventrem medium) undequaque guttata maculataque, scapularium maculis maximis, pectoris guttis minimis; scapularium tegminunque alarum superiorum albo fasciatarum rhachibus albis, crucem efformantibus; remigum pagonii externis rufescenti fasciatis maculatisque; fronte nigro; strigâ frontali utrinque supra oculum productâ gulâque albis.

Fœm. Fronte, strigâ inde ad utrumque latus ductâ, gulâque dilutâ castaneis. *Irides* obscurâ flavo-ochraceâ; *rostrum* rubrum.

Long. corporis 5 unc.; caudae 1½v.

This very handsome bird I have never met with out of the valley of Karleh in the Ghâts, frequenting the same ground as the *black Partridge*, *Perdix picta*. But there is a single specimen in the British Museum, from whence I do not know.

The bill and legs are red, which colour nearly disappears in dried specimens. The tongue is the same as in other *Quails*; the *irides* are of a brownish yellow-ochre colour. The *tarsi* are totally destitute of any tubercle or rudimentary spur. The whole crown and base of the under mandible are velvet black; the throat is pure white, and a white bar passes across the forehead and is extended over both eyes to the back head. Whole upper surface of the body and breast rich chocolate brown, studded with lunules of velvet black; the feathers of the scapulars, wing-coverts, and secondaries with large patches of black; a yellow line runs down the shaft, which is crossed by one or two yellow lines. Wings red brown, spotted and barred with faint chestnut on the outer webs. Tail brown, spotted with black and barred with yellow lines. Lower part of the breast, belly, and vent rufous; each feather of the flanks with a broad spot of black, and tipped whitish.

The female differs from the male only in the absence of the black on the head and the white bar across the forehead, the latter being rufous; and in the throat, breast, and under parts being dilute chestnut, which on the breast is brownish.

In two males and a female, the intestinal canal was found to vary only from 13 to 13½ inches in length, the proportion to the body in these instances being respectively
as 2·60 to 1 and 2·70 to 1. Canal wide; *duodenum* barely wider; from the insertion of the *caca* to the *rectum* 1 2/3 to 1 ½ inch. *Ceca* thick, club-shaped at the end, varying in length in different individuals from 1 ½ to 1 ⅞ inch, and not exactly of the same length in the same individual. *Ceca* full of green pulp. Liver of two lobes, not equal in size; the left lobe with a deep fissure, and the right lobe ending in a long rounded process, as in the *Perdix picta*, or black *Partridge*, a peculiarity not observed in other birds of the *Tetraonidae*, excepting the *Hemipodus pugnax*. I did not observe a gall-bladder, but traces of gall. Spleen ovate, ½ inch long, situated on the right side of the *proventriculus* at its junction with the gizzard. Stomach oval, compressed, muscular, digastric muscles ⅞ inch thick, constituting a true gizzard. *Testes* very small, oblong, ⅞ inch long only. Eggs numerous and very minute.

Stomach full of grass seeds, with a few seeds of *Ervum Lens*.

Length of the bird, inclusive of the tail, 6 ½ to 6 ¾ inches: tail 1 ⅞ to 1 ⅞ inch: bill to the gape ½ to ⅜ inch; height at the nostrils ⅞ to ⅞ inch: *tibia* 1 ⅞ inch: *tarsi* 1 inch: middle toe ¼ inch, nail ⅞ inch; hind toe and nail ⅞ inch, rarely touching the ground.

C. *Mandibulda* superiore validè arcuata; *alis* rotundatis; *tarsi* tuberculatis:

4. *Coturnix Argoondah*.

*Rock Quail of Dukhun.*

Tab. II.

*Cot.* suprà *rufescenti-brunnea*, *fascis* angustis dilutè *ferrugineis* notata; *infra* sordidè *alba*, *fascis* *equidistantibus* *nigris*; *fronte* *mentoque* *ferrugineis*; *strigà* *superciliari* *rufescenti-albìdd*.

*Foem.* *Infra* dilutè *ferruginea*; *fascià* *nullà*.

*Iridès* *fusco-rubrà*; *rostrum* *nigrum*.

*Long.* *corporis* 5 unc.; *caudè* 1 ½.

There are so many trifling variations in the markings of the plumage of the upper surface of this *Bird*, that it is difficult to fix upon the exact type. The male is readily distinguished by the numerous transverse narrow black bars upon the breast; but the young males and the females want these bars, and vary so much in the markings on the back, that with those disposed to manufacture species from plumage alone, the eleven specimens before me from Dukhun would furnish at least four new species.

This *Bird* affords another instance of the insufficiency of the received generic characters of *Coturnix* to embrace all the species of *Quail*. It has a bill higher than broad; and in respect to the *common Quail* and *Partridge* the bill is comparatively short: it should therefore be neither *Quail* nor *Partridge*. It has the rounded wing, and agreeably to
M. Temminck, cannot be a Quail, but may be a Partridge; but having rudimentary spurs it might be a Francolin, save that it never perches. With the size, the air, the internal organization, the general habits, and common characteristics of a Quail, would the objects of natural history be advanced by constituting it the type of a new genus? I think not, and have therefore preferred throwing anomalous species into sections to instituting genera for them.

The following is the description of the sexes in a mature state. Bill black, short, compressed, higher than wide. Upper mandible the segment of a circle. Tongue of the same form as in the other species. Legs and toes reddish. Irides reddish fuscous. Whole upper surface rufous chocolate brown, barred with lines of yellowish dilute tawny, edged with thread-like lines of black, and every feather freckled with the most minute black dots; on the scapulars, secondaries, and wing-coverts, are a few scattered and irregular blotches of black: feathers of the head and back neck tipped with black: tail barred with black, brown, and tawny: primary and secondary quills barred with tawny, principally on the outer web: forehead and throat rufous, the latter with a spot of white at the bottom of the rufous: over each eye a line of reddish white, continued to the back neck: cars chocolate brown. Whole under surface of the body white, barred with numerous parallel velvet black bars: a shade of rufous on the thighs and flanks. Under wings uniform pale brown, without spots. The female differs from the male in the whole upper surface of the body being destitute of any marked yellow or tawny bars, or black blotches; and a superficial view leads to the belief of its being of a uniform rufous brown: but a closer inspection shows that each feather is crossed with thread-like zig-zag lines of black and tawny, composed of the minutest dots. Head brown: throat and whole under surface dilute rufous light brown, faintest at the vent. Female without tubercles on the tarsi. Both sexes have the feathers of the thighs, vent, and under tail, long and downy.

The varieties, in eleven specimens, consisted in adult male Birds being destitute of the black blotches on the upper surface, black bars on the tail, and black tips to the feathers on the back neck, but having the tawny bars. One adult male exactly resembled the female on the upper surface in the absence of distinct markings, but had a more rufous shade of plumage. A female had faint black bars on the breast. Had these Birds come to hand as isolated specimens, they would probably have been considered distinct species.

There is scarcely any difference in the size of the Birds, males or females. The measurements are, bill to the gape \( \frac{2}{3} \) to \( \frac{3}{4} \); depth at the nostrils \( \frac{1}{4} \) to \( \frac{3}{4} \) inch: tip of bill to end of tail \( 6\frac{1}{8} \) to \( 6\frac{1}{2} \) inches: tail \( 1\frac{3}{4} \) to \( 1\frac{5}{8} \) inch: tibia \( 1\frac{7}{8} \) to \( 1\frac{5}{8} \): tarsi \( \frac{1}{4} \) to \( \frac{1}{2} \) inch: middle toe \( \frac{1}{4} \) inch, exclusive of nail of \( \frac{1}{4} \) inch; hind toe \( \frac{1}{6} \) to \( \frac{1}{5} \) inch, nail \( \frac{1}{8} \).
Grass seeds only were found in the stomach.

These *Birds* do not frequent cultivated lands, but are found all over Dukhun on the general level of the country, amidst rocks and low bushes: they rise in coveys of from ten to twenty, or more, from under the feet, with a startling suddenness and bustle; and the young sportsman is perplexed in selecting his bird. They are gregarious, and I infer polygamous, as I never saw them solitary, or in pairs. Flesh perfectly white.

This is the species used for *Quail* fights by the natives, and not *Cot. dactylisonans* or *textilis*.

5. *Coturnix Pentah.*

*Mountain Quail.*

Tab. III.

*Cot. suprâ saturât brunnea; infrâ rufescenti-albida nigro fasciata; ventre crissoque albido-ferrugineis; interscapulio scapularibusque nigro maculatis, plumarum rhachibus dilutè flavis; remigibus brunneis pallidè ferrugineo maculatis; strigid superciliaris sordidè albâ; mento rufescente.

Fœm. *Infrâ rufescens, haud fasciata; plumarum rhachibus albis.*

*Irides ochraceo-brunnea; rostrum rufescenti-brunneum; pedes flavescentes.*

Long. *corporis 5½ unc.; caudâ 1½.*

Bill as in the last species, but stouter, and reddish fuscous instead of black; tongue as in other *Quails*; legs yellowish, with a red tinge; *tarsi* of males with tubercles. Whole upper surface of a rich reddish dark brown, maculated rather than barred with obscure rufous. The feathers of the scapulars, wing-coverts, and secondaries, are ornamented in a remarkable manner: most of the feathers of the scapulars have a yellow or tawny cross on a velvet black ground, the lines of which cross swell or thicken at the intersection; the feathers of the wing-coverts and secondaries have one transverse arm of this cross shortened or wanting; and instead of the whole field of the feathers being black, this colour is confined in most of the feathers, though not in all, to the lower interior intersection of the arms, the remaining three places of the cross being rufous brown. Shafts of the feathers on the back neck and back white. Tail barred with a few narrow bars of black. A reddish white line over each eye edged with black; also a faint whitish line going back from the gape. Throat deep rufous. Whole under surface white, barred with parallel narrow black bars, the bars disappearing towards the vent and the ground colour becoming rufescent. Primary quills spotted on their outer web with tawny.

The female differs from the male in the whole of the under surface, from the chin to the vent, being brownish dilute rufous, part of the shaft of each feather being white: in some specimens there is a faint disposition to transverse black bars on the breast. The
upper coverts of the tail have also some yellow dots down the shafts, and the bars of the tail are more obscure than in the male.

Like the last species, these birds have the feathers of the thighs, vent, and under tail, long and downy.

Length of sexes $6\frac{3}{4}$ to 7 inches, inclusive of tail of $1\frac{3}{4}$ and $1\frac{1}{2}$ inch; bill to the gape, $\frac{1}{4}$ to $\frac{3}{4}$ inch; height at the nostrils, $\frac{3}{4}$ to $\frac{5}{8}$ inch; tibiae $1\frac{1}{2}$ to $1\frac{3}{4}$ inch; tarsi $1\frac{3}{4}$ to $1\frac{1}{2}$ inch; middle toe $\frac{5}{8}$ inch, inclusive of nail of $\frac{3}{4}$ inch; hind toe $\frac{3}{4}$ to $\frac{5}{8}$ inch, inclusive of nail of $\frac{3}{4}$ inch.

These birds are met with only on the mountains, on the slopes and sides of which they rise in coveys from amidst reeds and long grass and brushwood, with the same startling whirl, uttering cries of alarm, as Cot. Argoondah. My specimens were shot at 4000 feet above the sea.

Some accident has placed out of my reach the notes of the internal organization of this species, but I have not any impression upon my mind that it differed materially from the other Quails examined.

A male and female from the Himalaya mountains, belonging to the Zoological Society, are characterized by the peculiarities of Cot. Pentah, and are undoubtedly identical in species with it. Nevertheless, there are trifling discrepancies which are indicative of its distinct habitat; namely, in the blackness of the bill, greyish cast of the rufous brown of the plumage above, in the deeper tint of the rufous of the throat in the male and female, and in the female being of a uniform rufous below: if anything, the size is also somewhat greater, being from $7\frac{3}{4}$ inches in the female to $7\frac{1}{4}$ inches in the male, inclusive of tail of $1\frac{1}{4}$ inch.

In nine specimens of the same species from the Madras Presidency, probably from the table land of Mysore, the first feature is that of somewhat smaller size and less robust form than Cot. Pentah. Some of them have the black bill and greyish cast of the upper plumage of the Himalayan birds; others the reddish dark brown bill and rufous cast of the brown plumage of those from Dukhun: all the males have the black transverse bars, and the females the uniform rufous tint below, of the Himalayan variety; but three of the females have the deep rufous (almost dark chestnut or bay) throat of the male, while three others want this character. Six birds have the black blotches, yellow shafts, and imperfect yellow crosses on the scapulars and secondaries so characteristic of the Dukhun and Himalayan birds; while two others have the black blotches, but neither yellow crosses nor yellow shafts; and one specimen is destitute of black blotches, yellow crosses, and yellow shafts. Indeed, in two specimens only, and these are females, are the markings of the upper surface of the bird exactly like Cot. Pentah. One of the birds has so strong a cast of rufous above and below, has also so few spots of black on the scapulars and secondaries, and moreover has a bill approaching so nearly to
that of *Cot. dactylisonans*, although with a rounded wing, that I should have hesitated to consider it of the same species as the other birds, had it not formed part of the same batch. From these anomalies I would scarcely pledge myself that *Cot. Argoondah* and *Cot. Pentah* are absolutely distinct species: but my observations enable me to say that there are reasonable grounds for believing them to be distinct.

The above notices of the variations in plumage in twenty-two specimens of the same species from three distinct localities, afford ample proof of the extreme caution requisite in instituting species in consequence of the absence of certain markings, or on variations in plumage and type. Even in those birds of widely separated countries, which resemble each other in every respect excepting in some permanent blotch or blotches of black or white or other colour, or in certain band or bands, I would consider them rather varieties of the same species than distinct species, and would denominate them, from their locality, the China, Dukhun, Himalayan, or Cape variety.

M. Temminck¹ has given drawings of the *Perdix Cambayensis*. He says, "L'article que nous publions ici peut servir de preuve nouvelle que les publications trop précoce nuisent plus ou moins à l'étude de l'histoire naturelle." The accidental loss of a nail to the hind toe of a specimen induced him to consider it a *Cryptonyx*. I notice the drawings here because they resemble very much my *Cot. Pentah*, and yet have some of the characters of *Cot. Argoondah*. The drawings differ from my birds in having a white line down each feather on the back instead of the yellow cross I have described; in yellow instead of reddish-yellow legs; in the lower mandible being yellow instead of brown, and in the upper mandible brown instead of reddish fuscous. The colourings appear to me to be too strongly marked. It is stated to be from Bengal, but no account is given of its habits. I am not quite satisfied that my bird is not intended. M. Temminck's bird, however, is only 5½ to 6 inches long, whilst mine is nearly 7 inches.

**Genus Hemipodius, Reinw.**

1. **Hemipodius pugnax, Temm.**

M. Temminck's coloured figure of this bird², which he obtained from Java, gives a very good idea of it; and his detailed description in the 'Pigeons et Gallinacés'³, is sufficiently close not to require modification: the only omissions appear to me to be the mention of the yellowish white margins of the end of each feather on the back, and of the rufous of the mid-belly being separated from the black and yellowish white bars of the breast by a defined line. It is necessary to notice also the very rich character of the plumage above, consisting of a multitude of bars of chestnut, velvet black, and yellow white or straw colour.

¹ Pl. Col. 447. fig. 1 & 2. ² Pl. Col. 60. fig. 2. ³ tom. iii. p. 617.
The sexes do not differ in plumage. M. Temminck received several individuals from Java; and as they all resembled each other, he drew the just inference that the female could not differ much from the male. I mention this the more particularly, as the absence of varieties in his specimens will assist to justify me in considering the next-described bird as a new species.

The first four quill-feathers are nearly of equal length; but in some specimens they gradually lengthen from the first to the third, manifesting a disposition to a rounded wing.

I never met with *Hem. pugnax* in coveys. The birds were frequently in pairs, but mostly solitary. They affect cultivated lands, particularly chillee fields (*Capsicum annum*), and the resorts of *Cot. textilis*. Their flight is lazy and short, and they are not readily put to the wing.

The remains of black ants, minute coleopterous insects, and grass seeds, were found in the stomach.

The flesh is in layers brown and white.

The following are the measurements of a male and female: bill to the gape $\frac{7}{8}$ inch and $\frac{1}{6}$ inch; height at the nostrils $\frac{7}{8}$ and $\frac{7}{8}$ inch: length, inclusive of tail, $6\frac{1}{2}$ and $6\frac{1}{2}$ inches: tail $1\frac{1}{2}$ and $1\frac{1}{2}$ inch: *tibie* $1\frac{1}{2}$ and $1\frac{1}{2}$ inch: *tarsi* $\frac{1}{6}$ and $\frac{1}{6}$ inch: middle toe and nail $\frac{7}{8}$ and $\frac{7}{8}$ inch, nail barely $\frac{7}{8}$ inch; no hind toe nor rudiment of one.

The liver consisted of two lobes, each with a ligulate process, as in *Cot. erythrorhyncha* and the black Partridge. With this exception, the internal organization bore a close resemblance to *Cot. textilis*. The intestines were singularly tender, and 11 inches long: the *ceca* $1\frac{1}{2}$ inch long, club-shaped, and full of green pulp; their insertion was at $1\frac{1}{2}$ inch from the *rectum*. The stomach was very muscular. The *testes* and ovaries were distinctly marked.

The muscular stomach and proportionally long intestines, compared with *Otis*, would prevent its being placed in that genus; but its cursorial habits and the form of its bill would justify its displacement from the *Tetraonidae*, and it might come in after *Otis* in *Struthionidae*.

Its pugnacious qualities are quite unknown in Dukhun and even in Java.

The Zoological Society has a specimen of this bird from Madras. It would appear, therefore, to have an extended geographical range over the eastern islands and India.
2. Hemipodius Taigoor.

Tab. IV.

Hem. supra castaneus; plumis stramineo marginatis nigroque undulatim fasciatis; tegminibus alarum stramineis nigro fasciatis; remigibus fuscis; mento gulaque albis; pec- 
tore nigro alboque fusciato; ventre crissoque diluté ferrugineis.

Irides pallidè flavæ; rostrum nigrescens.

Long. corporis 4½ un.; caudæ, 1½ un.

I was at first disposed to regard this species as the immature bird of the Hem. pugnax; but finding the manifestations of sex fully developed, and some peculiarities of plumage permanent, I proposed it as a new species: and my opinion has been strengthened, as I before mentioned, by M. Temminck not meeting with it among his specimens of Hem. pugnax. It differs from Hem. pugnax only in its more slender bill, its white chin and throat, its dilute red instead of rufous belly and vent, and in the colours of the plumage being much less brilliant. It has the same chestnut, black, and straw-yellow bars and bands above, and the same black transverse numerous bars on the breast, although the latter are somewhat more slender than in Hem. pugnax. Its measurements correspond very closely with those of Hem. pugnax, but the bird on the whole is less robust.

I did not remark any peculiarity in the internal organization differing from the preceding species to call for notice.

3. Hemipodius Dussumieri, Temm.

Button Quail of European sportsmen in India.

This bird, which is not in M. Temminck's 'Pigeons et Gallinacés', is very well figured and described by him in his 'Planches Coloriées', excepting probably that the colours on the back are scarcely dark enough and rich enough. His specimens were obtained from Bengal.

Tongue as in the Quails. Irides yellow. Legs whitish. Sexes alike.

They affect thick short grass and fields of pulse of Dolichos biflorus, Phaseolus Max, and Errum Lens. I never found the bird otherwise than solitary. It is so difficult to flush, that it not unfrequently rises from beneath the feet; and when on the wing, its flight is so abrupt, angular, and short, that it is generally down ere the gun is well up to the shoulder.

The following are the measurements: bill to the gape ⅜ inch; height at the nostrils barely ⅓ inch; length from the tip of the bill to the end of the tail 5½ to 5⅛ inches: tail 1½ and 1¾ inch, very narrow and subulate: tibia 1⅜ inch: tarsi ⅞ inch: middle toe and nail ⅛ inch, nail ⅞ inch.

1 Pl. 454. fig. 2.
The intestine varied in length only from 8 to 8½ inches, and the ceca from 1 to 1¼ inch: the latter were inserted into the intestine at 2 inches from the rectum. The liver consisted of two lobes; but there was a deep fissure in the left lobe of one bird. Stomach muscular, oval, compressed; digastric muscle ⅛ thick, which was considerable for the size of the bird. Organs of sex minute. Eggs numerous, very minute. I do not observe any mention of a gall-bladder in my notes.
II. Descriptions of a few Invertebrated Animals obtained at the Isle of France.
By Robert Templeton, Esq., Corr. Memb. Z.S.

Communicated July 28, 1835.

The following paper is devoted to the description of a few Invertebrate Animals which were selected from the specimens I brought home with me from the Isle of France, and of which descriptions, as far I can ascertain, have not yet been offered to the public.

Genus Actinia, Linn.
Actinia sanguineo-punctata.
Tab. V. Figg. 1, 2.

Reddish brown, or yellow, with longitudinal rows of brilliant red dots, the interspaces being charged with minute concolorous points. The tentacula are subulate, hyaline, greenish brown with pinkish tips: from their base white streaks pass towards the centre, becoming lost in the depression which surrounds the truncate cone bearing the mouth. The mouth is very small, and has five blue patches coalescing and encircling it. The base is lobed, formed of a very fine membrane, which is thrown into folds by a set of internal, apparently muscular, partitions, which radiate irregularly from the centre.

This species appears hitherto undescribed. It is exceedingly pretty in the water, but never arrives at a large size, an inch being the utmost limit I have ever found it to attain. It is found on the rocks, beneath low water mark, nearly all round the Isle of France; but does not appear to thrive well where the water is much agitated by the wind or south-east swell.

Genus Xenia, Lam.
Xenia Desjardiniiana.
Tab. V. Figg. 3—8.

Xen. pallidè livido-cærulea; polypis 8-, rariùs 9-radiatis.

VOL. II.
Disc livid, or pale blueish, with a small corrugated mouth on a gently raised central eminence. Rays eight or nine, thick, fleshy, the discoid surface with numerous little bodies which resemble the suckers of the Sepia. Peduncle thick, corrugated into annuli when undistended, blueish with some lividity, gradually becoming carnose as it reaches the common soft cortical texture from which the peduncles all spring.

On stones below low water mark within the reefs, near Black River, Isle of France, not uncommon.

I have named this curious species in honour of my friend M. Desjardins, a distinguished naturalist, and the indefatigable Secretary of the Natural History Society of Mauritius.

The material from which the peduncles arise is spread over the surface of the stones to an extent in many places of more than a foot. It is about the eighth or tenth of an inch in thickness, though it is at parts occasionally much thicker, from the substance diving into the minute hollows of the stone, and yet leaving the outer surface without evidence of the depressions. When cut into it appears composed of irregular tubes interlacing in every possible way, and of various sizes. Among them, and apparently outside of them, I detected a vast number of minute whitish grains, spherical and polished, which I should have reckoned ova, but from the circumstance that little knobs were here and there apparent, which were obviously rudimentary peduncles, leaving no doubt of the mode of growth or propagation. Eight or nine (according to the number of the rays) of these tubes coalescing, and receiving a common covering from the base, form the stem, in the centre of which is found the alimentary canal, a distinct and separate tube, the inner membrane being corrugated and minutely papillated. On tracing these tubes up the peduncle, we find them compressed, so as to become somewhat quadrangular, but easily detachable from each other, a fine cellular tissue alone connecting them. Their inner surface resembles that of the central alimentary tube, except that they are destitute of the folds: they continue together until they arrive at the disc, when each separates from its fellows, and is continued into a ray, and ultimately sends a branch into each of the little suckers; it forms here, however, a cul de sac, there being no communication that I could detect with the external surface. The mouth is a simple fleshy ring when contracted, either forming a slit or three or four irregular plaits, but not more rigid than any other part of the animal.

The discs are perpetually in motion, waved from side to side, as if in search of objects; and the moment anything comes in contact with any part of the rays, the suckers or cilia close in upon it, and the ray doubles up like a finger, and carries the prey to the mouth: if the object be large, two or three of the rays are employed; and
if its size be such as not to admit of its being swallowed, it is again disengaged and permitted to escape.

The back of the rays and of the suckers or cilia is marked with transverse lines, pointing out the positions of the places where the greatest motion ensues on the curving up of these members.

**Genus Anisomelus.**

*Os tentaculis simplicibus octo, per paria dispositis, filiformibus,prehensilibus in-structum.*

*Branchiae*? simplices, tentaculiformes, pedibus haud multò longiores, in segmentis corporis quatuor anterioribus sitæ.

*Testa* cylindrica, calcarea, erecta, ad basin in saxis immersa.

**Obs.** *Numero et symmetriâ tentaculorum, necnon branchiarum simplicitate?, a Terebellâ cæterisque generibus affinitis distinguitur.*

Mouth simple, with numerous elongate *tentacula* surrounding the oral disc. Superior rings of the body presenting ventrally from six to ten small *tentacula* or *cilia*, which are, probably, the *branchiae*: the remainder each with a spatulate foot, from which project four spines capable of slight retraction.

Forming an erect calcareous tube partially immersed in the coral rock.

**Anisomelus luteus.**

*An. totus pallidè luteus.*

Yellow. *Tentacula* eight: one pair very short; another pair long; and an intermediate pair on either side of moderate length: dilating slightly towards their *apices*, and with transverse folds. Beneath the disc and the roots of the *tentacula* is a double circle of minute black dots, and a contracted part or neck, which stands out from, and is capable of being received into, the first ring. The rings of the body are only obvious in the undistended state of the animal: the three or four superior have minute arms, resembling *tentacula*, proceeding from them; the lower have on each side a somewhat spatulate foot, declining slightly, and from its *apex* project four elongate spines, which are capable of a moderate amount of retraction.

On the coral rocks, Black River, Isle of France.

This minute species forms for itself a thin calcareous tube, which stands up from the surface of the rock, but not a sufficient way to admit of the concealment of the whole body of the animal within it: in consequence, the tube is prolonged into the
substance of the coral, as becomes at once apparent when the attempt is made to remove the animal, the least touch breaking sharp off the exterior tube. When anything disturbs it, it immediately retires within the cell, the long tentacula being in many instances placed also within, along the side of the animal, but most usually permitted to float about in the water. When it comes out from the tube, it does not project further than about the fourth or fifth foot: it then swings itself from side to side, tossing the tentacula about; and whenever anything is discovered suitable for its food, the tentacula seize on it, as the Sapajous grasp an object with their prehensile tails, and it is then carried to the mouth, and is swallowed or rejected as the case may be. The tentacula have a vast number of annuli, and in their interior is discovered a tube in which oval globules are distinctly seen moving to and fro, as the motions of the tentacula affect a few adjoining joints.

Genus Piratesa.

Os tentaculis seu branchiis numerosis, longè ciliatis, subulatis, simplici serie dispositis cinctum.

Testa cylindrica, calcarea, erecta, e saxo parum prominente.

Obs. Genus propter tentaculorum branchiferorum dispositionem a Sabellà, Cuv., sejun-gendum.

Mouth simple, at the summit of a gentle elevation: oral disc with numerous ciliated tentacula. Beneath slightly contracted, so as to form a neck capable of being received within the first ring of the body. Body sharply annulated, the rings bearing each a flat spined pedicle or foot, that proceeding from the second ring being the largest: the last ring, forming the tail, very small and with three pedicles or feet, two lateral and one dorsal.

Forming a calcareous tube projecting a little way from the surface of the coral rock.

Piratesa nigro-annulata.

Tab. V. Figg. 15—18.

Pir. brunnea, tentaculis pallidioribus nigro confertim interruptè annulatis.

Near Black River, Mauritius, in the coral rock within the reefs.

Not being able to find any genus exactly suited for the reception of this little animal, I have, with a considerable feeling of doubt, created one for it. The orifice of the mouth is simply a round opening in the centre of the oral disc, with the edge a little elevated and lined with a flocculent membrane which is thrown into folds, and continues of the same
character down the centre of the body of the animal. The outer surface of the body resembles very much that of the common Lumbricus, but has numerous corrugations over the surface of the rings, which, however, become obliterated in particular motions of the animal. The tentacula have a double row of cilia, arising laterally from the superior surface, which turn in upon anything that is seized, so as to embrace it tightly: but when at rest, they are doubled up into little coils or knots, and are only expanded when the animal is searching for food. When engaged in this occupation, it elevates itself out of the tube, turns the disc down upon the adjacent part of the stone with very deliberate motion, and examines the surface with minute attention, the tentacula moving about, so as to ensure the entrapment of any minute objects which may rest there.

PLATE V.

1, 2. Actinia sanguineo-punctata.

Fig. 1. The entire animal.
   2. The oral disc, with several of the tentacula.

3—8. Xenia Desjardiniiana.

Fig. 3. Exhibits the appearance of the animal of about twice the natural size.
   4. Is an enlarged view, showing the mode of origin from the cortex.
   5. Exhibits the posterior surface of one of the rays.
   6. The superior surface.
   7. A section of the peduncle.
   8. A section just beneath the disc, showing the tubes branching off into the various rays.


Fig. 9. Represents the animal of the natural size.
   10. A magnified view.
   11. The superior rings, and inferior part of the disc, still more enlarged, to exhibit the dots, the neck, the small tentacula, and the feet.
   12. A foot, with its spines.
   13. Shows the proportion of the tube and globules in the middle of one of the tentacula.
   14. The apex of the same tentaculum.

Fig. 15. Represents the animal of the natural size.
17. Part of one of the *tentacula*, exhibiting the form and size of the *cilia*.
18. The tip of a foot with its spines.
III. On a Remarkable Species of Pteropine Bat. By E. T. Bennett, Esq., F.L.S., Sec. Z.S.

Communicated October 13, 1835.

A BAT that has just come into the possession of the Society, exhibits a character so striking as to authorize its being especially signalized: and it is with the view of directing general attention to so curious a creature that I offer a description and figure of it. To these I shall add occasional remarks on other animals with which it is connected by some of the more remarkable points of its external organization.

On the first glance at this Bat the attention is arrested by a singular projecting patch of long white hairs placed on each side of the neck in front of the shoulders, and looking almost like a mass of white feathers. They seem so unlike the rest of the fur and so different from any appearance usually observed in Bats, as to excite a suspicion that they are a deceptive introduction into the skin; an artificial attempt at the creation of a remarkable object, designed to be mistaken for a natural body of singular interest, yet having no real existence in nature. A close examination is induced by this supposition; and it then appears that these curious appendages really form part of the animal, and that, however incongruous their appearance and however uncommon their occurrence, they require to be considered with reference to it and to its congeners.

The oval patch on either side of the neck occupied by the white and peculiar tufts measures about an inch in its longest diameter, which is from before backwards. The skin is in this part altogether destitute of the ordinary hairs of the body, and has no covering but that which is peculiar to the spot itself. This consists of straight, soft hairs, which diverge in all directions as from a common centre. Those that are situated towards the middle of the patch are longer than the others, and are partly directed forwards and partly backwards, having generally a dorsad inclination: their length is twice as great as that of the longer hairs of the body. The mode of their insertion into the skin is unlike that of the ordinary fur: in the latter, the hairs are implanted either singly or a few only near each other, so that the covering by them becomes nearly uniform; in the patches on the sides of the neck the hairs are gathered together into bundles, and are inserted in fascicles into the skin, leaving between the several minor tufts interspaces altogether naked. Each of the separate fascicles contains probably from fifty to sixty hairs: and the approximation of these at their base and their divergence towards their tips might almost be regarded as bearing a distant analogical resemblance to the quill and the dilatation of the feather of a bird. The same
character of implantation in fascicles belongs to some of the shorter hairs on the verge of the white patches; which are also so far influenced by their proximity as to assume a portion of the colour that belongs to those parts, being white at the base and becoming towards the tips of the dull pale chestnut tinge that prevails on the body generally.

But although in the Bat under consideration the curious arrangement which has just been described exists at perhaps its maximum of development, it is not to be looked upon as being confined to a single species. It is found also, but to a much less extent, in the nearly allied animal, obtained from the same country and by the same collector, to which Mr. Ogilby has recently given the name of _Pteropus macrocephalus_. In the latter it is, however, so little conspicuous that it would scarcely fail to be overlooked if the attention were not especially directed to the ascertaining of its existence. The hairs of the sides of the neck in that species are of a pale dull fawn colour, are generally slightly longer than the adjoining ones, and pass insensibly into those of the under surface, which resemble them in all respects except in being paler. There is among them no mass remarkable either for its colour or for its length, or indeed for any extraordinary appearance. Yet among them there will be found, on separating the fur so as to allow of an inspection of its mode of insertion, a part in which the hairs are implanted in bundles; and it will be seen that the hairs so implanted have a tendency to diverge as from a common centre, which, however, on account of their softness, is by no means striking. The part at which these fascicled and diverging hairs are detected corresponds precisely with that of the white patches that deck the sides of the neck in the species that forms the subject of this communication; and the structure may consequentiy be safely regarded as analogous. M. Temminck has also described a corresponding structure in another species, designated by him, in his "Monographies de Mammalogie", as the _Pter. tittaceheilus_. He speaks of the males of his Bat as having on each side of the neck a tuft of hairs diverging from a common centre, which are white in the young animal, and become in the adult male (like the adjoining parts) of a bright red and eventually of an orange colour: and he believes that a similar arrangement exists also in the _Pter. amplexicudatus_. That eminent zoologist is of opinion that the tuft of diverging hairs on the sides of the neck in his _Pter. tittaceheilus_ cover a glandular apparatus for the secretion of an odorous substance, which may probably afford indications to these animals in the season of their amours: and he suggests as analogous cases the cavity on the forehead of _Rhinolophus Speoris_, Geoff.; the opening on the chest of _Phyllostoma hastatum_, Ej.; the little cavity under the throat of _Dysopes velox_, Temm.; and the large pouch beneath the chin of _Taphozous Saccolaimus_, Ej.

The view which has been taken by M. Temminck of the purposes for which this apparatus is designed is probably correct: if the possession of it be limited, as he

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2. tom. i. p. 198.
has stated, to the males alone, it can, indeed, scarcely be doubted that he has justly determined its use. A secondary use might perhaps be assigned to it by the supposition that the secretion poured forth from it might serve to sheathe and protect a projecting part of the animal from the friction to which it must be subjected during its passage through the air; and it is possible that some advantage may, in this way, be derived from it: it is worthy of remark too, as bearing in some degree on the subject, that in all the analogous cases just adverted to the secreting organ is placed in front of the body, and generally in situations especially exposed to the impulses of the air. A suggestion that has been made with reference to my species alone, may be mentioned merely to guard others against incautiously advancing the same proposition; that the bright white tuft might serve to attract night-flying insects within reach of the Bat’s jaws: it was forgotten, at the moment, that the Pteropi feed on fruits.

Another suggestion that has occurred as to the use of the largely developed shoulder-tuft in the species under consideration connects itself with a curious point of structure which the animal appears to exhibit. The wings, in the specimen as preserved, are placed so far backwards as to be apparently behind the centre of gravity; and on this account it seems possible that the projecting tufts of hairs, looking almost like little wings, may aid in giving buoyancy to the animal and in sustaining the ill-poised weight of its head and neck. But as there is evident distortion in the mode in which the skin is preserved, it is impossible to determine to what undue extent the wings may have been kept backwards and the neck have been elongated; and until these points can be ascertained, by the examination of specimens preserved in spirit, no deductions can safely be founded upon them. If the present condition of the specimen should prove to be even a near approximation to the correct form of the animal, the backward position of its flying membranes would justify its separation as the type of a distinct genus, for which the name of Epomophorus might be used. It is possible that the Pter. macrocephalus of Mr. Ogilby might be generically associated with it, as in that animal also the alar membranes appear to be affixed to the body at a more backward point than usual; although by no means so remotely as in my species.

The Pter. macrocephalus of Mr. Ogilby has other relations with the Bat which I am now describing. Besides the apparently backward position of the wings, and in addition to the fact, already adverted to, of its inhabiting the same country, it has also the same system of dentition, with a single trifling and anomalous exception. The same system of dentition is also exhibited by another Bat from the same country, the Pter. Gambianus, Og. When describing the two species referred to, Mr. Ogilby remarked that they “present some modifications of dentition which have not yet been observed in other species, and which appear to indicate a subgenus, probably representing the common Asiatic forms on this [the western] coast of Africa. These animals have the
incisors and canines of the same form and number as the rest of the genus, but there
are only three molars in the upper and five in the lower jaw. The incisors are small
and regular: the canines of intermediate size: the first false molar in the lower jaw is
small and of the normal form, but the second in this jaw and the first in the upper are
of the same form as the canines and very little inferior to them in size, so that when the
mouth is opened there appear to be four canines in each jaw; next follows in either jaw
a tooth with a large lobe upon the outer edge and a smaller one within, which is of
intermediate form between the true and false molars; after which come two normal
molars in the lower and one in the upper jaw. All the molars are separated from one
another by a vacant space on each side: this gap is particularly large between the real
and spurious canines or first false molars in the upper jaw, the corresponding space in
the lower having in its middle the small false molar already mentioned.” These words
describe so correctly the form, position, appearance, and number of the canine and
molar teeth in my specimen, that it is unnecessary to do more than quote them as
fully descriptive of its dentition so far as those teeth are concerned. The incisors,
however, present a slight deviation in one respect, which can only be regarded as acci-
dental: there are on the left side three of these teeth in the upper jaw. The upper
incisors are small, conical, and pointed: the lower are expanded towards their tips,
and somewhat lobed.

So perfect an agreement in dentary characters between three animals inhabiting the
same country, and distinguished by those characters from all other known species,
would apparently indicate the necessity of distinguishing them as a separate group:
but the dentary characters of the Bats seem to vary so irregularly that it would be
hazardous to rely on them alone for generic distinctions. The organs of locomotion,
and the appendages to the organs of the senses, furnish, in all their variations, im-
portant elements in the construction of the genera of Bats: and with the latter is con-
nected even the grand division, indicated also by the form of the molar teeth, into
fruit-eating and insectivorous. But the number of the teeth is of far less moment.
That of the incisors is notoriously different in the same individual at various periods of
its life. The molar teeth also are equally liable to vary by the presence or absence of
the first or of the last of the series, either singly or conjointly.

In the Pteropidae the normal number of the teeth appears to be thirty-four, of which
sixteen belong to the upper and eighteen to the lower jaw. In Pteropus, as restricted
by M. F. Cuvier, there are four incisors in the upper jaw; two canines; two false
molars; six true molars; and two small posterior molars: in the lower jaw there are
four incisors; two canines; two false molars; eight true molars; and two small poste-
rior molars. This full and perfect set of teeth is liable to modification by omissions in
various ways: among the incisors; among the false molars; and among the posterior
small molars. According to these modifications several genera have been proposed; and others might, doubtless, be created on the same principles and to a considerable extent. Thus the genus Pteropus of M. F. Cuvier has the full number of teeth above mentioned. If the false molars in each jaw be omitted, the dental formula is that of Macroglossus, F. Cuv. If the false molars be retained, and the posterior small molars be omitted, the formula is then that of Cynopterus, F. Cuv. The loss of two incisors from each jaw, and the retention of molars like those of Macroglossus, constitutes the character of the genus Cephalotes, Geoff. The absence of all incisors except two in the upper jaw, and the presence of the full number of molars, belongs to the genus Harpyia, F. Cuv. The removal from the Pteropine formula of the false molar from the upper jaw and of the small posterior molars from both jaws, would constitute a dentary character for Epomophorus: but it seems to me more advisable to abstain from regarding that genus as constituted until better opportunities have been secured for the clear understanding of the organs of flight in the animals apparently referrible to it.

In the Bat that constitutes the typical example of this group the head is more lengthened than is usual in the Pteropide, a character in which it accords with the Pter. macrocephalus. Its other characters of external form, excepting as regards the position of the alar membranes, are common to it with the remainder of the animals comprehended in the family. In the skin, as preserved, there is no vestige of a tail: but this organ, when it exists in the Pteropi, is in so rudimentary a state as to be easily destroyed or overlooked, and can exercise no perceptible influence on the habits of those species that possess it.

The fur of the body is closely set and soft; and consists of slightly wavy hairs which are generally of a moderate length. It extends along the anterior extremities nearly as far as the wrist, densely covering the limbs; and is equally furnished on the hinder limbs as far as the ankle. The interfemoral membrane is entirely invested with fur; and a band of short hairs passes along the hinder edge of the flying membranes for some distance from the ankle. On the flying membranes, in the part that intervenes between the bones of the arm and leg, a few very short adpressed hairs are implanted in small distant tufts, as in other species. The hairs of the large humeral tufts are much longer than any of the others, and are perfectly straight; they are not, however, harsh or rigid, and, when minutely examined, are not found to differ in the type of their construction from the rest of the fur.

In this Pteropus, as in other Bats, the hairs of the body generally have a serrated appearance along their margins, when seen under a high magnifying power; and thus exhibit a tendency to become decompounded, which may be regarded as analogous in some measure to the decomposition of the feathers of Birds. But the projecting points of the sides of the hairs in Bats are not the tips of processes laterally given off from a
continuous central stem, to which they are attached by their lower extremity: they rather resemble the free extremities of sheaths surrounding the stem of the hair, and slightly lengthened out in an oblique direction, which detach themselves at their tips and there recede, in a greater or less degree, from the common axis. The general effect thus produced is by no means unlike that which occurs on the lower part of the stem of some monocotyledonous plants, where the sheaths of many abortive leaves follow each other in rapid succession. Such is the appearance observed on the hairs of the body of this Pteropus generally, as well as on those which form the tufts on the sides of the neck. It is, however, variously modified on the hairs of different parts of the body, and even on different parts of the same hair; the seeming sheaths being much more closely set in the middle and towards the base of the hair than near the tip, and the serration in the immediate vicinity of the base being almost entirely obliterated, so as to produce the appearance of annulation rather than of imbedded obliquely truncated cups. The tips of the hairs offer consequently the most favourable opportunity for examining their structure, in as much as the lateral processes which form the serrations become gradually more remote from each other, and eventually assume in many cases an appearance by no means unlike that which characterizes the articulations of some species of Sertularia.

In so minute and difficult a subject, seen only by transmitted light, (for the high magnifying power necessarily employed precludes the possibility of observing the hairs as opake objects,) the risk of optical delusion is so great, that it would be unsafe to affirm that they are really jointed. Such, however, is the appearance assumed by the tips of the hairs, and more especially of those which form the fasciculated tufts so often referred to. Each joint seems under these circumstances to be terminated by a process inclined away from the general axis of the hair, the succeeding joint (by which the hair is lengthened out) being attached to its side prior to the divergence of its point. The terminal joint when present has usually the shape of a pointed stylet; but it is frequently wanting in consequence of the injuries to which the fur of the animal is exposed: and the mode in which it, as well as the other joints, separates from the remaining portions of the axis at its apparent articulations might be regarded as an argument in favour of the actual composition of the hair. This hypothesis is still further supported by the appearances presented by some of the more woolly hairs of the under surface of the body, the tips of which are apparently composed of obconical joints, the narrow part of each joint being attached to the centre of the truncated extremity of that next preceding it.

The microscopic characters here described, although common to all the Bats which I have examined, are considerably modified in the different species, and even (as has been seen above) on different parts of the body of the same individual; in this respect re-
SEMELING the scales of Lepidopterous Insects, which vary greatly both in form and structure according to their position on the wings. Nor is the serrated appearance in question confined to the Bats, although more common among them than in other tribes. It is most usual on those hairs which are crisped and woolly, assuming however in the more woolly kinds a totally different character, on which the property of felting possessed by such hairs evidently depends. It is, however, beside my present purpose to enter further into the details of the modifications which occur in the hair of different animals: I content myself with having thus lightly touched upon them, with the view of recommending them to the attention of the practical zoologist, as well as to that of the microscopic observer, who has long been familiar with many of their more remarkable appearances. The subject is well worthy of a careful study, both in a structural and physiological point of view; as an attentive examination of the different modifications, and of the circumstances attending them, is evidently calculated to throw much light on many obscure questions connected with the growth and production of hair.

In conclusion of these somewhat desultory observations, I subjoin a description of the remarkable Pteropus which has given rise to them.

The general colour of the animal is a dull and pale brown, slightly tinged with rufous. This extends over the whole of the upper surface, but is rather lighter towards the hinder part of the back. On the under surface the colour generally is similar to that of the back, but has somewhat of a grey appearance on account of the lighter tips of the loose hairs that occur in this situation: on the middle of the belly, where the hairs are short, frizzled, and by no means adpressed, they are entirely of a pale ash-colour approaching to white. A line almost equally pale with the middle of the under surface, and equally composed of loose waved hairs, extends along the under surface of the flying membranes immediately behind the fore-arm. The only other deviations from the generally sober colouring of the animal are the remarkable shoulder-knots of white, and a small and inconspicuous patch of short white hairs placed both before and behind, at the base of the naked ears.

The species may be thus characterized:

Pteropus Whitei.

Pter. pallidè brunnæus, posticè pallidior; ventre albido; scopà humerali albi mágnd.

Long. tot. 6½ poll.; capitis, 2½; expansio alarum, 12.

Hab. in regione Gambiens, D. Rendall.

Oms. Scopa humeralis forsan maribus propria.

In naming this remarkable Bat in commemoration of an individual who had no share in its discovery and by whom it was never seen, I may seem, strictly speaking, to have erred; but it is time that technical zoology should record the name of one who was by
no means unversed in its mysteries, and who has long maintained the highest rank as a popular zoologist. Gilbert White, of Selborne, was the first Englishman who ascertained the existence of indigenous Bats other than the two known as European to Linnaeus: to that good man and excellent observer be this singular species dedicated,—a species belonging to one of the few groups of Bats that are of direct utility to the human race, and which, preying not on other animals, rest contented with the simple fruits of their native woods.

PLATE VI.

Pteropus Whitei.

PLATE VII.

Fig. 1. One of the hairs of the lateral tufts of the neck of Pteropus Whitei, highly magnified.

a. A portion of the same hair, near its base;
b. Another portion, near its middle;
c. A third portion, nearer to its tip;
d. The tip: all seen under a still higher power.

2. One of the hairs of the back, magnified to the same extent as Fig. 1.

e. A portion of the same hair from its base;
f. Another portion from the middle;
g. The tip: all more highly magnified.

3. Portions, very highly magnified, of one of the hairs from the under surface of the neck.

h. The base;
i. The middle;
j. The tip.
IV. Some Account of the Crustacea of the Coasts of South America, with Descriptions of new Genera and Species: founded principally on the Collections obtained by Mr. Cuming and Mr. Miller. By Thomas Bell, Esq., F.R.S., L.S., G.S., & Z.S.

Communicated November 10, 1835.

The rich acquisitions which have accrued to science from the indefatigable exertions of Mr. Cuming have already furnished matter for numerous communications to the Zoological Society, which have hitherto been principally devoted to the description of new species of Mollusca, or to the anatomical structure of animals of the same great group. The collection of Crustacea procured by the same gentleman, amounting to about one hundred and fifty species, promised to afford many new forms; and it was at first my intention to content myself with the description of such new genera and species as were contained in that collection. Finding, however, that in some particular genera the new species were either so numerous, or so interesting and important in their characters, as to throw an entirely new light upon the character of the groups to which they belonged, and having these means of information enlarged by the kindness of my friend Mr. Miller, who has, with his usual liberality, presented me with the whole of a small collection made by him principally on the coast of Brazil, I have been induced to extend my original plan, by embodying an account of the whole of the species collected by these gentlemen; and offering, in a few instances, monographs of such genera as require an entirely new arrangement, or new distinctive characters, in consequence of these acquisitions. In furtherance of this object I have already communicated to the Zoological Society, a monograph of the restricted genus Cancer, enriched by no less than three new and highly interesting species 1; and I now proceed to offer the further detail of the contents of these collections in a systematic form, commencing with the Oxyrhynchi.

The arrangement which I have adopted is generally that of Dr. Milne Edwards, whose work on the natural history of Crustacea is not only by far the most complete that has ever appeared, but offers a classification which, though not free from some inconsiderable objections, yet, as being founded upon structural rather than mere formal characters, must be allowed to constitute the nearest approach hitherto made to a natural arrangement.

Classis CRUSTACEA.
Subclassis DECAPODA.
Ordo BRACHYURA.
Tribus OXYRHYNCHI.
Familia LEPTOPODIADÆ, Bell.

Genus LEPTOPODIA, Leach.
LEPTOPODIA SAGITTARIA, Leach.

Found by Mr. Cuming at Valparaiso.

Genus EURYPODIUS, Guér.
EURYPODIUS LATREILLII, Guér.

Found at Valparaiso by Mr. Cuming, and at Rio Janeiro by Mr. Miller.
Those procured from the latter locality were more than twice as large as those from the former place.

Familia MAIÆ (MAIENS, Edw.).
Genus MICERORHYNCHUS.

Testa subtriangularis, posticè rotundata, anticè rostro brevissimo terminata.
Oculi pedunculo elongato multò crassiores, retractiles.
Orbita suprà unifissa, extrorsùm unidentata.
Antennæ exteriores ad latera rostri insertæ, articulo basilarì rostro paulò breviore.
Antennæ interiores in fossulà integrà, anticè apertà, et ad apicem rostri férè attinente, locatæ.
Pedipalpi externi caulis interni articulo secundo cordiformi, anticè emarginato.
Pedes antici maris corpore vix longiores, reliquis multò crassiores, digitis arcuatis;
féminæ minimi : pedes octo posteriores subconsimiles, corpore férè duplò longiores, unguibus leviter curvis.
Abdomen maris 7- féminæ 5-articulatum (hujus articulis tribus ultimis conjunctis).

The genus thus characterized agrees in several remarkable and important relations with Camposcia: a comparison, however, of its structure with the essential characters of the latter genus, will warrant the step I have taken in forming a new genus for the two beautiful and very peculiar species about to be described, especially as they both agree in all the most striking and obvious characters in which each of them differs from Camposcia. The exact situation of the present genus it is perhaps not easy to ascertain.
From the characters of the feet, and the form of the body, as well as some other characters, it might probably be placed between Camposcia and Inachus, without any considerable violation of its affinities. There are, however, some indications about the structure of the external pedipalps, and the form of the abdomen, especially of the female, which would seem to intimate some not very obscure relations to a group remote from those genera.

**Microrhynchus gibbosus.**

Tab. VIII. Fig. 1.

*Micr. testá gibbosá, rostro bifido.*

*Hab. ad Insulas Gallapagos dictas.*


The carapax is broadly pyriform, gibbous, rounded; the regions elevated, and separated by rather deep furrows; the surface covered, particularly on each branchial region, with numerous distinct rounded tubercles resembling very minute pearls. The rostrum is very small and bifid. The orbits are wide, and have a hollow at the outer side for the lodging of the eyes when at rest, though not deep enough to conceal them entirely. A small fissure divides the upper margin of the orbit from the rostrum, and another externally from the tooth of its outer angle. The eyes are larger than their peduncles.

The external *antennae* are half as long as the body, the basilar joint as long as the rostrum, with a tooth at the outer angle. The internal *antennae* are lodged in a single cavity, open in front, bounded above by the rostrum, and on each side by the basilar joint of the external *antennae*. The pedipalps resemble those of Camposcia, excepting that the second joint of the inner footstalk is more heart-shaped, and deeply notched for the attachment of the moveable palp, which is long and greatly developed.

The abdomen of the male (the only sex yet observed) has seven joints, each of which has an elevation in the centre: the first, which is wholly apparent when the animal is viewed from above, is somewhat quadrate, with a small tubercular tooth in the centre; the second very short; the third much broader than the rest, and the remainder abruptly narrower.

The first pair of legs are thicker than, but not much more than half as long as, the others; the surface granulated; the hand rounded, and terminated by arched fingers which meet only at the apex, where they are denticulated. The four posterior pairs of legs are on the average nearly twice the length of the body, diminishing in the order 3. 4. 2. 5. They are cylindrical and hairy; and the nails are long, slender, and but slightly arched.

The general colour of the specimen is yellowish white.

Length of the carapax 6 lines; breadth 5 lines.

One specimen only, a male, was obtained by Mr. Cuming at the Gallapagos Islands, in sandy mud at six fathoms depth.

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MICRORHYNCHUS DEPRESSUS.

Tab. VIII. Fig. 2.

Micr. testä depressä, granulatä; rostro minuto, triangulari, integro.

Hab. cum Micr. gibbosä, ad Insulas Gallapagos dictas.


This very singular species differs greatly in general form and aspect, no less than in more minute detail, from the former. The carapax is much broader, suborbicular, very depressed, although the specimen is a female, and the regions, though sufficiently distinct, are but little elevated. The surface is covered with numerous minute granular elevations, with here and there a few larger ones. The orbits resemble those of Micr. gibbosä, excepting in being much larger, as are also the eyes. The rostrum is very small, triangular, and entire, the margins minutely granulated.

The tooth of the basilar joint of the external antennæ is incurved at the point. The internal antennæ resemble those of the former species, but their cell is still more open. The first joint of the inner footstalk of the external pedipalps is longitudinally channelled; the second joint cordiform, but less deeply notched than in Micr. gibbosä.

The sternal disc (in the female) is almost orbicular, and not nearly covered by the abdomen, which is five-jointed. The first joint is somewhat bell-shaped, with a long central tooth or spine projecting directly backwards; the second, third and fourth, extremely short; and the fifth, consisting of a perfect union of the last three joints, forms a flat orbicular disc, having a broad, depressed, longitudinal elevation.

The first pair of legs is, in this sex, extremely small; the arms much curved; the fingers very slightly arched, and minutely toothed towards the extremity. The remaining legs are similar to those of the former species.

Colour nearly white, but with a very slight pinkish tinge.

Length of the carapax 6 lines; breadth the same.

Of this species one specimen only, a female, was procured by Mr. Cuming with the former.

GENUS LIBINIA, Leach.

LIBINIA ROSTRATA.

Tab. VIII. Fig. 3.

Lib. rostro producto, valido, bidentato, dentibus compressis, acutis, divergentibus.

Hab. ad oras Peruviae.


The whole of the body and legs are covered with close short hair, the surface beneath the hair being minutely punctate. Carapax almost globose, the regions much elevated,
with numerous strong spines and tubercles, one longer than the rest standing out horizontally on each branchial region. Latéro-anterior margin with three spines, and a fourth behind them which forms the commencement of a flattened ridge extending backwards to the posterior margin. Orbits with a strong spine over the inner canthus. _Rostrum_ very prominent, flattened, terminating in two strong diverging teeth.

Exterior _antennae_ cylindrical, inserted at the side of the _rostrum_, and not at all concealed by it. The pedipalps similar to those of the other species of the genus.

The _abdomen_ of the male formed of seven distinct joints, each elevated in the centre, so as to form a longitudinal _carina_. The divisions of the _sternum_ very distinct.

The anterior pair of legs twice the length of the body; the arms furnished with numerous obtuse spines: the hands granulated, and without spines: the fingers touch each other only at the points, which are rather acute. The four posterior pairs of legs diminish regularly from the second to the fifth; they are wholly without spines, considerably thickened at the joints, and terminate in a strong curved nail.

The colour of the hair which covers the whole animal is a light brown; the body itself paler.

Length of the carapax, including the _rostrum_, 2 inches 8 lines; breadth 2 inches 3 lines.

A single male specimen only was found by Mr. Cuming on the Peruvian coast, in soft mud, at the depth of five fathoms.

This species differs from all others previously known in the genus, in a character which, unless a new genus were formed for its reception, requires the revision and alteration of the generic character as hitherto assigned to it. The _rostrum_, instead of being extremely small, and merely notched at the extremity, is broad, projecting, and terminates in two strong, diverging teeth. The other characters of the species, and its general habit and form, are, however, so essentially those of the genus _Libinia_, that I cannot but consider it as belonging to the same natural group.

**Genus Rhodia.**

_Testa_ pyriformis, in rostrum parvum, bidentatum antice producta.
_Oculi_ retractiles, globosi, pedunculo crassiores.
 _Orbita_ fissurâ magnâ, supernè apertâ.
_Antennae interiores_ in foveolis profundiis, lunatis, antice separatis receptae.
_Antennae exteriores_ rostro duplò longiores, articulo basilari bidentato, reliquis cylindricis, ad rostri latera insertae.
_Pedum par anticipum_ maris (immaturi) reliquis brevius; digitis minutissimè serratis:

-paria quatuor posteriora testâ longiora, à secundo ad quintum sensim paulò breviora.
_Abdomen maris_ 7-articulatum. _Fœminæ?_

This genus is allied to _Herbstia_, from which, however, it differs remarkably in the structure of the anterior feet. The fingers in _Rhodia_ meet throughout their whole length and the margins are minutely serrated: in _Herbstia_ they meet only at their
points, and are furnished with rounded tubercles. In the present genus the anterior legs are shorter than the posterior, and very slender; in *Herbstia* they are much longer than the others and very robust. One species only is known of the genus, of which but a single specimen exists in the collection formed by Mr. Cuming.

**Rhodia pyriformis.**

Tab. IX. Fig. 1.

_Hab._ ad Insulas Gallapagos dictas.


Carapax pyriform, somewhat depressed, the regions slightly and evenly elevated: _rostrum_ about as broad as it is long, small, consisting of two pointed teeth: lateral margin with four distant, minute teeth: posterior margin produced. Orbits large, with a triangular hiatus above, and a tooth at the outer and inner _canthus_. Eyes large, globose, fixed on very short peduncles, which are small at their junction with the eyes, but larger at their insertion into the orbit.

Internal _antennae_ lying in deep, circumscribed, longitudinal, somewhat lunulate cavities. External _antennae_ twice as long as the _rostrum_, the basilar joint broad, bidentate, the outer tooth being the shortest, and placed further back, at the inner _canthus_ of the orbit. The pedipalps were so much injured in the specimen as not to admit of description.

_Abdomen_ of the male seven-jointed, decreasing in breadth from the third joint to the last.

The anterior pair of feet rather thicker but shorter than the others; the arm and wrist hairy and beset with small spines; the hand hairy above, but without spines: the fingers are slender, and are in contact throughout their whole length, and the margin is very minutely serrated. The remaining feet are longer than the carapax, the second pair by nearly one third; the remainder diminishing gradually to the fifth. They are nearly cylindrical, hairy but without spines or tubercles, and terminate in a small, slightly curved claw.

The colour of the only specimen known is pink, the hairs brown; the legs are whitish with pink _annuli_ or bands; but as the specimen is considerably bleached and injured, it is impossible to judge of the natural colour.

Length of the carapax 8 lines; breadth 6 lines.

A single male specimen only, probably immature, was procured by Mr. Cuming, at the depth of six fathoms, on coral sand. It had evidently been long dead.

**Genus Pelia.**

_Testa_ pyriformis, rotundata, antice rostro elongato, apice bifido, terminata.

_Orbita_ suprà fornicata, externè unifissa, infrà emarginata.
OF THE COASTS OF SOUTH AMERICA.

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Oculi retractiles, globosi, pedunculo crassiores.

Antennae interiores in basin rostri insertae.

Antennae exteriiores rostro haud multò longiores, articulo basilari longissimo, ad medium rostri attinente, extus uni-denticulado; articulis secundo et terto cylindricis; reliquis setaceis gracilibus.

Pedipalpi externi caule externo semifusiformi; caulis interni articulo primo elongato-rhomboideo, secundo trapezoideo, margine integro.

Pedum par anticum reliquis paullo crassius, secundo brevius; digitis apicem versus serrulatis, digito immobili ad medium excavato, tuberculum unicum digitus mobilis recipiente: paria quatuor posteriora gracilia, compressa, pilosa.

Abdomen maris 7-articulatum.

Amongst the Crustacea brought by Mr. Cuming from the western coast of South America, there occurs a single specimen of a very small species, which, with some characters allied to those of Herbstia, and some by which it is related to Pisa, offers certain peculiarities which appear to me to establish it as the type of a distinct genus. From the foregoing account of its characters, the relations which I have mentioned will probably be recognised; but the structure of the anterior feet, of the exterior antennae, and of the pedipalps, is very peculiar. The fingers of the first pair of feet, when closed, are in contact throughout their whole length; the apical half of each is minutely serrated, and there is a single tubercle about the middle of the immoveable finger, received into a corresponding cavity in the moveable one. This is a combination of the serrated with the tuberculated form of finger, which at least is not common; and the accurate closing of a broad tubercle into a corresponding excavation in the other finger, is a structure which I have not observed in any other species. The extension of the basilar joint of the exterior antennae so far beyond the line of the orbit as to be exposed above through nearly its whole length, is also a peculiarity which I believe belongs to no other genus of this section. These characters, with the peculiar form of the external pedipalps, appear to constitute the essential data for the foundation of a new genus.

Pelis pulchella.

Tab. IX. Fig. 2.

Hab. ad Insulas Gallapagos dictas.


Carapax pyriform, gibbous, rounded, polished, somewhat hairy: the regions elevated, particularly the gastric and cardiac, the latter of which forms a rounded tubercle; lateral margin entire. Rostrum straight, much produced, nearly half as long as the rest of the carapax, bifid at the extremity, with a slight groove continued backwards from the bifurcation.

Internal antennae inserted at the base of the rostrum: external antennae placed at the
sides of the rostrum; the basilar joint reaching to about half its length, almost wholly exposed above, slightly tapering towards its extremity, where there is a small external tooth; the moveable portion setaceous, extending a little beyond the apex of the rostrum, the second and third joints cylindrical, and much larger than the terminal portion. External pedipalps with the external footstalks semirisusiform; the first joint of the internal footstalk elongate, rhomboid; the second joint of an irregular four-sided figure, the margins entire.

Abdomen in the male seven-jointed, the joints becoming gradually smaller from the third to the last.

Anterior feet longer than the body; the arm three-sided, having a toothed carina above, and two carinae beneath, the outer of which is minutely serrated; the hands slightly compressed, smooth: the fingers, when closed, in contact throughout their whole length, the half towards the apex being serrated, and a tubercle of the immovable finger received into a corresponding excavation in the moveable one. The remaining feet compressed, carinated and hairy above, the second pair longer than the first, the rest becoming gradually shorter.

Length 4 lines; breadth 2½ lines.

A single male specimen was taken by Mr. Cuming from sandy mud, at the depth of six fathoms.

Genus Herbstia, Edw.

The genus Herbstia was formed by Dr. Milne Edwards on the characters offered by Cancer conchyliatus of Herbst, and named in honour of that indefatigable carcinologist. That species, which is a native of the Mediterranean, has been successively placed in the genera Inachus, Maia and Mithrax, by Fabricius, Latreille, and M. Risso, and very properly separated from these by the acute naturalist above mentioned. The correctness of this separation receives an interesting confirmation in the discovery of the present species, which may, with peculiar propriety, be dedicated to him who first distinguished the characters of the genus.

Herbstia Edwardsii.

Tab. IX. Fig. 3.

Herbst. pedum pare antico inermi.

Hab. ad Insulas Gallapagos dictas.

The carapax is depressed, much rounded, the post-frontal portion being nearly of a circular form, but rather narrowed forwards. The surface is minutely punctated. The gastric region has four small tubercles placed transversely, and there are several similar ones on other parts, particularly on the branchial regions and the lateral margin. The front is moderately prominent, the rostrum very small, bifid, the horns being pointed
and a little flattened, as in *Herbst. condyliata*. The orbits are large, and furnished with a tooth at the upper and inner angle, another at the outer angle, and a third, small and rounded, beneath; between which and the basilar joint of the external *antennae* is a considerable hiatus. The eyes are scarcely larger than their peduncles, which are of moderate length.

The external *antennae* have the basilar joint broad and prominent, with a large tooth anteriorly, and a smaller one at the base of the latter: the second and third joints cylindrical, the latter extending a little beyond the *rostrum*. Internal *antennae* lodged in a circular hollow, having a raised margin, and a tooth in front, directed a little backwards and downwards. External pedipalps with the second joint of the inner footstalk cordate.

*Abdomen* of the male formed of seven joints of nearly equal length, becoming gradually narrower, and the terminal one rounded. The *abdomen* of the female nearly circular. First pair of feet in the male more than twice as long as the post-frontal portion of the carapax, rather robust, and nearly cylindrical; the hand rather larger than the other joints, perfectly smooth; the claws rounded and minutely denticulated at the extremity, slightly hollowed, and having one large strong tooth on the finger and another on the thumb. The remaining pairs decreasing in length from the second to the fifth; the third joint much larger than the others, with a row of small spines above, and sparsely hairy; the nails very slightly curved.

The general colour above is a greyish brown; beneath yellowish; the anterior legs plumbeous, the others somewhat flesh-coloured.

Length of the carapax 7 lines; breadth 6½ lines.

This species differs from *Herbst. condyliata*, which in most of its characters it much resembles, in its diminutive size, the greater proportional length of the anterior feet, and the absence of tubercles on the hands.

A male and a female specimen were taken by Mr. Cuming at the Gallapagos Islands, in coral sand, at the depth of six fathoms.

**Genus Thöe.**

manibus lævibus, digitis arcuatis, ad apicem tantum contingentibus: posteriores depressi, lateribus pilosis. 

*Abdomen* in utroque sexu 7-articulatum.

This genus, founded on a single known species, approaches *Herbstia* in the character of the *antenna*, the hands, the claws, and some other parts; but it differs materially from that genus in the form of the *rostrum*, the depressed and horizontal form of the body, and from every other genus in the remarkable excavations on the upper and outer sides of the arm. Its natural situation in the system is probably between *Herbstia* and *Hyas*. The genera, however, constituting the *Maiens* of Dr. Milne Edwards, require a thorough examination, in order to ascertain the real value of the characters upon which generic distinctions have hitherto been founded.

**Thöe erosæ.**

Tab. IX. Fig. 4.

*Hab.* ad Insulas Gallapagos dictas. 

Carapax somewhat triangular, longer than it is broad, rounded behind, depressed, horizontal, covered with low tuberosities; the lateral margin without teeth, perpendicular. *Rostrum* minute, tapering to the point, which is slightly divided. Orbits nearly round, without teeth, with three small fissures, one above the inner *canthus*, another at the outer angle, and the third beneath. Eyes subretractile, globose, smaller than the base of the peduncle.

Internal *antennæ* lodged in a *fossa*, which is anteriorly divided by a tooth projecting backwards and longitudinally excavated. External *antennæ* with the basilar joint very broad, produced forwards and backwards, the moveable portion three times as long as the *rostrum*, ciliated on the inner side. External pedipalps with the outer footstalk expanded at the outer margin; first joint of the inner footstalk nearly rhomboidal, with entire margins, ciliated on the inner margin; second joint without any emargination for the insertion of the palp.

*Abdomen* in both sexes seven-jointed. In the male, the third to the sixth joints are scarcely broader than the first and second.

Anterior legs in the male longer and much more robust than the remainder. The arm with a series of quadrilateral excavations on the upper and outer surfaces diminishing backwards. Hands smooth, carinated beneath, the fingers meeting only at the point, not excavated or serrated, but with a single tubercle near the middle of the moveable finger: remaining feet flattened above, longitudinally rugose, the sides furnished with rather long hairs; beneath rounded and smooth.

Colour light yellowish brown above, paler beneath.

Length 6 lines; breadth 5 lines.
Taken by Mr. Cuming at the Gallapagos Islands in sandy mud at the depth of seven fathoms.

**Genus Hyas, Edw.**

**Hyas Edwardsii.**

Tab. IX. Fig. 5.

Hy. testä anticè angustatä, post orbitas haud coarctatä, pilosä; orbitarum dente intëro mediocrï; abdominis (maris) articulo penultimo utrinque unidenticulato.

_Hab._ apud Valparaiso et ad Insulas Gallapagos dictas.


Carapax pyriform, elevated, posteriorly rounded, anteriorly narrow, but without a distinct contraction behind the orbits; covered with brown hair. _Rostrum_ formed of two elongated compressed teeth slightly converging at the apex. Orbits spacious, without spines, having a triangular tooth of moderate size at the outer _canthus_. Eyes globular, larger than their peduncles.

Interior _antennae_ lodged in a _fossa_ at the base of the _rostrum_, which is open anteriorly, and undivided. Exterior _antennae_ longer than the _rostrum_, very hairy, the basilar joint with raised margins; the second and third less expanded than in the other species of the genus. The pedipalps offer no peculiarity.

_Abdomen_ of the male with the penultimate joint with a small tooth on each side.

Anterior legs in the adult male rounded, the hand much thicker than the arm, and terminated by curved fingers, which touch each other only at the apex, which is serrated; moveable finger with a single tubercle near the base. In the female the hands are scarcely larger than the arms, the fingers are less curved, and there is no tubercle. The remaining legs are somewhat flattened above, obtusely carinated beneath, and very hairy: the second pair is the longest, and they diminish regularly to the fifth.

Colour reddish brown; the hands red.

In size the specimens from the two localities differ exceedingly. There are adult males from the Gallapagos Islands, of which the length is 6 lines and the breadth 4 lines. From Valparaiso I have examined a specimen of an immature male, as appears by the want of development of the anterior feet, the length of which is 9 lines and the breadth 7 lines. This remarkable discrepancy led me at first to expect that I should discover some specific differences; but the most careful examination has convinced me that they are all of one species.
Genus Pisa, Leach.

Pisa spinipes.

Tab. IX. Fig. 6.

Pisa testá ovatá; dente articuli basilaris antennae exterioris dente superorbitali longiore; margine antico-laterali et pedibus omnibus spinosis.
Hab. ad Insulas Gallapagos dictas, et apud Sanctam Elenam.

This is an elegant little species, bearing considerable resemblance to young specimens of Pisa tetraodon, Leach, but differing in many essential particulars from this and every other known species.

The carapax is depressed and granulated: the lateral margin on each side beset with about seven or eight sharp spines, which are much smaller and shorter in the female than in the male. The former sex has a strongly-marked granulated line over the posterior margin, which is much less conspicuous in the male; a circumstance which I have observed in many species, not only of this but of several other genera. The tooth above the orbit, unlike many other species, is shorter than that of the basilar joint of the exterior antenna. The horns of the rostrum are separated throughout their length, and are somewhat divergent.

The abdomen of the male specimen was lost: that of the female is as broad as it is long, and has a low longitudinal carina.

The feet are all furnished with small spines, particularly on the third joint; the anterior pair in the female scarcely larger than the rest: those of the male specimen were lost.

This species differs from all the others, excepting Pisa Styx, Latr., in having numerous spines on the legs.

Length 8 lines; breadth 5 lines.

The male specimen was taken by Mr. Cuming at the Gallapagos, at the depth of sixteen fathoms; the female at St. Elena at six fathoms: both on sandy mud.

Pisa aculeata.

Tab. IX. Fig. 7.

Pisa testá triangulári, dente articuli basilaris antennae exterioris dente superorbitali breviore; margine antico-laterali inermi, regione branchiali spinis quatuor armatá; pedibus suprà spinosis.
Hab. ad Insulas Gallapagos dictas.

Carapax triangular, nearly as broad as it is long: the latero-anterior margin without
spines, but furnished with three subimbricated processes, directed forwards. Branchial regions with about four small spines, of which two are placed near the lateral margin on each side; the rest of the body with small scattered tubercles. *Rostrum* with rather long, diverging, acute teeth. The orbits with a very short tooth over the inner *canthus*.

Exterior *antennæ* with the tooth of the basilar joint very long, acute, slender, and directed forwards and a little outwards. The pedipalps offer no peculiarity.

The penultimate joint of the *abdomen* in the male has a small tooth on each side.

Anterior legs of moderate size and length, the fingers but little curved; the arm with a few short, obtuse, and compressed spines: the remaining feet hairy and spinous above, the nails curved and very acute.

Colour fuscos.

Length 8 lines; breadth 7 lines.

Taken by Mr. Cuming on sandy mud at the Gallapagos Islands, at the depth of seven fathoms.

This and the preceding species belong to the third section of the genus, according to Dr. Edwards's arrangement, with *Pisa Styx*, Latr. They are characterized by the greater length of the basilar tooth of the *antennæ*, compared with that of the orbit.

**Genus Mithrax, Leach.**

**Mithrax rostratus.**

Tab. X. Fig. 1.

*Mithr. testá spinosá, rostro elongato, bidentato, dentibus divaricatis, ad apicem incurvis, terminato; pedibus spinosis; manibus levibus.*

*Hab.*


Carapax rounded, anteriorly produced, moderately elevated, the regions distinct; surface granulated, tuberculous, and with the margins and outer part of the branchial regions spinous. *Rostrum* much longer than broad, consisting of two strong diverging teeth, the *apices* of which are a little inclined. Orbit nearly circular, surrounded with warty tubercles. Eyes globular, smaller than the base of the peduncles.

Interior *antennæ* lodged in a *fossa*, which is divided only at the anterior half by a projecting tooth-like process. Exterior *antennæ* rather longer than the *rostrum*; the basilar joint with a small tuberculated tooth at the outer edge; second and third joints rather broad, and furnished with long hairs on each side; fourth joint cylindrical and elongated. Pedipalps as in most other species of the genus.

*Abdomen* of the male slightly and obtusely carinated; of the female nearly orbicular.

Anterior feet of the male moderately robust, of the female rather slender; the moveable finger in the former sex with a tubercle near the base; hand smooth, the other joints spinous and tuberculated. Remaining feet spinous and tuberculated, excepting on the last two joints, which, like the others, are hairy. The nails in the male are fur-
nished with a series of small denticulations beneath, as in the genus *Pisa*; the female
is without them.

Colour lightish brown; the hands mottled.

Length of the carapax 2 inches 2 lines, including the *rostrum* which is 4 lines long
and 2 broad; breadth of the carapax 2 inches nearly.

Two specimens, a male and a female, were obtained by Mr. Cuming.

Notwithstanding the length and spinous form of the *rostrum*, the more elongated
form of the carapax, and the moderately developed character of the claws, I cannot but
consider this species as belonging to the genus *Mithrax*, as all its essential characters
 correspond with that group. It may perhaps be considered as offering a step towards
the genus *Pisa*, not only in the characters already mentioned, but also in the denticu-
lations on the under surface of the nails in the male; a character which, although con-
sidered as essentially distinguishing the last-named genus, can only be ranked as of very
secondary importance, as in the present species it constitutes but a sexual distinction,
the male possessing it, and the female being wholly destitute of it.

**Mithrax Ursus.**

Tab. X. Figg. 2, 3.

*Mithr.* testá granulatá, verrucoso-tuberculata, rostri dentibus obtusis, granulosis; tuberculis
octo pone rostrum, et sex circum orbitas; manibus levibus.


*Hab.* ad Insulas Gallapagos dictas.


Carapax in the young specimens somewhat pyriform, in the adult nearly orbicular,
granulated, and with numerous warty tubercles, of which there are four immediately
behind the *rostrum*, forming a square, and four a little behind them similarly disposed.
The latero-anterior margin has three or four strong prominent tubercles each with one
or two smaller ones at its base. *Rostrum* projecting, formed of two strong rounded
teeth, each terminated by a warty tubercle. Orbits with six similar tubercles, of which
that over the inner *canthus* is the most prominent. Eyes globose, smaller than the base
of the peduncle.

The exterior *antennae* hairy in the younger specimens; the basilar joint with a large
tubercular tooth at its outer angle, the *apex* of which, like all the other tubercles in
this species, is granulated or warty. The interior *antennae*, the external pedipalps, and
the *abdomen* do not materially differ from those parts in the other species of the genus.

The anterior pair of feet are, in the female, a little longer and more robust than the
others; the arm and wrist covered with prominent tubercles; the hand smooth, the
fingers in this sex, and in young males, serrated at the margin, but without a tubercle.
(It is probable, that in the adult male the hands are more robust and the fingers fur-
nished with a strong tubercle as in *Mithr. verrucosus*, Edw.) The remaining feet covered with similar tubercles above, and a few very small ones beneath. The nails much hooked and acute.

In the young state, the carapax, the legs, and the *antennae* are covered with a thick coat of hair, and the tubercles are small and sharp, so that the margin of the shell, the *rostrum*, the orbits, and the legs, may rather be described as spinous than tuberculated.

Colour of the adult a deep purplish brown; of the young, light brown.

Length of the carapax in the adult female 2 inches; breadth 2 inches.

Two adult females and several young specimens of both sexes were obtained by Mr. Cuming from sandy mud at the Galapagos Islands at the depth of six fathoms.

The *Cancer Ursus* of Herbst has not, I believe, been observed since his figure was published. Dr. Edwards suggests that it may be a species of *Paramithrax*, and the erroneous drawing of the anterior feet in Herbst’s figure might authorize such a supposition. The examination, however, of several specimens of different ages has enabled me to ascertain that it is a true *Mithrax*, and that the characters of the genus are so imperfectly developed in the young state, that not only in this, but in many other instances such a mistake might readily occur. It was from a specimen about half grown that Herbst’s figure was taken, and I now offer a figure of a still younger individual, and one of an adult female, with the assurance that the intermediate states enable me confidently to consider them as the same species. The little spines in the young are everywhere identical with the tubercles in the adult.

The observations which I have here ventured to make, show the importance of examining *Crustacea* in various degrees of development, in order to ascertain the specific and even the generic characters. The parts which differ most in the two sexes, are generally found to be those which undergo the greatest changes by age. And in those genera which, like the present, exhibit a peculiar structure in the hands,—organs which offer the greatest variation in both these circumstances,—it is peculiarly necessary that the structure of these parts in both sexes and at various ages should, if possible, be described.

Herbst gives his own collection as the place where the specimen he figured was deposited, and states the South Sea as its habitat.

**Mithrax nodosus.**

Tab. XI. Fig. 1.

*Mithr. testa trigono-rotundata; margine tuberculis tribus fortibus, rotundatis, et dente unico; rostro brevi; pedipalpis articulo secundo caulis externi irregulariter lunulato; manibus levibus, suprâ carinatis; brachiis et carpis tuberculatis; pedibus posterioribus suprâ spinosissimis et pilosis.*

*Hab.* ad Insulas Gallapagos dictas.

Carapax somewhat depressed, rounded, slightly triangular, broader than it is long; the surface with broad elevations, which are highest over the gastric region; the latero-anterior margin with three strong rounded tubercles, and a small spine behind them. *Rostrum* very short, rounded and bifid. Orbits with a small round tubercle over the inner *canthus*, and a small fissure above.

Exterior *antennae* with the basilar joint as prominent as the orbitar tubercle, but rather less so than the *rostrum*; second joint somewhat heart-shaped, furnished with a tuft of rather long hair on the inner edge, as is also the remaining portion of the *antenna*. Pedipalps with the second joint of the inner footstalk of an irregularly semilunar form, much broader than it is long, not cordate as in the other species of the genus.

*Abdomen* with the seven joints very distinct.

Anterior legs above covered with tubercles; the hand quite smooth, with a *carina* on the upper edge. The fingers are much curved, and in contact only at the *apex*, which is scarcely denticulated; the moveable one has a strong tooth near its base. The posterior legs are covered on the upper surface with hairs and numerous spines, many of which are furnished with two or three distinct hairs at the point.

The colour above is brown; that of the hands dark plumbeous: it is paler beneath. Length of the carapax 1 inch; breadth 1 inch 3 lines.

Found by Mr. Cuming in considerable abundance under stones at low water.

This species belongs to the third section of the genus, as divided by Dr. Edwards: his *Mithracis deprimés*.

*Mithrax denticulatus*.

Tab. XI. Fig. 2.

*Mithr. testá profundè sculptá; margine laterali dentibus quatuor obtusiusculis; pedipalpis articulo secundo caulis interni cordato; manibus laxibüs; pedibus posterioribus pilosis, spinosissimis.*

*Hab.* ad Insulas Gallapagos dictas, sub lapidibus.


A small species resembling in most of its characters the former one, though differing sufficiently to be distinguished from it at the first glance. The markings on the carapax, though similar in situation, are much more distinctly and deeply incised; the teeth on the lateral margin, though rather obtuse, have not the rounded, tubercular character of the same appendages in *Mithr. nodosus*. The arms and the feet also are more sharply spined. But the character which at once distinguishes them, on a closer inspection, is the form of the second joint of the inner footstalk of the external pedipalp, which in *Mithr. nodosus* is crescent-shaped, and much broader than it is long; and in the present species is cordate, and as long as it is broad.

Colour plumbeous, passing into fuscous.
Length 5 lines; breadth 6 lines.
Found by Mr. Cuming in considerable numbers with the former.

**Mithrax pygmæus.**

Tab. XI. Fig. 3.

*Mithr. testâ depressâ, rotundatâ, lavi; fronte obtusissimo lato, obsolete bilobato; pedibus anticus corpore duplo fêrè longioribus; manibus lavibus.*

_Hab._ ad Panama, Americæ Centralis.


Carapax depressed, broad across the branchial regions, contracted forwards, and obtuse in front; the regions rather distinct; the surface smooth; the lateral margin with a few small teeth or spines. Front very obtuse, obscurely bilobed, laminated. Orbits with a minute tooth over the inner canthus, and two externally, much excavated beneath. Eyes large, prominent, globular.

External _antenna_ with the basilar joint very broad, anteriorly denticulated, the moveable portion cylindrical, half as long as the body. External pedipalps with the first joint of the inner footstalk nearly quadrate, the second emarginate at the anterior and inner angle.

_Abdomen_ of the male seven-jointed, nearly triangular.

Anterior feet nearly twice as long as the carapax; the arm and wrist with a few minute tubercles; the hand robust, smooth; the moveable finger with a small tubercle near the base, the apex excavated and serrated at the margin. The remaining feet slender, shorter than the first pair; having a few tubercles on the first three joints, the remainder smooth.

Colour pale brownish above, reddish beneath; hands a red brown.

Length nearly 3 lines, breadth the same.

Of this little species Mr. Cuming procured two male specimens at Panama, on sand, at the depth of ten fathoms.

The characters offered by this pygmy _Crab_, are such as to occasion some hesitation whether to consider it as a species of _Mithrax_, or as the type of a new genus. It has certainly many important relations to the genus mentioned, and I have preferred placing it therein to increasing the number of genera upon what may appear to be too slender foundations. The characters in which it differs from the other species, are the smoothness of the carapax and arms, the slenderness and extraordinary length of the anterior feet, the laminated and obtuse form of the _rostrum_, and the length of the external _antennæ._

**Genus Othonia.**

_Testa_ late ovata, rostro parvo, brevi, bifido, baud deflexo, terminata.

_Oculi_ pedunculo elongato, cylindrico, subcurvo baud crassiores.
Antennae interiores minutissimæ.

Antennæ exterioræ breviusculæ, articulo basilari lamellosō, extus dente triangulari ar-
mato; secundo compresso cordato, antice emarginato, et tertio multō majore;
reliquis parvis cylindricis.

Pedipalpi externi caulis interni articulo secundo triangulari, extrorsum subproducto.

Pedes mediocres. Par anticum maris...? feminae reliquis minus, digitis minutè
serrulatis, digitō mobili longiore: paria quattuor posterioria ordine 2.3.4.5. gra-
datim breviore; digitis subius minutissimè denticulatis.

Abdomen maris...? feminae 7-articulatum.

The relation of this genus to Micippa, Leach, and Paramicippa, Edw., is very
striking. It agrees with them in most of its essential characters, as well as in its ge-
eral aspect; but is readily distinguished from them by the form of the rostrum, which
in those genera is large and deflexed, whilst in Othonia it is extremely small and hori-
Zonal. There are two species in the collection brought from South America by
Mr. Cuming, of each of which two female specimens only were found: the characters
of the anterior feet and of the abdomen must therefore at present be confined to those
of that sex.

Othonia sex-dentata.

Tab. XII. Fig. 1.

Oth. testae margine laterali dentibus sex triangularibus acutis.


Hab. ad Insulas Gallapagos dictas.


Carapax broadly oval, moderately elevated, the surface rough, granulated, and slightly
hairy; the lateral margin with six flattened triangular, falciform teeth, the points acute
and directed forwards; a ridge of prominent granulations over the posterior margin.
Rostrum very small, bifid, with a small sulcus continued backwards from the division.
Orbits with a broad triangular fissure above, the tooth on each side flattened and trian-
gular, the outer one the larger. Eyes not larger than the peduncles, which are elon-
gated, slender, projecting forwards and slightly curved inwards.

Internal antennæ extremely minute, and placed far back behind the rostrum. Ex-
ternal antennæ hairy, short, the basilar joint broad and flat, having a triangular external
tooth, which extends forwards as far as that of the orbit; second joint flat, cordate,
 anteriorly emarginate for the insertion of the third joint, which is also compressed, and
much smaller than the previous one: the remaining joints are small and cylindrical.
External pedipalps with the outer footstalk gradually acuminated: the inner footstalk
with the first joint rather broad and rhomboidal; the second triangular with the an-
terior angles somewhat produced.

Abdomen (in the immature female) oval, consisting of seven nearly equal articulations,
obtusely carinated along the centre; each of them delicately ciliated at its anterior margin.

Feet of moderate length: the anterior pair (in the female) considerably smaller than the rest, slender, slightly compressed, and smooth; hand with a small obtuse tooth above and one beneath, at the base; the fingers with the margins minutely serrated. The moveable finger longer than the other, and curved over its extremity. The remaining pairs of feet decreasing in length from the second to the fifth, depressed, and slightly hairy; the antepenultimate joint has a shallow sulcus on each side; the terminal joint is minutely toothed beneath.

Of the colour nothing can be said, as both the specimens preserved by Mr. Cuming were bleached.

Length 9 lines; breadth 8 lines.

Found by Mr. Cuming at the Gallapagos Islands in sandy mud, at the depth of six fathoms.

Othonia quinque-dentata.

Tab. XII. Fig. 2.

Oth. testae margine laterali dentibus quinque triangularibus acutis armato.


Hab. cum præcedente, ad Insulas Gallapagos dictas.


This species resembles the former one in most of its characters. It differs, however, in the number of teeth on the lateral margin, and very considerably in size. The frontal portion of the carapax is more produced, and the surface more scantily granulated, and without spines. The two specimens of the former species are nearly an inch long, and are both evidently immature, as the abdomen is but very little developed. Those of the present species, which are very little more than half an inch in length, have the abdomen fully developed, being very prominent, and of a circular form.

The general colour is brown; the feet with alternate rings of reddish and brown.

Two female specimens were found by Mr. Cuming with the former.

Genus Tyche.

Testa oblonga, depressa, angulata, antecè declivis, fronte lato, rostro bidentato piloso terminata; rostri dentes compressi, obtusi, apicem versus internè emarginati. Orbita suprè latissima, in dente prominenti complanato antecè producta, infrè cares. Oculi pedunculo elongato minores. Antennæ interiores in fossulâ ad basin rostri insertæ. Antennæ exteriores rostro longiores, articulo basilarì latiusculo, antecè angustiore; articulo tertio secundo abruptè minore; omnibus externè pilosis.
Pepipalpi externi rugosi, caule exteriore subulato, caulis interioris articulo primo canaliculato, exitus profunde emarginato; secundo securiformi, tridentato. Pedes antici graciles, simplices, pari secundo breviore, digitis inermibus; posteriores cylindrici, unguidibus acutis, curvis, complanatis terminati. Abdomen maris 7-articulatum. Fœminae . . . ?

This genus offers in its general form and aspect, as well as in its more minute and important characters, several very remarkable peculiarities. The flattened body with its recurved and angular margin, the sloping direction and extraordinary size of the front, the laminated and extended form of the superior margin of the orbits, the absence of any inferior process of those parts, the eyes lengthened so as just to peep out beyond the extraordinary development of the orbits, whilst they are wholly uncovered beneath, the forms of the antennæ and pedipalps,—altogether present a very interesting assemblage of characters, which, whilst they indicate a near affinity to the genus Criocarcinus Guér., show it to be essentially distinct not only from that but from every other genus of Crustacea.

Tyche lamellifrons.

Hab. ad Panama, Americæ Centralis.

Carapax depressed, of an oblong irregularly four-sided figure, flattened behind the gastric region, which is considerably elevated and with the lateral and posterior margin forms a hexagonal outline: posterior margin turned up. The lateral margins are parallel, and anteriorly separated by a minute fissure from the superior orbitar process, which expands outwards, in a broad and flattened plate, covering the elongated eyes, so as to allow only the extremity of those organs to be seen from above; it is curved forwards in a prominent flattened tooth which extends nearly to the level of the apex of the rostrum. The orbits are wholly wanting beneath. The rostrum is formed of two flattened teeth, separated from each other from its base; they are obtuse, and excavated at the inner margin near the apex: both margins are furnished with hooked and elevated hairs. The eyes are smaller than their peduncles, which are elongated, somewhat larger at their base, gradually attenuated towards the apex, and wholly exposed from below, though concealed above (excepting at their tips) by the superior orbitar plate.

The interior antennæ are placed in an excavation at the base of the rostrum, which is partially divided by a small process of the anterior margin. Exterior antennæ a little longer than the rostrum; the basilar joint broad, compressed, becoming rather narrower forwards, and having a very shallow longitudinal sulcus: the remaining joints cylindrical, furnished on the outer side with numerous hairs, which are hooked at the extremity; the second joint with a minute tubercle at its base; the third abruptly smaller than the preceding one. External pedipalps with the outer footstalk subulate; the first
joint of the inner footstalk longitudinally channelled, externally deeply emarginate for the articulation of the second joint, which is somewhat securiform, and tridentate at its inner margin.

*Abdomen* consisting of seven joints in the male, the third being longer and broader than the contiguous ones.

Anterior feet simple, slender, smooth, shorter than the second pair; the fingers perfectly simple, and meeting only at their points. The remaining feet cylindrical, slightly hairy above, the hairs being thickened at the points and hooked, as are also those of the *antennae* and *rostrum*. The nails long, acute, compressed, and curved.

Colour a dull uniform brown, paler beneath.

Length of the carapax, including the *rostrum*, 7 lines; breadth 4 lines.

Two male specimens were found by Mr. Cuming at Panama, on sand at the depth of six to ten fathoms.

**Genus Pericera, Latr.**

**Pericera villosa.**

Tab. XII. Fig. 4.

*Per.* testá depressá, villosá, regionibus elevatis, sulcis separatis, spiná obtusá laterali utrinque; rostri cornibus validis, sublamelliformibus, divergentibus; dente articuli basilaris antennae externae dente superorbitali multò longiore; antennis exterioribus sub rostro insertis.

*Hab.* in Sinu Guayaquil.


This species belongs to Dr. Edwards's second section of the genus, in which the tooth of the upper margin of the orbit is much shorter than that of the basilar joint of the external *antennae*. The general appearance of the carapax, its form, its remarkable sculpture, and its dense villous covering render it one of the most interesting of the genus.

The carapax is irregularly rhomboidal, longer than it is broad, considerably produced anteriorly, the posterior margin obtusely angular. It is generally depressed, but the regions are individually elevated, and separated from each other by deep *sulci*. The whole surface is covered by a dense villous coat. The lateral margin is armed on each side with a long, thick, horizontal spine, somewhat conical, obtuse, and bent a little forwards. The eye is very small, placed on a moderate peduncle, and projects a little beyond the margin of the orbit, which is furnished with a single short obtuse tooth above. The basilar joint of the external *antennae* is prolonged forwards into a tooth, which projects considerably beyond that of the orbit. The moveable portion of these *antennae* does not extend to much more than half the length of the *rostrum*, by which they are wholly protected and concealed. The *rostrum* is very broad, and prominent;
consisting of two flattened, rather obtuse, diverging horns, which are nearly as far apart at the apex as the distance between the eyes.

The abdomen in the male consists of seven segments, each elevated in the centre into a tubercle, forming a sort of interrupted obtuse carina: in that of the female the segments, which are also seven, have each three elevations, producing a kind of tessellated appearance of the whole.

The feet are covered with extremely short hair. The anterior pair in the male is rather larger than the others, though less so than in Per. heptacantha. The fingers meet only at the extremities, though they approximate throughout their length more nearly than in some other species. The nails of the other feet are robust and somewhat curved.

The colour of the male is a brown red, the latter colour predominating on the outer surface: that of the female is a darker brown without any admixture of red.

Length 1 inch 7 lines; breadth the same, including the lateral spines, each of which measures 3 lines.

Three specimens, an adult male, and an adult and an immature female, were obtained by Mr. Cuming in the bay of Guayaquil, on sandy mud, at the depth of eleven fathoms.

**Pericera ovata.**

Tab. XII. Fig. 5.

*Per. testá elongato-ovatá, spinis viginti ad viginti quatuor armátá; dente superorbitali dente articuli basilaris antennae externe longiore.*

*Hab. ad Insulas Gallapagos dictas.*


The carapax of this species is oval, longer in proportion to its breadth than in many others, considerably elevated, at least in the female, the only sex as yet observed, sparingly covered with short close hair, and furnished with numerous spines, of various length and size, of which there are four small ones on the median line of the gastric region, three on the cardiac and genital, of which the middle one is the largest, one on the intestinal, a very small one on each hepatic, three on the branchial, and four or five on each lateral margin. The orbit is formed nearly as in the other species, the upper and anterior spine extending much beyond that of the basilar joint of the external antennae. Between this spine and the outer one is a fissure, and below a considerable hiatus bounded by the basilar joint of the antennae. The eyes are rather larger than their peduncles, and extend beyond the margin of the orbit. The rostrum is formed of two diverging horns, and has a depression at their base.

The basilar joint of the external antennae is very broad; its outer spine is short and triangular, and there is a very small tooth beneath the insertion of the second joint. The moveable portion is as long as the rostrum, and beset with a double series of bristles. The second joint of the internal footstalk of the outer pedipalps is triangular, the anterior margin rounded, and scarcely notched.
The abdomen of the female is oval, seven-jointed, and has an obtuse interrupted carina running its whole length, formed by a tubercle on the centre of each joint: the first joint has a small tooth.

The legs are without spines, but covered with close hair; the first pair in the female is not larger than the others, and shorter than the second and third, which are the longest of the whole. The hand is simple, naked, and slender; the claw small and furnished with extremely minute teeth.

The colour is a rich, rather light, reddish brown.

Length 1 inch; breadth 6 lines.

Two specimens, both females, were dredged by Mr. Cuming at the Gallapagos Islands on coral sand at the depth of six fathoms.

Pericera heptacantha.

Tab. XII. Fig. 6.

Per. testá pyriformi, dorso quinque-spinoso, ordine 1—3—1, lateribus utrinque unispinosis; rostri cornibus parvis, acutis.

Hab. ad Americae Centralis oras. (Puerto Portrero.)

♂ Mus. Soc. Zool.—♀ Bell.

The carapax of this species is broader in proportion to its length than in most others of the genus, contracted forwards, and considerably elevated. It is moderately covered with close short hair, longer towards the fore part, and has seven large spines, of which one is placed on the genital region, one on the cardiac, one on the intestinal, one on each branchial, and one on each side beneath the latter; they thus form a cross, of which that on the cardiac region forms the point of intersection. The two branchial and the intestinal spines are a little recurved. The orbit, as in all the species of this section, is furnished above with a long tooth, which is recurved. The eyes project but little beyond the orbit. The rostrum is small, occupying not much more than one third of the distance between the external margins of the orbits; the cornua are as long as the breadth of the rostrum, acute, styliform, and divergent.

The external antennæ have the basilar joint moderately broad, with the external tooth shorter than that above the orbit; there is a small tooth beneath the former, and the tooth which goes to form part of the inferior margin of the orbit is long, acute, and laminated. The moveable portion of the antennæ is setaceous, as long as the rostrum, and furnished with a few hairs.

The second joint of the inner footstalk of the external pedipalps is quadrate and emarginate at the anterior and inner angle.

The abdomen of the male is rather prominent; the second joint has a small central tubercle, the third three slight elevations, the sixth, which is the longest, has a central tubercle, and on each side a minute projection; the seventh is rounded anteriorly. The abdomen of the female is broad, rounded, and has a broad obtuse carina.
The first pair of feet in the male are much larger and longer than the others: in the female they are the smallest of all. They are covered with scattered granulations, but are without spines. The claw is obtuse, the fingers curved, meeting only at the point, which is obtuse, rounded, and denticulated. The remaining feet are nearly equal, covered with short hair, the nails moderately curved.

Colour light brown, covered with darker hair; the first pair of feet reddish.

Length 1 inch 5 lines; breadth, including the lateral spines, 1 inch 7 lines.

Two specimens, a male and a female, were obtained by Mr. Cuming at Puerto Portero, in Central America, on sand, at the depth of thirteen fathoms.

**Genus Acanthonyx, Latr.**

**Acanthonyx Petiverii, Edw.**

Found by Mr. Cuming at the Gallapagos Islands on fine coral sand at the depth of five fathoms; and by Mr. Miller on the coast of Brazil.

**Genus Epialtus, Edw.**

**Epialtus dentatus, Edw.**

*Ep. rostro bifido; dente minimo utrinque ante orbitam; margine laterali rotundato, haud marginato, dentibus tribus et tuberculó unico.*

Found by Mr. Cuming at Valparaiso in crevices of rocks in deep water.

**Epialtus marginatus.**

Tab. XI. Fig. 4. ♂. Tab. XIII. ♀.

*Ep. rostro bifido; dente minimo utrinque ante orbitam; margine laterali marginato, dentibus duobus antice et tuberculis duobus ad latera, quorum posterius obsoletam.*

*Hab. ad Insulas Gallapagos dictas, D. Cuming; et ad oras Brasiliae, D. Miller.*


The carapax is rounded behind but angular and produced forwards; the surface even, punctate; and the regions divided by impressed lines. The upper and under surfaces are separated by a distinct marginal line, on which are two small tubercles, of which the posterior is obsolete, or marked only by a slight turn in the marginal line. The anterior margin has two acute prominent teeth. The *rostrum* is narrowed forwards and bifid; and there is a small tooth on each side in front of the orbit. The orbits are circular and entire, and the eyes globular, accurately fitting the orbits and scarcely projecting beyond them.

The internal *antennae* are lodged in a large *fossa*, which is open and undivided anteriorly, but divided from behind forwards by a long narrow spine. The external *antennae* are concealed by the *rostrum*; the basilar joint broad and much produced forwards; the moveable portion cylindrical, shorter than the *rostrum*. Pedipalps with the outer
footstalk having parallel sides, except at the *apex*, which is triangular; inner footstalk smooth and polished, with the second joint truncated at the inner and posterior angle.

*Abdomen* of both sexes with seven joints.

Anterior feet of the male very robust, nearly twice as long as the carapax, very minutely granulated: the arm with two tubercles above and two beneath: the hand rounded, smooth; the fingers strongly tuberculated through their whole length, meeting only at the points, which are somewhat excavated; the movable finger longer than the other. Posterior feet cylindrical, the joints tumid: the second pair longer than the hinder ones, which decrease in length to the fifth. A tooth on the inferior side of the penultimate joint, which is hairy at the point: it is smallest on the second pair and longest on the fifth. The last joint is curved, acute, and finely toothed beneath.

Colour of the adult dark brown; of the young female, paler and reddish.

Length of the carapax 4 inches; breadth 3 inches 3 lines.

The large male specimen was found by Mr. Cuming with *Ep. dentatus* at Valparaiso in crevices of rocks. The young female specimen was brought by Mr. Miller from Rio Janeiro.

It is not without considerable hesitation that I have decided on giving to these *Crustacea* the characters of distinct species. I was first led to the opinion that they were so, by comparing with Mr. Cuming's specimens of *Epialtus* one of an immature female which was kindly presented to me by Mr. Miller, and which he had taken at Rio: and a subsequent more particular examination of the former specimens has tended greatly to confirm this view, as the largest and finest of them, a very fine adult male, possesses all the characters which had led me to consider Mr. Miller's specimen as distinct. I have thought it desirable to offer a figure of each of these two individuals, and as they differ from *Ep. dentatus* only in slight characters, which are easily appreciated, it appeared unnecessary to figure that species, especially as it has been described by my friend Dr. Milne Edwards, and will I hope shortly be figured by him.

The characters upon which I have founded this distinction are these. In *Ep. dentatus* the lateral margin is rounded, the sides of the carapax passing off from above to beneath in a continuous rounded surface: in *Ep. marginatus* the upper and under surfaces are separated by a distinct slightly salient margin; the posterior tubercle, which in the former is very distinct, is in the latter only indicated by a very slight degree of prominence in the marginal line; and the lateral spine of the former is in the latter supplied by a tubercle. The very great difference in the size of the anterior feet probably depends on age: but it is worthy of notice that in the rest of the feet the inferior spine near the extremity of the penultimate joint, is much smaller and shorter relatively in *Ep. dentatus* than in *Ep. marginatus*.
PLATE VIII.

Fig. 1. *Microrhynchus gibbosus*, ♂.
   a. Abdomen.
   b. Anterior foot.
   c. External antenna.

   d. Under surface of the head and anterior part of the body.
   e. Abdomen.
   f. Anterior foot.


PLATE IX.

Fig. 1. *Rhodia pyriformis*, ♂.
   a. Under surface of the head.
   b. Anterior foot.
   c. Abdomen.

   d. Under surface of the head.
   e. Anterior foot.
   f. Abdomen.

   g. Under surface of the head.
   h. Abdomen of the male.
   i. Abdomen of the female.

   k. Under surface of the head.
   l. Anterior foot.
   m. Abdomen of the male.
   n. Abdomen of the female.
   o. Abdomen seen from behind.

   p. Anterior foot.
   q. Abdomen of the male.
   r. Abdomen of the female.

   s. Under surface of the head.
   t. Anterior foot.
   u. Abdomen of the female.

   v. Abdomen of the male.
PLATE X.

Fig. 1. *Mithrax rostratus*, ♂.
   a. *Abdomen* of the male.
   b. *Abdomen* of the female.


   c. *Abdomen* of the young male.
   d. *Abdomen* of the young female.
   e. *Abdomen* of the adult female.

PLATE XI.

Fig. 1. *Mithrax nodosus*, ♂.
   a. Under surface of the head.
   b. *Abdomen*.

   c. *Chela* of the anterior foot.
   d. External pedipalp, with its inner footstalk.
   e. *Abdomen*.

   f. Under surface of the head.
   g. Anterior foot.
   h. *Abdomen*.

   i. Under surface of the head.
   j. *Abdomen* of the male.
   k. *Abdomen* of the female.

PLATE XII.

Fig. 1. *Othonia sex-dentata*, ♀.
   a. Under surface of the head.
   b. Internal antenna.
   c. Anterior foot.
   d. *Abdomen*.

   e. *Abdomen*.

   f. Under surface of the head.
   g. Internal antenna.
   h. External pedipalp.
i. Anterior foot.

j. Abdomen.

4. Pericera villosa, ♂.

k. Under surface of the head.

l. External pedipalp.

m. Abdomen of the male.

n. Abdomen of the female.

5. Per. ovata, ♀.

o. Under surface of the head.

p. External pedipalp.

q. Abdomen.

6. Per. heptacantha, ♂.

r. Under surface of the head.

s. External pedipalp.

t. Abdomen of the male.

u. Abdomen of the female.

PLATE XIII.

Epialtus marginatus, ♂.
1. Rhedia pyriformis. 2. Pelia paucitissa. 3. Herbstia Edwardsii.
1. Melitas nudaica
2. Melitas denticulatus
3. Melitas pygmaeus

4. Epialtus marginatus
1 *Cliboaa arcuatoas.
2 *C. quinquedentatus.
3 *Tyle hurnelliferus.

4 *Pissiv a villosi.
5 *P. vento.
6 *P. keptaconcha.

Communicated November 24, 1835.

Although the days are for ever gone by when any one seen feeding a caterpillar, digging for a grub, or with expanded net endeavouring to capture an insect on the wing, would be considered as intellectually below the standard of his fellow men, still there are not wanting those who require to be convinced of the utility of entomological investigations; and by no better mode can the entomologist prove the value of the science he cultivates than by a practical application of the knowledge he acquires of the properties and economy of insects, to secure the advantages to be obtained from some, and to prevent the injuries inflicted by others.

To the agriculturist in particular the labours of the entomologist are calculated to be of the deepest interest. The injury that has recently been done to the sugar cane, to the amount of one third of the produce of the crop, by the rapid and alarming progress of a small but most destructive insect in the island of Granada, its ravages now extended over two thirds of the island, and its appearance in the neighbouring islands, may be quoted as an instance abroad; while the serious losses sustained by the growers of turnips in our own country, particularly during the last summer, bring the various sufferers to the entomologist for his assistance, perfectly aware that a knowledge of the life of the insect through all its various states and changes is the first important step towards the adoption of some effectual method of preventing its future depredations.

The destruction of a portion of the turnip crop in this country, usually effected by the larvæ of two small insects, the Halteca nemorum and Hall. concinna of authors, has long afforded a subject for investigation; and the reader who is interested may consult with advantage the 'Report of the Committee of the Doncaster Agricultural Association' on this subject. I may here add that there is now a better prospect of checking the ravages committed by the young of these little beetles, the larva and pupa having lately been accurately ascertained, and specimens sent to the Entomological Society of London, with a communication, by Mr. Lekeux.

But the destroyer of a very large proportion of the turnip crop, on the light and chalky soils of this country, during the last dry summer, is an insect of a different kind, and one that happily does not make its appearance in great numbers except at wide intervals, and during those seasons that are remarkable for the almost total absence of rain.

The first public notice I am acquainted with on the subject of this particular insect,
and the extent of the injury it inflicts, is in the 'Transactions of the Royal Society' for 1783: in which William Marshall, Esq., an agriculturist in Norfolk, details at some length the particulars of the appearance of the parent fly during 1782, the year in which he wrote his account; and refers to a previous visitation, about twenty-two years before that time, when the loss from the destruction of the turnip crop was but little less severe.

In the year 1782, Mr. Marshall informs us, many thousands of acres upon which a fairer prospect for a crop of turnips had not been seen for many previous years, were ploughed up; and as the season was too far advanced to expect any profit from a fresh sowing, the loss to the farmer individually was considerable, and to the county immense.

"It was observed," says Mr. Marshall, "in the canker year above mentioned, that prior to the appearance of the caterpillars great numbers of yellow flies were seen busy among the turnip plants, and it was then suspected that the canker was the caterpillar state of the yellow-fly; since that time it has been remarked, that cankers have regularly followed the appearance of these flies. From their more frequently appearing on the sea-coast, and from the vast quantities which have, I believe, at different times, been observed on the beach washed up by the tide, it has been a received opinion among the farmers, that they are not natives of this country but come across the ocean; and observations this year greatly corroborate the idea. Fishermen upon the eastern coast declare that they actually saw them alight in cloud-like flights; and from the testimony of many it seems to be an indisputable fact that they first made their appearance on the eastern coast; and moreover that, on their first being observed, they lay upon and near the cliffs so thick and so languid that they might be collected into heaps, lying, it is said, in some places two inches thick. From thence they proceeded into the country, and even at the distance of three or four miles from the coast they were seen in multitudes resembling swarms of bees."

Whatever may have been the source from which this country derived the original stock, it is quite certain that during the last year the maritime counties on the east and south coasts were the most infested; but the simultaneous appearance of the insect in some inland counties also but too clearly proves that it is now established as a native.

Early in July 1835 the yellow-fly was again seen in abundance upon the young turnips, and it was recollected by some that this was the fly which prevailed also in the year 1818, and which was followed by the caterpillar which they knew by the name of the blacks. Another observer, as noticed in a popular weekly publication, said, "It is of no use hoeing these turnips, for I perceive this year a fly which is the forerunner of the 'nigger' caterpillar."

These predictions were soon verified. The female fly, by means of a delicately serrated instrument under the abdomen, is enabled to make a small aperture on the under surface of the leaf of the turnip, in which she deposits a single egg; and each female produces and deposits in different places about twenty of these eggs. In eight or ten days the eggs are hatched, and the dark-coloured caterpillars crawl forth and commence
AN INSECT DESTRUCTIVE TO TURNIPS. 69

the work of destruction by feeding voraciously on the soft parts of the leaves of the turnip, leaving the fibres untouched: after a few days they cast their black skins, and then assume one of a more slaty or grey appearance; they still continue, however, to feed on the leaves, passing from one to another. The destruction is complete, a whole field in a very short time presenting only an assemblage of skeletonised leaves, and this too even when the turnip itself has gained a considerable size. The caterpillar having passed through this feeding stage of its existence buries itself in the ground; and an exudation from its skin enables it to form for itself out of the soil, by the agglutination of particles, a strong oval cocoon. Some of the earlier broods passed very rapidly into the perfect insect, and were found on examination to be full of ova.

The insect thus bred proved to belong to the order Hymenoptera, the family Tenthredinidae or Saw-flies, the genus Athalia of Dr. Leach, and the species Centifolica of Panzer, described by Mr. Stephens in the seventh volume of his "Illustrations of British Entomology," page 42, species 2, as follows: "Head and antennae black; mouth yellowish; thorax luteous, with a large triangular black patch on each side, extending to the metathorax; abdomen pale luteous, with the base of the 1st segment black, and the tip of the ovipositor in the female; legs pale luteous, with the extreme apex of the tibiae and of each joint of the tarsi black; wings pale testaceous at the base, colourless, and with nervures fuscous at the tip; costa and stigma fuscous or blackish." "Length of body three to four lines, breadth with wings extended seven to eight lines."

The larva or caterpillar is from half an inch to five eighths of an inch in length, and about the thickness of a crow-quill, with the head and upper part almost black, a lighter grey line along the side, six short articulated legs, and eight pair of accessory membranous appendages. On opening one of the cocoons on the 16th of November, the larva was found to have undergone little or no change at that time; the caterpillar was alive and soft, and the inside of the cocoon was perfectly smooth, and exhibited a shining silvery-coloured lining.

The crops of turnips in the counties of Kent, Essex, Sussex, part of Buckinghamshire, Hampshire, and Wiltshire were considered a failure; and so long did the various broods continue their attacks, that the produce of a second and even of a third sowing

1 From the serrated instrument on the abdomen of the females.
2 The Rev. W. Kirby, who has perused this paper previously to its publication, has favoured me with a reference to an observation which is closely connected with its subject. Fabricius, who regarded the Ath. Centifolica (Tenthredo Centifolia, Panz.) as synonymous with his Hylatoma Spinatum, the Ath. Spinatum, Leach, remarks in his "Systema Politorum" with reference to the latter, "Larva tota nigra victitit in Brassica Rapae quam destruit." If these species be, as Mr. Stephens considers them, really distinct, the habit of destructively feeding on the turnip would consequently seem to be common to both Ath. Centifolica and Ath. Spinatum; each of which occurs in this country. They are, however, so nearly allied to each other that the only distinction between them indicated by Mr. Stephens is the colour of the antennae: and as this character appears to be variable in different individuals, Mr. Kirby is not disposed to regard the distinctness of the species as being yet definitively determined. In the individual figured in illustration of the present communication, a male, the antennae are of a dull yellow underneath.
did not escape destruction, nor was it till the occurrence of the rains in September, after an unusually dry summer in many districts, that the mischief ceased. Some farmers who sowed for turnips again, immediately after the first rain, were as successful as the lateness of the period would admit. It has been observed of those turnips that suffered in the leaf from the attacks of the black caterpillar, but not sufficiently to produce the death of the plant, that the turnip itself had become pithy and of little comparative value. So great was the failure of the turnip crop generally, that in some of the counties on the coast where water-carriage was available, ship-loads of turnips were said to have been contracted for from the Continent to supply the deficiency.

Of the degree of success which attended the various remedial measures adopted, I possess but little precise information. On a former visitation of this insect in the county of Kent, some farmers, it is stated, saved those fields in which the injury had scarcely begun, by turning in hundreds of ducks, with a boy going before them with a long pole, brushing the caterpillars off the leaves of the plants; and it is added that it was an amusing sight to observe the ducks waddling after their courier, and devouring the insects with avidity, eyeing both sides of every leaf lest they should miss such palatable morsels. A heavy roller passed over the ground in the evening or night, when the caterpillars were at their feed and exposed to its effects, was another remedy resorted to. But that which was considered the most effectual was the strewing of quick-lime by broad-cast over the ground, and renewing it when dispersed by the wind. By this means, I was told, one field of turnips near Dover was saved, though surrounded by others that suffered greatly where no such preventative was employed.

PLATE XIV.
Athalia Centifolia.

Fig. 1. The perfect insect, magnified.
2. The same, of the natural size.
3. The antenna of the male, considerably magnified.
4, 5. The larva.
6. The cocoon.
7. The same, divided longitudinally and seen from the inside.
8. The pupa, of the natural size.
9, 10, 11. The same, magnified and seen in various positions.
12. A Dipterous parasite (one of the Muscidae) which, having completely devoured the interior of a larva, has undergone its change to a coarctate pupa within the skin of the larva of the Athalia, portions of which (greatly stretched) are seen remaining on the outside of the Dipterous pupa, as well as the head of the larva which remains entire. An analogous instance, in Ophion Dorithæa, has been recorded by M. Audouin in the 'Annales de la Société Entomologique de la France' for 1834.
VI. Mémoire sur une nouvelle Espèce de Poisson du Genre Histiothope, de la Mer Rouge.
Par M. E. Rüppell, M.D., Membre Externe de la Société Zoologique.

Communicated December 8, 1835.

MESSRS. Cuvier et Valenciennes publièrent dans le 8ème volume de leur 'Histoire Naturelle des Poissons,' pages 293 et suivantes, la description des trois espèces du genre Voilier ou Histiothope qui leur étoient connues, et qu'ils nommèrent Hist. Indicus, Hist. Americanus, et Hist. pulchellus. L'objet du présent mémoire est de faire connoitre une quatrième espèce, que j'ai recueilli dans la Mer Rouge. Elle paraît se rapprocher de celle que les naturalistes de Paris indiquèrent sous le nom de Hist. Americanus, ce qu'un examen ultérieur de cette espèce peut seul décider; car ce que ces Messieurs ont publié sur cette espèce est trop incomplet pour comparer et discuter les rapports de ces deux poissons. J'ai reçu mon nouveau Histiothope à Djetta, sur les côtes d'Arabie: on venoit de le prendre dans les filets. Cependant cela ne devait être qu'un cas accidentel, car les pêcheurs Arabes ne savoient m'indiquer un nom trivial pour un poisson d'une forme si extraordinaire.

Les deux espèces connues de la mer des Indes sont faciles à distinguer de celle dont je vais donner la description, car le Hist. Indicus est reconnoissable par ses longues et robustes pectorales, dont le premier rayon est très large et tranchant, égalant ¼ ou ⅔ de la longueur totale du corps ¹. Le Hist. pulchellus se caractérise principalement par l'épine saillante à l'angle inférieur de son préopercule. Enfin ces deux espèces et même celle nommée Americanus ont la première dorsale mouchetée par des taches, pendant qu'à celle que je vais décrire cette nageoire est d'une couleur noire uniforme, dont le bord libre est découpé en demi-cercle; c'est même cette particularité du manque des taches qui m'a fait choisir pour nom spécifique de ma nouvelle espèce le mot de Hist. immaculatus, sous lequel je propose d'introduire dans le catalogue systématique la description de la figure que j'ai fait sur le vivant, et dont j'ai déposé le poisson original conservé en alcohol au Musée de Francfort.

La forme du corps du Voilier sans taches (Histiothope immaculatus) est un cylindre allongé, comprimé verticalement, la tête en cone pointu, la queue assez plate, la nageoire caudale formant un grand croissant, dont les pointes sont acutangles. Comme le bout de la mâchoire supérieure est un peu usé, je prends pour unité de mesure la distance du

¹ Cuvier, loc. cit., p. 295.
milieu de la pupille jusqu'au bord postérieur de l'opercule, distance non équivoque et qui dans l'espèce en question correspond exactement au plus grand diamètre vertical du corps, qui est vis-à-vis du commencement de la première dorsale ; ce diamètre se trouve six fois et un quart dans la longueur du corps depuis le bord postérieur de l'opercule jusqu'au bord externe du milieu de la caudale, et deux fois depuis le bord antérieur de l'orbite jusqu'à l'extrémité de la mâchoire supérieure, tel qu'elle est actuellement dans mon individu. La pointe de la mâchoire inférieure ne s'avance du centre de l'œil que 1½ de la hauteur verticale du corps ; les nageoires pectorales n'égalent que ¾ de ce diamètre, de sorte qu'elles se trouvent 13½ fois dans la longueur totale du corps.

La première dorsale, qui commence vis-à-vis du bord du préopercule, est entièrement composée de rayons simples, dont le premier est très petit, les suivants augmentent en progression régulière, jusqu'au dix-huitième, qui est le plus long et égale trois fois le plus grand diamètre vertical du corps. Les rayons suivants s'accourcissent peu à peu, mais depuis le quarantième rayon jusqu'au quarante septième, qui est le dernier, ils décroissent très rapidement, et les quatre derniers sont petits. Ils réunissent la nageoire dorsale à rayons simples à la seconde dorsale, composée entièrement de rayons branchus, qui sont assez bas, mais dont le dernier surpasse les autres d'un tiers de leur longueur. Vis-à-vis de cette seconde dorsale est une seconde anale, qui lui est absolument égale en forme et en grandeur ; elle est séparée de la première anale par un espace de la longueur de cette nageoire : cette première anale est de forme triangulaire, à-peu-près équilatérale, et composée de rayons simples. Les ventrales, situées perpendiculairement sous les pectorales, sont composées de trois rayons non articulés ; le premier est très court et adossé fermement au second, qui est très long, aplati, et qui se prolonge depuis la base de la pectorale jusqu'à l'anus. Ce rayon est bordé postérieurement tout le long par une membrane étroite, qui lui réunit à sa base le troisième rayon, lequel est aussi petit que le premier rayon. Ces ventrales peuvent se cacher dans une rainure, qui se trouve le long du ventre ; la peau en forme une autre le long de la dorsale, mais elle n'est pas assez profonde pour pouvoir recouvrir toute la nageoire. J'ai déjà observé que les pectorales sont petites ; elles terminent en pointe, et leurs rayons n'ont rien de particulier. La membrane branchiostégée des deux cotés de la tête est réunie sous la gorge et entoure la poitrine sans y être attachée à l'isthme. Toute la peau du corps est garnie d'assez petites écaillres qui tombent facilement ; celles de la partie basale de la nageoire dorsale et au devant des ventrales sont toutes pointues. La ligne latérale décrit près des opercules une petite courbure, qui finit à l'extrémité des pectorales ; de là elle suit en droiture la moitié de la hauteur du corps ; il n'y a pas de carène, mais deux crêtes cutanées des deux cotés de la base de la caudale. Le nombre total des rayons est :
La couleur de la partie supérieure de la tête et du dos est bleu violet foncé; celle du ventre brille du reflet de l'argent; l'iris est brun clair avec un cercle jaunâtre à l'entour de la pupille. Les deux nageoires dorsales, les ventrales, et la caudale sont d'un noir bleuâtre uniforme. Les pectorales et les deux anales sont grisâtres; la première anale a de plus une tache noire à sa pointe inférieure.

Les deux mâchoires sont garnies à leur bord d'une bande de granulations fines, qu'on pourrait nommer de petites dents en velours; il y a au palais un voile membraneux, qui forme un cul de sac ouvert du coté de l'osophage, et derrière lui sur les cotés est une faible bande de granulations dentaires. La langue et les arceaux branchiaux sont lisses; à ceux ci manquent ces longues pointes en forme de peigne, qui garnissent le bord concave des arceaux branchiaux de beaucoup de poissons de la famille des Scombres.

Comme je n'ai reçu qu'un seul individu de ce poisson, je ne veux pas le sacrifier pour des recherches anatomiques, qui probablement donneraient les mêmes résultats que le Voilier disqué par M. Ehrenberg, et qui ont été publiés par M. Cuvier.

En communiquant la description de ce poisson, je ne puis faire à moins d'exprimer mon étonnement que les recherches ichthyologiques sont la partie d'histoire naturelle qui a le moins de cultivateurs, et cependant c'est la branche où il y a peut-être le plus d'observations nouvelles à faire, et dont l'étude devrait interesser d'autant plus, que cette classe d'animaux est d'une utilité si éminente pour le genre humain. Lors de la publication de mon premier voyage de la Mer Rouge, j'ai décrit et figuré une centaine de poissons presque tous espèces nouvelles, que j'avais recueilli dans ces parages; mon dernier voyage m'a fait découvrir dans la même mer à peu près le même nombre de poissons, et j'enrichirai ainsi l'Ichthyologie avec le portrait de deux cents espèces nouvelles ou peu connues. Cependant je n'ai pu me procurer aucun poisson des grandes profondeurs, à la capture desquels les pêcheurs du pays ne sont pas pratique. Que de découvertes reste-il donc à faire dans ces mers là! Les excellens ouvrages de Russell et de Hamilton Buchanan sur les poissons de l'Inde, précieux sous bien de rapports, ne contiennent qu'une bien petite partie des productions ichthyologiques de ces parages, et j'espère bien que les traces de ces naturalistes distingués seront bientôt suivi avec rivalité par leurs compatriotes qui ont tant contribué dans ces derniers temps pour faire connoitre les productions naturelles Indiennes des autres classes d'animaux.
PLATE XV.

Histiophorus immaculatus.
VII. On the Genus Octodon, and on its Relations with Ctenomys, Blaine., and Poephagomys, F. Cuv.: including a Description of a New Species of Ctenomys. By E. T. Bennett, Esq., F.L.S., Sec. Z.S.

Communicated December 22, 1835.

When early in 1832 I laid before the Society a specimen of a previously undescribed Herbivorous Rodent brought by Mr. Cuming from South America, and pointed out the characters by which it was generically distinguished from all the groups that were at that time known, I stated it to be my intention to defer giving a more formal account of it until there should occur, by the death of one of the individuals which were then living in the Menagerie, an opportunity of entering into some details respecting its anatomy, both visceral and osteological. That opportunity has not yet arrived; and there are, consequently, at my disposal no other materials than those of which I availed myself when characterizing the animal in the 'Proceedings of the Committee of Science and Correspondence', as the type of a new genus, under the name of Octodon Cumingii. To these, however, I am induced again to call the attention of zoologists, at an earlier period than I had originally proposed, with the view of elucidating the relations of Octodon with the nearly allied genus Ctenomys, described by M. de Blainville in the 'Bulletin de la Société Philomathique' for April, 1826, and of which a hitherto undescribed species is contained among the collections made by our excellent colleague, Capt. P. P. King, R.N., during his survey of the Straits of Magalhaens; as well as with another form which is even more closely connected with it, and which was first made known to science by M. F. Cuvier, in the 'Annales des Sciences Naturelles' for June, 1834: to the latter M. F. Cuvier has given the name of Poephagomys, the species on which it is founded being the Poeph. ater. The affinity between Ctenomys, Octodon, and Poephagomys was first indicated by M. F. Cuvier, who, in a letter addressed to me in September last (some extracts from which were immediately communicated to the Society), made known to me the fact that the molar teeth in Ctenomys are destitute of true roots.

In the little group which these three genera appear to constitute, the genus Octodon may be regarded as occupying a central station; if, as is generally admitted, the structure and form of the molar teeth be considered as of primary importance in the arrange-

1 Part ii. p. 46.
3 p. 62.
ment of the Rodentia. The Herbivorous Rodents exhibit more strikingly perhaps than those of the Omnivorous tribe, characteristic forms in the configuration of the crowns of their molar teeth; and the form peculiar to each species or genus among them is not liable, as in the other tribe, to vary with the progress of life, and with the consequent extent of detrition which is occasioned by their continued use. The Herbivorous Rodents are, indeed, rodents par excellence; for in them a provision has been made for the perpetual renewal of the rasping surface of all the teeth. In the Rodents generally the incisors are always growing from their base forwards; and a never-failing succession of cutting or penetrating edges is thus ensured to them at their tips: their points, in constant process of wearing, are in equally constant process of protrusion. In the Herbivorous tribe a similar arrangement prevails as regards the molars also. Destitute of true roots, and growing, like the incisors, from an enduring pulp, their crowns, although perpetually wearing away by the grinding and rasping actions which they exert upon the food and upon each other, are never destroyed: as their upper surface is rubbed off the deficiency is supplied from below, and by the continual growth from the base the requisite length of the tooth is maintained, while the crown is always preserved of the due height for mastication and furnished with those ridges and folds of enamel which were originally bestowed upon it, and which are perpetually renewed. The action of these teeth is rather that of rasping than of crushing, and it is in this manner that the food is reduced in the mouth to that state of minute subdivision which is essential to the animals that are provided with teeth of this description. In the animals of the Herbivorous tribe the curious structure of the fauces, originally described by Mr. Morgan in the Capybara, Hydrochoerus Capybara, ErxI., and since observed in other Rodents, appears to be most developed: and it is only one among the numerous and beautiful illustrations of the adaptation of various portions of the organization of an animal to each other, to find in combination with a narrowing of the entrance of the pharynx to such an extent as to allow of the passage through it of none but the most minutely subdivided particles, a structure of teeth by which the existence of the means of so minutely subdividing the food should be permanently secured at all periods of the animal's existence.

At the time when Octodon was first made known to science it was remarked, as one of its most distinguishing peculiarities, that the form of the crowns of its molar teeth were, in the two jaws, strikingly dissimilar. But it was not at that time anticipated that the two forms of dentition exhibited by Mr. Cuming's Rodent would each be found to be characteristic of another nearly allied genus. It is in this manner that Octodon becomes evidently intermediate between Ctenomys and Poephagomys, by having the molars of its upper jaw constructed on the type of those of the former, and the molars of its lower jaw on that of the latter genus. The relations of these several groups, as indicated by their dentary characters, will best be understood by a brief consideration
of the form of the molar teeth of *Octodon*, and by a comparison of them with those of the allied genera.

The upper molars of *Octodon* have, on their inner side, a slight fold of enamel, indicating a groove which has a tendency to separate, on this aspect, the mass of each tooth into two cylinders. On their outer side a similar fold penetrates more deeply, and behind it the crown of the tooth does not project outwardly to so great an extent as it does in front. If each molar of the upper jaw were theoretically regarded as composed of two cylinders of bone, surrounded by enamel on all their aspects except that by which they are broadly united to each other, slightly compressed from before backwards, and somewhat oblique in their direction as regards the axis of the jaw, the anterior of these cylinders might be described as being entire, and the posterior as being truncated by the removal of its outer half. Of such teeth there are in the upper jaw of *Octodon*, on each side, four; the hindermost being the smallest, and that in which the peculiar form is least strongly marked. In *Ctenomys* the molar teeth, both of the upper and lower jaw, correspond with the structure that exists in those of the upper jaw of *Octodon*. They are formed on precisely the same type. The exceptions to their perfect similarity consist in their crowns being slenderer and more obliquely placed, whence their emargination becomes less sharply defined; and in the hinder molar of each jaw being so small as to be almost evanescent, and consisting of a single minute triangular prism. As is generally the case, however, in the dentition of this tribe of Rodents, the relative position of the teeth is in *Ctenomys* counterchanged in the two jaws; and the vacancy in the outline of the crown of the molars, which in the upper jaw is external and posterior, becomes in the lower jaw internal and anterior.

In the lower jaw of *Octodon* the crowns of the molar teeth assume, as has been already remarked, a figure very dissimilar from those of the upper, dependent chiefly on the prolongation of both portions of the tooth to the same lateral extent, and on the depth to which they are penetrated on their inner side by the fold or emargination between their anterior and posterior portions. Each of them may be regarded as consisting of two cylinders, not disjoined in the middle, where the bony portion of the tooth is continuous on the crown, but partially separated by a fold of enamel on either side, producing a corresponding notch, of which the innermost is the deepest. Placed obliquely with respect to the general direction of the jaw, they resemble, in some measure, a figure of 8 with its elements flattened obliquely, pressed towards each other, and not connected together by the transverse middle bars. With the lower molars of *Octodon* those of *Poephagomys*, as figured by M. F. Cuvier, agree in structure in both jaws.

*Octodon* thus evidently exhibits, in its dissimilar molars, the types of two genera: the molars of its upper jaw represent those of both jaws of *Ctenomys*; those of its lower jaw correspond with the molars of both jaws of *Poephagomys*.

In the absence from any collection to which I have at present access, of a specimen
of *Poephagomys*, it is not in my power to pursue further a close comparison between
the whole of these three genera. But a few general remarks on them may be offered;
and the comparison may afterwards be limited to that which can be made between the
two of which examples are now before me.

The general form of the animals of these several groups bears a close resemblance to
that of the *Water Rat, Arvicola amphibia*, La Cép. The compactness of the body is the
same; the head is equally distinguished for its shortness and rotundity; the limbs are
of moderate length; and the tail, covered like that of the *Water Rat* with short adpressed
hairs, is, similarly with the tail of that animal, of less length than the body. In the
proportionate length of the latter member there exists, however, a considerable differ-
ence among the types of the three genera: in *Octodon* the length of the tail is more
than one half of that of the body and head taken together; in *Ctenomys* it is rather
more than a third; in *Poephagomys*, according to M. F. Cuvier’s admeasurements, it
is exactly one third. Another external difference is observable among them in the
size of the outward ear: in *Octodon* and in *Poephagomys* the auricle is of moderate size
and distinctly visible, its length being about equal to the distance interposed between
its base and the eye; in *Ctenomys* it is so minute as to be concealed amid the surround-
ing fur. A third external difference among them is of far more importance than either
of the preceding, in as much as it is indicative of widely different habits: in *Octodon* and
in *Poephagomys* the claws are rather long, moderately curved, and acute at their points,
a form connected rather with arboreal than with terrestrial habits; in *Ctenomys* the
claws are long, nearly straight, thick, and blunt, and have altogether the character
which belongs to those of a burrowing animal. In all the three genera the toes are five
in number on each foot: in *Octodon* and *Poephagomys* the claw of the inner toe on the
fore foot is flattened and nail-like; in *Ctenomys* it resembles that of the other toes in its
strength, but is shorter and more curved. As the incumbent comb-like bristles sur-
mounting the inner claws of the hinder toes are observable in both the animals before
me, it is to be presumed that they exist equally in the other also.

Between the crania of *Octodon* and of *Ctenomys* there are some differences in general
form, resulting chiefly from the greater comparative length of the skull of the latter, and
from the more ample development of its auditory appendages: the extent of the cellu-
lar mass of bone connected with the internal organ of hearing bearing in these two
animals an inverse ratio to that of the external ear; and the deficiency of auricle in
*Ctenomys* being compensated for by the enlargement of the auditory cells. On account
of the development of these cells in *Ctenomys* both laterally and posteriorly beyond the
occipital ridge, the hinder portion of the *cranium* acquires a breadth and squareness
which afford a marked base, as it were, to the somewhat lengthened *frustrum* of a cone
formed by the bones of the head and face: the greatest width of the entire mass is in
*Ctenomys* at its hindermost part, while in *Octodon* the greatest width is at the external
opening of the auditory passage; behind which, for the short portion of the mass that
remains, the cranium shelves away, both on its sides and upper surface, towards the
comparatively small flattened face surrounding the foramen magnum and opposed to the
neck. With the exception of the abruptness of this posterior shelving in Octodon, the
outline of the upper surface of the cranium may be described as constituting in both
animals a slight and regular curve; which is, however, more gentle in Ctenomys than in
the one with which it is now compared. The general outline, viewed from above, is in
Octodon of an ovate form; in Ctenomys it resembles that of a lengthened triangle, trun-
cated at the apex. If, however, the comparison in the vertical view be limited to that
portion of the bony mass which lies anterior to a line crossing the skull at the upper
and hinder part of the orbit, the outline in Ctenomys will be found to be nearly paral-
lelogrammic, while that of Octodon will resemble a truncated and lengthened triangle,
widening posteriorly: a figure which is produced chiefly by the greater comparative
breadth of the frontal bones, consequent on the greater width of the ascending ramus
of the incisive at the point where it is united with the branch of the maxillary forming
the slender line of bone that separates the orbit from the large suborbital foramen. In
both these animals, as in most of the tribe, the infra-orbital foramen is single, and
attains its maximum of possible development; involving the whole of the external face
of the maxillary bone except a slender process passing to where the malar joins it after
limiting the lower edge of the orbit, and of another equally slender process arising from
this point to form the anterior margin of the orbit and unite above with the frontal and
the ascending ramus of the incisive bone. Excepting in thus limiting below the infra-
orbital foramen, and in separating that foramen by a hinder margin from the orbit, the
maxillary bone is reduced, in animals of this type, to an alveolar ridge for the entire
series of the molar teeth, and to affording capacious space for the implantation and
growth of the prolonged roots of the exceedingly developed upper incisor.

To the subjoined table of some comparative admeasurements of the crania of these
two animals the remark must be prefixed that the individual of Ctenomys is not yet fully
adult, as is evidenced by the incomplete state of closure of its anterior fontanelle.

<table>
<thead>
<tr>
<th></th>
<th>Octodon</th>
<th>Ctenomys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of the skull</td>
<td>1.6</td>
<td>1.75</td>
</tr>
<tr>
<td>Breadth of the skull at the meatus auditorii</td>
<td>.75</td>
<td>.95</td>
</tr>
<tr>
<td>Breadth of the skull at the zygoma</td>
<td>.9</td>
<td>1</td>
</tr>
<tr>
<td>Distance between the orbits above</td>
<td>.45</td>
<td>.4</td>
</tr>
<tr>
<td>Diastematic distance, upper jaw,</td>
<td>.4</td>
<td>.55</td>
</tr>
<tr>
<td>Diastematic distance, lower jaw,</td>
<td>.3</td>
<td>.4</td>
</tr>
<tr>
<td>Length of the molar series</td>
<td>.33</td>
<td>.33</td>
</tr>
<tr>
<td>Length of the mastoid process or mass of the tympanic cells</td>
<td>.45</td>
<td>.6</td>
</tr>
</tbody>
</table>
Having thus adverted to some of the more interesting points in the consideration of these animals conjointly, I now proceed to describe individually the two that are contained in the Society’s Museum. For the third, to the most important distinctive characters of which I have already alluded while comparing it with the others, I cannot do better than refer to the paper of M. F. Cuvier previously quoted, in which all the necessary details respecting it will be found. That able zoologist possessed the opportunity of inspecting the viscéra of Poephagomys, the only one of the three genera that has yet been anatomically examined; and by his sketch, as well as by his description, it appears that the intestinal canal is lengthened, as is usual in herbivorous animals, and that the cæcum, as is also generally the case in such animals, is of considerable dimensions: in length it exceeds the stomach, is not greatly inferior to it in circumference at its larger end, and rapidly tapers towards the opposite extremity into a point\(^1\).

\*\*\* \n
Fam. Arvicolidae?

Genus Octodon.

\*Dentes primores quattuor acutati, antice læves: molares utrinque utrinsecus quattuor, complicati, subæquales; superiores subtransversi, facie antica latæ, postica (ob incisuram externam profundam) duplæ angustiæ, interna in medio uniplicatæ, plicis a primo ad postremum sensim minoribus; inferiores obliqui, singulo pliçâ externâ internâque suboppositis coronidem in areas duas oblique transversales, figuram 8 vel clepsydrum quodammodo simulantes, subdispartientibus, plicâ externâ in postremo vix conspicuâ.

\(1\) Since the above was written, the Octodon which was then living in the Society’s collection has died: but, by some oversight, I was not informed of the occurrence until long after it had taken place; and the opportunity of anatomically examining the animal was consequently lost to me. From Mr. Martin’s notes of the dissection, however, I learn that the cæcum was very capacious, and measured in length more than the stomach, the length of the one being 3, and of the other 2, inches: and that it was succulated; its precise form, however, could not be ascertained, the ulceration which had taken place in it having prevented its distension; that the stomach was of a regular, nearly oval shape, equally rounded at both extremities: and that the small intestines measured 2 feet 6 inches in length, and the large intestines 1 foot 6 inches; making a total length of 4 feet, and being about seven times the length of the body: and that the commencement of the colon was disposed in a long loop or fold, its latter portion, with the remainder of the large intestines, scarcely equaling in diameter the small intestines. In all these particulars the alimentary canal of Octodon, like that of Poephagomys, accords with the general structure of the same part in other Herbivorous Rodents.

The details of Mr. Martin’s dissection will be found in the Proceedings of the Society for July, 1836.
Artus subaequales, omnes pentadactyli, digitis liberis; unguibus falcularibus, subcurvis, acutis; ungue pollicari lamnari.  
Cauda mediocris, subannulata, pilosa, ad apicem floccosā.  
Americae Australis incola, terrestres vel arborei, subsalientes.

Octodon Cumingii.  
Tab. XVI.  
Oct. suprā fusco-flavescenti-griseus nigrescente intermixtus, infrā et ad pedes pallidior; caudā suprā et ad apicem floccosum nigro.  
Hab. in Chili, prope Valparaiso.

In size and shape the present animal generally resembles the Water Rat, with which it is, systematically, nearly connected. The facial line is regularly and strongly arched, and the muzzle obtusely truncate; the eyes are small, and seated nearly midway between the base of the ears and the nostrils; and the ears are of moderate size, thinly covered both within and without with short adpressed hairs, and rounded at the tips. The whiskers are rigid, and the longest exceed the head in length. On the body, which is compactly proportioned, the fur consists almost entirely of straight hairs, lying flat, and varying in length from half an inch to nearly an inch: they become shorter on the limbs and beneath the body, and still more so on the tail and feet. Of the limbs the hinder are somewhat the longest, but the disproportion is by no means so great as might have been inferred from the saltatory habits of the animal. All the feet have five toes; but the innermost, both before and behind, is very short, and is separated by a wide interval from the rest. Except the thumb of the fore-feet, which has a short, flattened, obtuse nail, all the toes are armed with rather long, slightly curved, sharply pointed claws, partially concealed by long bristly hairs. Of the four outer toes anteriorly the two intermediate are nearly equal in length, and the two lateral somewhat shorter: posteriorly the three intermediate toes are of nearly equal length, and considerably exceed the outer. The tail, although covered rather thickly with short stiff hairs, is distinctly annulated.

The general colour of the upper surface and sides is of a brownish gray, intermixed with frequent indistinct and undefined spots and patches of dusky black. It becomes slightly darker towards the rump; and the upper surface of the entire tail, together with its under surface for one third of its length from the tip, is so deep in colour as to approach closely to black. The under surface of the animal is dusky gray, mingled with a shade of brown, lighter and nearly white beneath the base of the tail, and deeper on the breast and neck, where it is almost of the same general hue with the upper sur-
face and head. The ears are dusky, with a few stiff gray hairs at their base anteriorly, and some whitish and more closely set hairs on their inner surface. The shorter whiskers are for the most part white, and the longer black. The legs are grayish mixed with brown, becoming of a paler gray towards the feet; and the claws are deep black.

The following admeasurements are taken from a stuffed specimen:

<table>
<thead>
<tr>
<th>Measurement</th>
<th>In.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of the head and body</td>
<td>6.66</td>
</tr>
<tr>
<td>Length of the tail</td>
<td>4</td>
</tr>
<tr>
<td>Length of the head</td>
<td>1.66</td>
</tr>
<tr>
<td>Length of the muzzle, anterior to the eyes</td>
<td>.66</td>
</tr>
<tr>
<td>Length of the longest whisker</td>
<td>2</td>
</tr>
<tr>
<td>Height of the ears</td>
<td>.75</td>
</tr>
<tr>
<td>Breadth of the ears</td>
<td>.7</td>
</tr>
<tr>
<td>Length of the carpus to the end of the longest toe</td>
<td>.75</td>
</tr>
<tr>
<td>Length of the tarsus to the end of the longest toe</td>
<td>1.25</td>
</tr>
</tbody>
</table>

To Mr. Cuming, to whom I have dedicated this species, the Society is indebted for all the representatives of it that it has yet occurred to me to see. The animal, however, although apparently local, is exceedingly abundant in its native country. Captain King informs me that he has seen thousands of them at Valparaiso: and Mr. Cuming refers to them as being very numerous in that neighbourhood. To the latter gentleman I owe the subjoined information respecting their habits in a state of nature. "These animals burrow in the ground, but always under brushwood fences or in low thickets. They are so abundant in the neighbourhood of Valparaiso, that in the high road between that place and St. Jago, more than a hundred may frequently be seen at one time in search of food. Sometimes, but not often, they are observed on the lower branches of the shrubs, and on those which form the fences. They fly at the least alarm, and in running carry their tufted tails bent like a bow. A species of horned Owl, of which I had the pleasure of presenting a specimen to the Society, feeds principally on these pretty little creatures."

Two living specimens, brought from Chili by Mr. Cuming, were placed by him in 1831 in the Society's Menagerie. One of them has since escaped, but the other remains alive, and is still as active and as lively as it was on its first arrival. In captivity they appear rather shy, and have but little playfulness. They readily leap, with great agility and without any appearance of exertion, from the floor of their cage to a narrow perch placed at the height of nearly a foot, on which they remain seated quite at their ease. Their food is, of course, entirely vegetable.

These were probably the first individuals of the species that were brought to Europe. They arrived here in 1831; and were described by me, early in the ensuing year, under the name and with the characters which are still retained for them. In 1833 the animal was again described by Dr. F. J. F. Meyen, in a communication made to the German
Academy on the subject of certain of the animals collected by him during his travels in South America. Regarding it as constituting the type of a new genus, but not aware that it had previously been characterized elsewhere, he proposed for it the name of Dendrobius: and, as he considered the animal identical with the Degus of Molina, an obscure species (like many others noticed by that author), he gave it the appellation of Dendr. Degus: referring to it, as synonymous, the Sciurus Degus, Gmel. et Auct.; the Myoxus Getulinus, Papp.; and the Tamias Degus of several travellers. If, however, Molina's description of the Degus be correct, I cannot regard his animal as identical with the one under consideration: and even assuming that the name used by that writer is applied (as would seem from Dr. Meyen's statement to be the case) to Mr. Cuming's species, it is by no means improbable that it may have rather a generic than a specific value, and that it may not be limited to one animal, but include several allied to each other in outward form. Dr. Meyen briefly adverts to the habits of the species, but his remarks add little to the information furnished by Mr. Cuming and by Captain King. The position assigned by him to the genus,—which he places among the Squirrels, in immediate apposition with Myoxus,—appears to me to be altogether forced, the only important point in which they agree being their arboreal habits: the form of the molar teeth as regards their lamination is altogether dissimilar; while the absence of fangs to those teeth in the one and their presence in the others indicate a distinction of such high value as to place them in different tribes of the order to which they belong, the one ranking among the Herbivorous and the others being referrible to the Omnivorous Rodentia.

Genus Ctenomys, Blainv.

Dentes primores ½, acutati, antice laves: molares utrinque utrinsecus ⅘, postremo sub-obsoleto, caeteris similibus, simplicissimulis, veluti e laminæ simplici subarcuatâ constantibus, in maxillæ superioire externè et posticè, in inferiore internè et antice, latè exsulpēta.
Artus subæquales, omnes pentadaactyli, digitis liberis; unguiibus falcularibus, unguliformibus, subelongatis.
Cauda breviscula, subannulata, pilosa.
America Australis incolæ, fodientes.

Ctenomys Brasiliensis, Blainv.

Cten. supræ nitidè rufus, subtìs rufescenti-albidus; caudâ nigrescenti-brunneâ. (fide Blainv.)
Hab. in Brasiliâ, in provinciâ Minas Geraes.
Ctenomys Magellanicus.

Tab. XVII.

Cten. flavescenti-fusco-griseus, sub'tus pallidior; pedibus caudáque albentibus.

Hab. ad Fretum Magellanicum, prope Cap. Gregory.

In general form this animal appears, as far as can be judged of from a skin alone, to resemble very nearly the Octodon Cumingii, and to have the same short and broad head, compact body, nearly equal limbs, and sparingly haired tail: the latter member is, however, comparatively shorter, and is destitute of any marked tuft of longer hairs at its extremity. The facial line is probably less strongly arched than in that species; the eyes are, as in it, small, and seated about midway between the ears and the muzzle; but the ears are remarkably different, being so short as to be inconspicuous on account of their being buried within the surrounding fur: the short auricle is slightly pointed, closely covered on its outer surface with short hairs, nearly naked within, and furnished at the base of its upper edge with a ridge of stiff short bristles. The whiskers are numerous, chiefly white, but having among them, especially at the upper part of the tuft which they form, a few black ones: these are generally longer than the others, and some of them considerably exceed the head in length, their tips reaching as far as the shoulder. The hairs of the body are soft, silky to the feel, wavy towards their base, and straight at their tips; they are generally about three quarters of an inch in length, but some of them exceed an inch and a quarter: beneath the body they are almost entirely of the shorter kind; and on the head they are much shorter, as they are also on the lower part of the limbs. Of the five toes the innermost, both before and behind, is much shorter than the others; the intermediate the longest; those that adjoin to the middle one nearly equal to it in length, and of equal length with each other; and the outer one much shorter, the tip of its claw scarcely reaching so far as the base of the claw of the next toe. All the claws, especially those of the anterior feet, are strong, lengthened, nearly straight on their lower surface, slightly curved towards their tip on the upper, and rounded above: those of the fore feet are contracted below so as to form an edge, while the lateral margins of the hinder claws remain disunited on the under surface, leaving a vacancy within them: the claw of the inner toe on the fore feet is comparatively short, but has the same structure as the others, except in being much more curved. The whole of the claws are of a horny colour. The hairs covering the tail are shorter than those of the feet, and are rather silky, and almost altogether destitute of the rigidity of the hairs on the tail of Octodon: those towards the end unite to form a slight conical tip to the tail, but there is no approach to a distinct tuft.

The general colour of the upper surface and sides is a brownish grey, tinged with yellow, and scarcely varied by blackish; the colour is, in fact, the same as that of Octodon, but of a rather lighter tint. The separate hairs are of a dull leaden colour to-
wards the base, and the tips of most of them are pale brownish ash: the tips of the longer hairs, which are few in number, are almost black. On the under surface none of these longer, black-tipped hairs occur, and the tips of the ordinary hairs being at the same time paler in this situation than on the back, the colour of the belly is considerably lighter than that of the upper surface: on the chin and throat it is a pale fawn. On the feet and on the tail the short hairs are almost white.

The following admeasurements will aid in the comparison of this animal with Octodon:

<table>
<thead>
<tr>
<th>Measurement</th>
<th>In.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of the head and body</td>
<td>7.5</td>
</tr>
<tr>
<td>Length of the tail</td>
<td>2.75</td>
</tr>
<tr>
<td>Length of the head</td>
<td>1.9</td>
</tr>
<tr>
<td>Length of the muzzle, anterior to the eyes</td>
<td>.9</td>
</tr>
<tr>
<td>Length of the longest whisker</td>
<td>2.25</td>
</tr>
<tr>
<td>Height of the ears</td>
<td>.1</td>
</tr>
<tr>
<td>Breadth of the ears</td>
<td>.25</td>
</tr>
<tr>
<td>Length of the carpus to the end of the longest toe</td>
<td>.75</td>
</tr>
<tr>
<td>Length of the tarsus to the end of the longest toe</td>
<td>1.375</td>
</tr>
</tbody>
</table>

Captain King, to whom zoology, among other sciences, is deeply indebted for much valuable information acquired during his various and arduous surveys, made on the subject of this animal the following memoranda. "From the size of the jaw, as compared with the abundant remains of this little animal which are scattered over the surface of the ground, I think that the present specimen is rather a young one. On examining the teeth I find that it cannot be referred to any of the genera of M. F. Cuvier's arrangement in his 'Dents des Mammiferes': that to which it approaches most nearly is Helamys; but it is sufficiently distinct to constitute a new genus. The red colour of the incisive teeth is very remarkable in all the specimens which I have seen. The little animal is very timid; feeds upon grass; and is eaten by the Patagonian Indians. It dwells in holes, which it burrows, in the ground: and, from the number of the holes, it would appear to be very abundant.

"It inhabits the East entrance of the Strait of Magalhaens at Cape Gregory and the vicinity."

PLATE XVI.

Octodon Cumingii.

Fig. 1. The skull seen from above.
2. The same seen laterally.
3. The upper jaw, exhibiting the crowns of the molar teeth.
4. The lower jaw.
PLATE XVII.

Ctenomys Magellanicus.

Fig. 1. The skull seen from above.
2. The same seen laterally.
3. The upper jaw, exhibiting the crowns of the molar teeth.
4. The lower jaw.

Communicated December 8, 1835.

The molluscan animals, the anatomy of which I propose to describe, whilst they are distinguished from the Tunicata by their calcareous parts, differ from the Brachiopodoaeous Conchifera by being furnished with two lateral lobes to the mantle, secreting a right and a left valve; by having commonly an elastic intervalvular cartilage, and a more simple muscular system to open and close the shells; by having also four fixed, membranous, pectinated organs at the mouth, and four others for respiration, &c.

The Anomia I consider to be an intermediate genus between the Lamellibranchiata and the Brachiopoda; some parts of its structure being more in unison with that of the former, and some with that of the latter. The position of the animal in the shell is neither vertical as in the one, nor horizontal as in the other, but oblique with respect to the disposition of its organs. It agrees with Orbicula in having a divided muscular system, a rudiment of a pedal disc, a short intestinal canal, ovaria ramified in the mantle, the labial and branchial appendages conjoined, &c.; whilst in other respects it resembles the Monomyarian Lamellibranchiata.

I would suggest that the fossils called Spharulites are allied to the Anomia, and would intimate how desirable it would be to examine the anatomy of Thecidea, Crania, Placuna, and the different species of Anomia, Terebratula, &c.

Some degree of obliquity, and a difference of size in the two valves, is present in many genera of Lamark’s first division Monomyaria; whilst, if any inequality exist in those of his second division, Dimyaria, it does not arise from a tendency, as in the former case, to that relative position of the soft parts to the shell, which characterizes the Brachiopoda, but results from the nature of the hinge.

It is unnecessary here to enter upon the affinities of the order, or to describe the growth of shell. In the distant layers of shell in the valves of some Lamellibranchiata I think I see a resemblance to the elongated cellular valves of certain fossil genera and to multilocular shells. The figure and size of the foot influence most materially the form of the anterior part of the shell; whilst that of the posterior is dependent upon the modifications of the siphons. In order to explain the remoteness of the beaks of the valves in some

I find in some British Tunicata calcareous pieces, under the form of two conical, reticulated tubes, situated in, and projected externally from each orifice of the tunic. These, overlooked by Savigny, were found by Eysenhardt.
Conchifera, I would observe that it can only happen when there is an erosion or giving way of the cartilage, as the beaks, by means of the cartilage, are always originally in connexion. In Isocardia, for instance, we see the beaks remote and the valves volute; and it may be seen that as the cartilage increases behind, it gives way and becomes bifurcate before. Sometimes this giving way takes place more from one valve than from the other, in which case one valve may be much longer in its beak than the other, as is seen in Gryphaea, &c. We cannot account for the growth of some shells, without admitting that the animal has the power of lessening them at certain points; thus in the under valve of the Anomia, how can we explain the enlargement of the notch, an almost perfect foramen, without admitting such a power, which appears exerted through the influence of the constant currents of water produced by the vibratile cilia of the animal?

The coloration of the valves, of the foot, of the siphons, &c. is produced by a secreted colouring matter, the chemical nature of which is not known, but a similar secretion to which is found in all Mollusca. This secretion has the property of taking a much brighter tint on exposure to light. It is secreted either from the veins or from venous secreting organs, to be hereafter mentioned. The markings of the valves appear to be caused by the disposition of the veins of the mantle, and are often interrupted, from the cessation of the secretion at certain periods.

The varieties in the articulation of the valves, in the cartilage, ligament, and teeth, may be thus explained. When, as in the Cardium, the cartilage is external, and convex and prominent above, its compression does not happen from the pressure of the valves, as is the case with the species possessing internal cartilages, but from its bending upon itself. The cartilage of this conformation differs from that of the other by its containing a portion of carbonate of lime in its composition. The teeth are wanting or weak when there is great strength of muscle or cartilage; when the irregularity of the edge of the valves prevents sliding motion; or when the shell is small, flat, and polished, and hence little exposed to violence; also when the hinge and cartilage are long; though they are numerous in the long hinge of the Areaeeae, compensating for the weakness of the cartilage. We see a distinct pinnate process of the mantle for the purpose of secreting the numerous teeth of the Nucula. In those genera which have long fleshy siphons and gaping shells, the cartilage is internal, and situated upon a projecting process of one of the valves, as in the Mya, by which disposition the shell is not readily quite closed, nor far opened. The shell is only allowed to be opened widely when the lobes of the mantle are conjoined to a small extent, as is done by the internal cartilage of many of the Monomyaria. When, as in the Area, the foot is thick, we see in the straight linear hinge, and in the remoteness of the beaks, a provision for the con-

1 To produce the famous purple of the ancients, it appears only necessary to expose the soft parts of the animal of the Purpura to the influence of the light and air, when its natural brownish secretion becomes of a bright purple colour.

2 And not from the liver, as Blainville says.
siderable opening of the valves by that organ; and in some species the valves themselves are gaping inferiorly for its exsertion.

There is a cartilage between the two small spinous processes of the hinge in the Pholas candidus. In other species of Pholas, which have no rudiment of it, and allied genera, which have a particular character of articulation, I consider the motion of the valves as but a secondary cause in the perforation of the substances in which these animals are found.

Muscular System.

The gland for the formation of the byssus (the existence of which is denied by Blainville) may be found readily at the base of the foot (in the Modiola, for instance,) with a duct opening at the bottom of its groove. It is bilobate, and of a dark granular appearance. I consider the foot of the Pecten, Spondylus, &c. to be an organ of prehension of the food, collected by the vibratile currents near the mouth. In these it has but one long slender muscle. The uses of the foot as an organ of locomotion are described by naturalists. One use of the part called the crystalline stilette, I consider to be the giving resilience to the foot. It projects above into the stomach, and is directed inferiorly to the pore by which water is admitted into the foot, as it is in many species. The upper extremity has a small membranous cartilage upon it, called the tricuspid body. In the Anomia the stilette supports a free portion of the mantle; in the other Monomyaria it is absent; the membrane is always present. The whole appears to be the analogue of the curious tongue of other Mollusca.

Some species have two sacs of the mantle, containing sometimes a gaseous fluid, which is probably formed by the secreting organs, with which they are connected. These animals can thus lighten themselves, and easily change their situation at the ebb and flow of the tide.

Nervous System.

In more than twenty genera examined, I find a great similarity in the Nervous System. Poli, Cuvier, and Blainville are rather incorrect in their description of the nervous system of the Lamellibranchiata. Mangelli describes that of the Anodonta with great accuracy.

When a foot is present, there are three ganglia or pairs of ganglia; when absent, but two. These ganglia are of an orange colour externally, and white within. Two ganglia are situated at the mouth, more or less removed from each other, but always connected by a supra-esophageal nerve; they are sometimes on a level with, or before the mouth, sometimes behind it. They give off on each side filaments to the anterior muscle, tentacles, lips, and anterior part of the mantle. Each ganglion likewise gives off a twig going to the posterior ganglia, which are situated between the branchiae on the posterior muscle. These are united into one, when the branchiae are themselves united medially, as in Maetra, Mya, Solen, &c., but are at a distance from each other, when the branchiae are remote; but in this case, are always connected by a transverse nerve, as in Modiola,
Aricula, Lithodomus, Arca, &c. These ganglia give nerves to the branchiae, siphons, posterior muscle, mantle, &c. The anterior ganglia also give off two twigs, which enter the foot and unite into a double ganglion, from which that organ is supplied with nerves. Only a transverse connecting filament exists when there is no foot. The posterior and pedal ganglia are totally unconnected with each other. The mouth then is surrounded by a ring, of which the part posterior to the situation of the labial ganglia upon it, is double. In the Pecten it appears evident that the labial ganglia are compound. There is no visible sympathetic system, though said to exist by some.

Digestive System.

Poli supposes the tricuspid body to regulate the flow of bile into the stomach; with which opinion I coincide, from finding its extremities always in the bile ducts. The intestine in molluscs animals gives origin to an abundance of veins, which probably act as lacteals. The first part of it is glandular. Sometimes it is not so long as the animal, at other times twelve times the length. A ridge is generally seen in it similar to what we find in the naked Acephala. This part of the subject has, however, been exhausted by Poli; and we pass to the

Circulating System.

Bojanus has given a correct description of the circulation in the Anodonta, and has shown it to be less simple than it had been described by Cuvier. The result of the labours of Bojanus has been this: that the real respiratory organs are two dark-coloured spongy bodies, situated at the root of what are generally considered to be the branchiae, and which are formed by the meeting of many of the veins of the system. I do not come to the same conclusion. By means of mercurial injections I find that in the Scallop (Pecten maximus) the whole of the venous blood returning from the body does not go immediately to the branchiae; but a large portion of it, that of the ovaries, liver, and intestine, first circulates in part through the two dark-coloured, venous, secreting organs, (lungs of Bojanus,) and in part enters a large sinus or venous dilatation situated upon the adductor muscle, which sinus appears to form the branchial artery on each side, communicating, however, freely with branches from the secreting organs, these last again having a third set of branches entering the branchial artery. The sinus above-mentioned, which likewise exists in the Dimyaria, situated under the pericardium, receives in the Pecten also the veins of the mantle in part, one termination of them being directly into the auricles. The branchial arteries are formed by the large branch of the sinus, the branches from the secreting organs, and a few small ones from the mantle and roots of the branchiae. The blood from the branchial veins enters the auricles, which have appendages upon them, probably secreting the pericardial liquid. The auricles, which in the Oyster are joined together, here communicate by a channel; generally they are quite separate. Two semilunar valves exist at the entry of each
auricle into the ventricle; valves also exist at the origin of the aorta. It is well known that the rectum commonly pierces the ventricle, and that in the Oyster there is an exception to the general rule. In the Anomia the ventricle lies upon the rectum. In Arca, Lima, and some Pectunculi, there are two ventricles, the rectum passing between them. There is nothing remarkable in the distribution of the arteries. Sometimes, as in Cardium echinatum, the first part of the aorta appears very wide, having strong parietes with numerous fleshy columns on their internal surface.

The veins then do not all go to form the branchial arteries; whilst some of the venous blood enters directly the auricles, another portion is first distributed to the secreting organs. There also exists a reservoir, or sinus, or set of very large veins receiving much of the venous blood, and which appears to empty itself both into the veins of the branchiae, and into those of the secreting organs. The venous blood from the body in some measure, likewise, enters the auricles. The branchial arteries receive few veins, but the principal supply to them is from the sinus. Some resemblance to a portal circulation is seen in this, though it has not place in the liver, in which the bile is secreted from the arteries.

Blood taken from the auricles is almost colourless, separates on standing into a liquid and solid part, and, microscopically examined, presents a curious phenomenon, which appears to have been observed by Mayer; viz. its globules, which are about the one thousandth part of an inch in diameter, appear with projections upon them, showing an evident motion. The heart is slow in its pulsations; they are generally from twenty to thirty in the minute.

Respiratory System.

I am disposed to regard the disposition and form of the branchiae and siphons as being of great use in the classification of these animals; for instance, Anomia, Pecten, Arca, Modiola, Unio, Cardium, Cyclas, Donax, and Mactra, have each a particular disposition of the branchiae, sac, of the mantle, valves, siphons, &c. giving rise to particular modifications of the course of the aërating currents of water to the branchiae. In all the above genera, no complete division of the sac of the mantle exists. However, in Solen, Hiatella, Pholas, &c. a different disposition takes place; here the branchiae are prolonged into the inferior siphon, and as they are not separated from the base of the foot within, nor from the mantle without, the water drawn in through the inferior orifice must make its exit by the same, or by the anterior opening. But water is likewise drawn in by the superior siphon, and so gets access to the interior interlaminary spaces of the branchiae (oviducts of some); and by this superior siphon, the ova, faces, and secretions are discharged. Here the branchiae are often very long, and the siphons

1 I do not find that the rectum in the Myn Pictorum perforates the ventricle to make its exit and re-enter again, as stated by Dr. Grant; Lect. Anat. Comp. Lancet, vol. ii. (1833-4), p. 708.
2 We see this also in the Tunicata. By one orifice water enters the respiratory sac, by the other it is drawn
very muscular. We sometimes find small supplementary branchiae, as in the Psam- 
mobia, Pholas, &c. The external pair may be shortened in front, as in Mya, Venerupis, &c. In Pandora the only appearance of the external laminae consists of two very nar-
row strips at the base of the others; this is the case also, according to de Blainville, in the Osteodesma, allied to Pandora. Though it is not by the action of the orifices or siphons, or by the relaxation of the closing muscles, and the opening of the valves, that the water is drawn into the mantle, yet these actions accompany the influx; and 
though the water commonly escapes in a continuous stream from the action of the cilia, 
a sudden ejection of it frequently takes place, accompanied by a closing of the valves 
and a contraction of the siphons.

Excretory System.

The veins of the mantle, which are very numerous, appear to secrete the valves, 
and often contain quantities of carbonate of lime, visible with the microscope in the 
form of minute spicule. In the freshwater Muscle, anatomists have been puzzled to 
account for the appearance at certain times of a greyish matter diffused over the whole 
body, and entering into all the tissues. The accumulation of this matter in the veins 
of the mantle has led to its having been considered as the male organs. We know 
that the shell is more increased at some periods than at others, and this accumulation 
may precede the deposition as a provision for its accomplishment, or it may be for the 
purpose of being thrown off by the excretory organs; as it is about the veins which 
surround them that the accumulation principally takes place. This grey matter is 
principally carbonate of lime.

The excretory organs throw off mucus and colouring matter as well as carbonate of lime, 
which latter is often found in them in the form of concretions; also uric acid. In the 
Pecten a minute orifice leads directly on each side into them. The oviducts likewise 
enter them. Above, each excretory sac leads into a single transverse cavity under the 
pericardium. In the Unio, &c. an orifice close to that of the oviduct leads into a large 
cavity of the mantle under the pericardium, into which the excretory organ opens by an 
internal orifice on each side. Bojanus was not aware of this internal opening, or he 
would not have considered these organs to be lungs. The external orifice is seen to 
open at the anterior angle formed by the foot and the branchiae. The oviduct is also 
distinct from the sac in Modiola, Mytilus, Lithodomus, &c., whilst in Tellina, Cardium, 
Maetra, Pholas, Mya, and most others, the ova are discharged into the excretory organs. 
Generally the orifice of the excretory organs is near the posterior muscle, and the ovi-
duct more anterior. The former is often so minute as to be found with difficulty. In 
the Oyster the vessels do not seem to form a gland, but throw off from their extremities 
into the external meshes of the branchiae. The water drawn in by each opening must make its exit by the 
same. Those who say the contrary, appear to do so erroneously, unless the water passes through the stomach 
and intestine.
distributed to the mantle the calcareous matter to the valves, which in a more perfect animal is only got rid of, by being secreted by a glandular organ, and thrown out by an excretory orifice. In higher Mollusca, for instance, we find the coloured secretion in some furnished by the veins of the mantle, in others accumulated into a glandular bag. Swammerdam believed the dark-coloured organs of the Lamellibranchiata to be concerned in the formation of the shell, as did Poli, who terms them the testaceous viscera. De Blainville compares them to kidneys; and I think I have said much to confirm his opinion.

An analogous condition may be observed in the Radiata. In the Stellerides the veins of the viscera meet, and become conjoined with a brownish spongy substance, forming two organs, which probably open without, through the dorsal plate or disk, or near to it. From this disk there extends, by the side of the spongy substance into the circular union of the hydroferous canals, a cylindrical calcareous part, which is articulated, and appears to be analogous to the stem of the Pentacrinus, but which has become internal by the formation of the dorsal integument. The naked Acephala being destitute of calcareous parts, have scarcely a rudiment of secreting organs; but in the Gasteropoda a secreting organ always exists when there is a shell. This organ is evidently formed in them by a tissue of veins. In the Patella it opens by the oviduct and rectum, and is situated over the viscera: de Blainville considers it to be the organ of respiration in these animals. In some Patelliform animals there are two orifices. The orifices in the Chiton are between the branchial processes, not far from the oviducts. Where there is no trace of a shell, secreting organs are not present. In the species of Doris, which have commonly calcareous matter in the integument of the back, the sac described by Cuvier as opening near the anus seems a rudiment. In Bulla aperta, which has a shell, two glands exist by the mouth, though overlooked by Cuvier. It is needless to mention that an organ secreting mucus and calcareous matter is found in all spiral Gasteropoda. It (the mucous sac of authors) sometimes opens near the anus by a duct, as in the Phytivora; or by a large opening at the back of the branchial cavity, as in the Carnivora; in which latter case the animal probably has the power of breathing air by means of it when out of the water.

The mucous sacs of the Cephalopoda, opening by papillae on each side the rectum, are traversed by the great veins which secrete into them, from particular appendages on their surface, much muco-calcareous matter. The bile ducts, likewise, pass through the cavity, and secrete into it. In these animals, the blood from the visceral veins seems directed into the hepatic, as was noticed by Cuvier; and I consider their circulation to be intermediate to that in which the ovarian, intestinal, &c. blood goes to the liver, and that in which the hepatic, intestinal, and ovarian blood all passes through the excretory organ. No mollusceous animal appears to possess absorbents, hence the necessity of the skeleton being external and out of the circulation.
Cilia.

The vibration which has been noticed by authors on the surface of the intestine of molluscsous animals, originates from the passage of that canal being through the secreting sacs, into which water is drawn by the action of cilia upon their surfaces. From noticing the appearance on the intestine of the Chiton, I was led to find the two orifices described above, by which the water is drawn in.

The beautiful and wonderful phenomenon of the vibration of the minute cilia of the lower animals was noticed by many of the older naturalists, but from the defect of their instruments, was often confounded with the circulation. Raspail has shown that many of the animalcules of Müller and Baer are merely the vibratile parts of other animals. Home explains the rotation noticed in the embryo of the ovum of the Lamellibranchiata to be caused by a species of Vibrio getting into its interior and feeding upon it; and the figures which he has given of this supposed animalcule are those of the branchial processes of the Anodonta. The hydroferous vessels of the Radiata are internally covered with cilia, and it is by these that the circulation in the Beroë is plainly caused. I do not find them in the Crustacea nor in the Cirrhopoda, nor in the aquatic larvae of insects. Dr. Sharpey was unable to see them in the Tunicata, but he might have done so with the aid of a more powerful lens. They cover in great numbers the meshes of the branchiae, but are unusually small in those organs. I do not find them on the branchiae of the Cephalopoda. They are present in the stomach of the Asterias and Actinia, and the long white threads sometimes seen hanging from the Act. diantha are covered with them.

The piercing of rocks, stones, wood, &c. by Lamellibranchiate animals cannot in every case take place by the mechanical action of the valves. The valves of some genera, as the Lithodomus amongst many others, are not at all adapted for such an action. Neither can such perforation be caused by a solvent fluid secreted by the animal; for what fluid would dissolve so many substances, and yet not injure the animal’s own shell? The fact appears to be, that the phenomenon is caused by the vibratile action of the parts exciting constant currents of water against the substances, aided by its impetus when drawn in down the elongated body of the animal, and in some cases, perhaps, by the rasping of the valves. Often the shell, from its flattened form, or from its fitting closely, cannot act at all. The Patella when sticking to a rock often forms a hole an inch in depth, and this by the action of its ciliated branchiae; the hole cannot be made by the shell, as it fits exactly in it, and is of such a figure that no rotation can take place. The Hipponyx, another Gasteropod, forms cavities in the Patella and other shells to which it adheres. The crypts of the Saxicava are not circular; hence M. de Bellevue and Osler in this instance believe them to be formed by the action of the phosphoric acid secreted by the animal, and they suppose this animal to inhabit rocks only which are composed of carbonate of lime; which last supposition is not, to my own
knowledge, correct. Turton says the valves of the Teredo do not correspond with the bore, though I think that in this case they do act as mechanical instruments. But the Pholas conoides is often found in hard timber, though its valves do not seem in the least adapted for any boring or filing.

Certain Annelides apparently possess this power of excavation. The rocks on our coast are pierced by a minute worm, probably of the genus Diploïs of Montague; it is strongly ciliated, but its mouth does not appear adapted for making its way into such hard substances. By the currents excited by Vorticella, &c. it is that the erosion noticed at the beaks of fresh-water bivalves takes place; the laminae at that part being soft, and more distant from each other. We find the valves of the Oyster, Pecten, Lutraria, &c. perforated by small circular apertures leading into internal cavities. Dr. Buckland showed this to depend upon the action of a zoophyte, which Prof. Grant has particularly examined, and named Cliona celata. Dr. Buckland considers the holes to be formed by little borers which the polypes possess; these, however, do not exist, and I believe the phenomenon to be caused by the action of the cilia of the animal.

Freminville, Nilsson, Beudant, Stark, and others, agitate the question as to whether freshwater Mollusca can live in salt water, and vice versá. To ascertain whether respiration could go on in the Lamellibranchiata, the habitat being so changed, I took a portion of the branchia of a Macra, and placed it in fresh water for one minute; the cilia, strongly in action before the experiment, stopped in their vibration, and could not be restored by immersion in sea water. Five grains of common salt were added to an ounce of fresh water, and a portion of the branchia placed in the solution, upon which the vibration ceased. In a solution of ten grains of common salt to an ounce of fresh water, the vibration was continued, as it was also in a solution of twenty grains to the ounce. In a stronger solution it shortly stopped. After a short immersion in the strong fluid, it was restored by the second solution; but a Macra, of which the branchia were exposed for fifteen minutes to the action of fresh water, did not recover itself though returned to its native element. Sea water, or a solution of even two grains of common salt in an ounce of fresh water, immediately stopped vibration in fresh-water Mollusca. It would seem from this, that the capacity of bearing a change as to the freshness or saltiness of the water is very limited in these animals; for if the cilia cease to vibrate, respiration must stop, as well as the collection of the nutrient particles from the water. Perhaps the inhabitants of estuaries are best adapted to bear a change in this respect; but what Nilsson and Freminville state respecting the Anodonta, &c. being found in company with Telline, &c. appears very debatable; the circumstance probably arose at the mouth of a river. The Cardia, Macræ, Amphidesma, &c. found in salt marshes, die when the water becomes concentrated by evaporation, or when it loses its saltiness by being mixed with fresh. The Mytili found in fresh-water docks are probably freshwater species brought from foreign rivers attached to vessels, and which have probably survived their voyage by having kept their valves constantly closed accurately.

VOL. II.—PART II.
Having shown the fatal effect which would be produced by the concentration of the sea water on the branchiae of its bivalve inhabitants, it is worth inquiry, how in those animals which, on the retreat of the tide, are exposed to the desiccative action of the sun and air, the evaporation of the water is prevented. Those animals which possess naked ciliated branchiae have the power of retracting them into sheaths, when they, like many species of Doris, frequent the bare rocks; or if this power of withdrawing them does not exist, as in other species of Doris, the Tritonia, Solida, &c., they take care to cover themselves with the wet Algae, or to lurk in shady crevices. The Patella in hot days sticks firmly to the rocks, so as to prevent the escape of the confined moisture. The Ascidiae frequent pools among the rocks which are not drained at low water. The Actinia, Lobulariae, &c. adhere to the dripping under surface of the cliffs, or frequent shady places. The Polypifera either reside in deep water, or find a habitat where the sun does not reach them. Those Lamellibranchiata which, like the common Muscle, are exposed on the bare rocks to the action of the sun and air, have the valves fitting to each other most exactly, preventing all evaporation. When the valves are open at any part, the animal either inhabits deep water, as many species of Pecten, or has the power of burrowing in the mud or sand, when left dry by the ebb of the tide. The Gasteropoda also hide themselves from the sun, though their branchiae are not much exposed. Aristotle says they hide themselves during the dog-days. Along the sandy beach we see numerous holes leading to the branchiae of different animals, which by boring hide themselves, and protect their organs from the effect of evaporation, as well as obtain a supply of water loaded with nutrient particles.

The phenomenon of animal phosphorescence seems almost peculiar to ciliated animals. In an Annelide, which presents the phenomenon very beautifully, covering in profusion the nets of the fishermen when drawn up, I found that the luminosity stopped when the action of the cilia was destroyed; that it was greatest when they were most active; and that the tremulousness of the light appeared to correspond with an unsteadiness of the vibration. It appears worth inquiry, whether the appearance does not arise from the friction of the cilia upon the particles of water. The experiments of Beccaria seem to prove that the light is not owing to any chemical principle, and that it exists in exactly such circumstances as the cilia would continue to vibrate under.

Reproductive System.

The opinions of Leuwenhoek, Mery, Prevost, and Dumas, &c. on this point respecting the different sexes of the Lamellibranchiata are well known; but there appears every reason to believe that there is no difference in the individuals as to sex, and that the ova are discharged from the ovaries in a state fit to develop; or, in other words, that they are fecundated before they leave the ovaries by testes which are conjoined with those organs. Some authors have mistaken the excretory organs for testes. The ovaries differ much in their situation; sometimes they form distinct parts, sometimes they are
found in the foot, sometimes they are ramified in the mantle, which last disposition is present in Modiola, Anomia, Lithodomus, Hiatella, and the like. The oviducts open variously in different species, as described above; the ratio of the difference appearing to be the situation of the ovaries. At an uncertain time before the discharge of the ova from the ovaria, a milky fluid, often pinkish in colour, makes its appearance in the latter, and is itself discharged from the oviducts. This appears to be the male fluid; when examined with a powerful lens it is seen to contain minute oval bodies, not more, perhaps, than the four-thousandth part of an inch in length, swimming in the thinner fluid, and having a very vivid motion. They do not appear to have caudal appendages, though minute vibriones, as well as vibratile particles of the branchiae, may often give rise to the appearance of them. The ova seem to enlarge from the influence of this fluid, and the vitellus becomes coloured by it. The ova are found to present a different shape in different genera; in the Unio they are globular and transparent, about the seventeenth part of an inch in diameter, consisting of a firm shell, in which is contained a clear fluid, with the yolk floating therein. The ova are generally discharged from the ducts immediately into the water; but in Unio and Anodonta they are conveyed, enveloped in stringy mucus, from the excretory organs into the inter-branchial spaces (oviducts of Home), where they are further developed, the shell breaking, and the young bivalves being attached by a byssus. It is curious that they are never found in the internal pair of branchiae, along the edge of which they are conveyed to the external ones. In summer the ova leave the oviducts, and at the approach of the following spring, the young animals leave the branchiae. A curious rotation may at one time be observed of the embryo within the ovum, from the action of the cilia, the rotation taking place seven or eight times in the minute. The young have the power of opening and shutting their valves before leaving the parent shell. Rathke considers them as parasites, under the name of Glochidium, in which opinion he is followed by Jacobson, who considers their appearance to preclude the possibility of their being the young of the animals on which they are found. The valves are triangular, with the ligament at the short straight side, the other two sides terminating in a point, at which we see a process of membrane to each valve, dentated on its exterior surface. Two pointed processes also appear projecting from the inner surface of the valves. There is no foot, and the muscle seems undivided, and allows the valves to be completely opened. But on inspecting a very young Unio, we find that the valves are really commenced by triangular nuclei. The membranes may be the branchiae, and the other processes appear to be the nuclei of the teeth of the valves. Home does not describe the true oviducts; Bojanus calls the branchiae, uteri, or oval receptacles; Joerg calls the external ones ovaria, and the internal ones testes. The Anodonta anatina and cygnea are both viviparous; though Drapermaud, on the authority of Poiret, denies that the former is so. In the Cyclades we always find from ten to twenty of the young fry in the internal branchiae; they are of different size, and are discharged one by one, when they attain
about the sixth of an inch in diameter. The oviducts in the Cyclades open over these internal branchiae, which are only accessible to the water from behind. Three or four of these young animals are inclosed in a membranous case, but the largest are found separate, adhering by a byssus. Turton says, that in the month of June he has found the young animals of the Kellia rubra containing about twelve perfectly formed young ones. In no case does it appear that the ova are discharged from the mouth, as has been supposed, nor by the true anus; nor is there any duct in those which are viviparous leading from the ovaria to the interbranchial spaces.

**Diseases and Parasitical Animals.**

As is well known, it is to a disease affecting these animals that we owe the beautiful ornament of pearls. The subject of their formation has, however, been exhausted by Pliny, Home, Vogt, and many others. Baer has described many of the parasitical animals infesting the Conchifera, especially the fresh-water species. The Aspidogaster conchicola is very common in the pericardium and excretory organs of the fresh-water Muscles. The Nummulella of Carus appears not to be a parasite, but to be formed by the rolling on itself of a branchial process. I found the foot of an Anodonta enormously distended with parasitic ova, which, when ruptured, were each found to contain several young individuals of a species of Distoma. In the foot of another Anodonta I found a parasite (Pl. XX. fig. 12.) presenting the following characters. In the mature state the body is more or less cylindrical in its shape, but varied much at the will of the animal: at one extremity it has two very long appendages, which are spiniferous at their terminations, and which in some individuals have a row of round bodies attached to one side for part of their length; these appendages are contracted with great rapidity, and are then very short. There is an opening by a circular lip between these appendages. A contraction separates this part, on which they are situated, from the rest of the body. There appears to be another opening at the opposite extremity of the animal.

**PLATE XVIII.**

1. Animal of the Psammobia floridæ in its shell.
2. The same exposed.
3. Animal of the Nucula nucleus in its shell.
4. The same, the left valve removed, and the mantle raised.
5. Animal of the Corbula striata in its shell.
6. Animal of the Pandora inæqualvis, left valve and part of mantle removed.
7. Left valve of the same.
8. Stomach, intestine, heart, &c. of the Solen ensis.
9. Stomach, &c. of the Macra stultorum.
10. Stomach, &c. of the Cardium echinatæ.
Fig. 11. Shows the disposition of the heart, pericardium, excretory organs, &c. in the Anodonta anatina.

12. Shows the gland of the byssus, mantle, oviduct, &c. of the common salt-water Muscle.

13. Shows the disposition of the branchiae, &c. in the Cardium edule.

PLATE XIX.

Fig. 1. Animal of the Pecten opercularis, the left valve removed, and the mantle turned up.

2. Stomach, intestine, liver, ovary, &c. of the Pecten maximus.

3. One of the ocelli or eyes found on the margin of the mantle of the same, and optic nerve, magnified.

4. All the blood-vessels of the Pecten maximus, excepting a set of large veins, situated upon the muscle, into which the veins, which are truncated in the figure, enter, and which forms the branchial arteries.

5. Nervous system of the Venerupis pullastra.

PLATE XX.

Fig. 1. Ova of the Unio pictorum from the ovaries and branchiae (\(\frac{3}{16}\) inch focus).

2. Valve of a young Unio, showing that its nucleus is of the same shape as the valves of the animals found in the branchiae.

3. Fry of the Cyclas rivicola, taken from the branchiae (\(\frac{3}{16}\) inch focus).

4. Ova of the Mytilus edulis (\(\frac{3}{16}\) inch focus).

5. Ova of the Pecten opercularis (\(\frac{3}{16}\) inch focus).

6. Ova of the Anomia cepa (\(\frac{3}{16}\) inch focus).

7. Globules of the blood, from the auricles of the Pecten maximus (\(\frac{3}{16}\) inch focus).


9. Ova and contained young of a species of Distoma (the two magnified figures \(\frac{3}{16}\) inch focus).

10. Nereis phosphorescens—Syllis, Lam. (\(\frac{3}{16}\) inch focus).

11. The head of the same (\(\frac{3}{16}\) inch focus).

12. Animal from the ovarium of an Anodonta as seen in the field of the Microscope (\(\frac{3}{16}\) inch focus).

13. Diploptis hyalina? Montag. (\(\frac{3}{16}\) inch focus).
Explanation of the Letters and Figures.

A. Right lobe of the mantle.
B. Left lobe of the mantle.
C. Mouth.
D. Rectum.
E. Tentacles.
F. Lips.
G. Branchia.
H. Foot.
I. Anterior muscle.
J. Posterior muscle.
K. Ovary.
L. Superior tube.
M. Inferior tube.
N. Liver.
O. Heart.
P. Ventricle.
Q, Q. Auricles.
R, R. Anterior ganglia.
S, S. Posterior ganglia.
T. Pedal ganglion.
U. Stomach.
V. Crystalline body.
W. Intestine.
X. Pericardium.
Y. Excretory organs.
β. Right valve.
γ. Left valve.
δ. Cartilage.
λ. Ligament.
τ. Teeth of the hinge.
a. Glandular sac of the mantle.
b, b. Tentacles.
c, c. Ocelli.
d. Byssus.
e. Gland of the byssus.
f. Pedal pore.
g, g. Retractile muscles of the foot.
h, h. Valves of the mantle.
i, i. Oviducts.
j, j. Orifices of the excretory organs.
k, k. Internal ditto.
l. Retractor muscle of the tubes.
m, m. Nerves of the tentacles, &c.
n. Supra-œsophageal nerve.
o, o. Connecting nerves of the anterior and posterior ganglia.
p, p. Nerves of siphons, branchia, &c.
r, r. Connecting nerves of the anterior and pedal ganglia.
t, t. Orifices of the bile ducts.
u. Æsophagus.
v. Tricuspid membrane.
1. Anterior aorta.
2. Posterior aorta.
3, 3. Veins of the mantle.
4, 4. Hepatic veins.
5, 5. Branchial veins.
6. Veins connecting the auricles.
7, 7. Veins of the pericardium, &c.
8, 8. Branchial arteries.
9, 9. Smaller veins of the mantle.
10, 10. Veins from the liver.
11, 11. Ovarian veins.
12, 12. Veins of the excretory organs.
13, 13. Ramuscules of the branchial veins.
14, 14. Ramuscules of the branchial arteries.
### ANATOMICAL CLASSIFICATION OF THE LAMELLIBRANCHIATA.

**Lamellibranchiate Bivalve Animals.**

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MONTATARIA, Lamellibranchiate</td>
<td>Tentacles very long, not distinct from branchiae; branchiae united; additional muscular system.</td>
</tr>
<tr>
<td>No foot</td>
<td>Foot long, cylindrical; ocelli at the edge of the mantle.</td>
</tr>
<tr>
<td>Tentacles short, separate from the branchiae</td>
<td>Branchiae disunited; pedicellate oval body; ocelli.</td>
</tr>
<tr>
<td>Orifices or tubes</td>
<td>Foot compressed; no ocelli.</td>
</tr>
<tr>
<td>Mantle without separate orifices or tubes</td>
<td>Mantle closed, cylindrical, bent at an angle; lips footed.</td>
</tr>
<tr>
<td>Mantle with a distinct anal orifice</td>
<td>Mantle closed around the foot; foot large, rather foliaceous; foot large, short.</td>
</tr>
<tr>
<td>Mantle with a superior and inferior orifice; foot not elongated into tubes</td>
<td>Branchiae not produced into the lower tube; tubes disunited; foot lanceolate.</td>
</tr>
</tbody>
</table>

### Notes
* For the anatomy of those marked with an Asterisk the author is indebted to Cuvier, Poli, or Blainville.
Lamellibranchiate Genera.
Left parts of Lamellibranchiate genera.
IX. *Descriptions of some New and Rare Cephalopoda.*

*By Richard Owen, Esq., F.R.S., &c., Hunterian Professor of Anatomy at the Royal College of Surgeons in London.*

Communicated February 23rd, 1836.

Amongst other contributions to natural history which have resulted from the labours of our zealous Corresponding Member Mr. George Bennett, during his late voyage to Australia, are several new or little known marine invertebrate animals, most of which were taken by means of the towing-net in the open sea, or among the gulf-weed. The value of these specimens, in a scientific point of view, is much increased, by the care with which the circumstances attending the capture of each are registered; and I now commence the fulfilment of a promise to my friend, by bringing a portion of these specimens before the notice of the Members of the Society, with such observations as seem to be worthy their attention.

The subjects at present under consideration belong to the class *Cephalopoda*: they are,

1st. A specimen of the *Cranchia scabra*, Leach.
2nd. Four specimens of a very small nondescript species of *Loligo*.
3rd. The head and principal viscera of a *Decapodous Dibranchiate Cephalopod*, from Port Jackson.
4th. Three specimens of a small nondescript species of *Octopus*.
5th. A very small specimen of the shell of *Argonauta hians*, Solander, with its inhabitant (*Ocythoe Cranchii*, Leach) and a large cluster of ova.

With respect to the first of these specimens, Mr. Bennett, in his Journal, remarks, "On the 1st of March, fine weather, with light and moderate trade breezes from the south-east, thermometer Fahr. 77° to 80°, latitude 12° 15' S., longitude 10° 15' W., at 8 p.m., captured, with the towing-net, several fine specimens of *Hyalea dentata*, and two species of the *Medusa* genus; the latter are preserved in spirits (bottle No. 4. D.). One was very prettily marked with dark red spots." The specimen thus distinguished is the *Cranchia scabra*, now on the table; and from the uncommon form which this very remarkable *Cephalopod* presents, one cannot feel surprised that it should have been referred by its captor to a *Radiate* family, with which the *Cephalopods* bear, in more than one respect, an analogical relation.

The *Cranchia scabra* is the species on which the genus dedicated to the enterprising naturalist by whom it was first taken, was founded: it belongs to that tribe of *Dibran-*
chiate Cephalopods which have a pair of long peduncles superadded to the ordinary eight arms, and to that family of Decapoda in which the rudimental shell is degraded to the condition of a single horny style, lodged in the substance of the mantle in the middle of its dorsal aspect.

The principal external character which entitles Cranchia to rank as a genus distinct from Loligo and Onychoteuthis, is the continuation of the mantle with the dorsal parieties of the head, and a consequent interruption of its free anterior margin at that part: from Sepioteuthis, Sepiola and Rossia, it differs generically (according to the circumstances which modern zoologists have agreed to regard as of generic importance,) not only in the proportions and position of the pallial fins, but in the structure and connexions of the funnel; and in some points of its anatomy, as will be afterwards described. With respect to the first-named character I would however observe, that species in which the pallial fins are short and terminal in position, and which present the same condition of the internal rudimental shell, the same connections of the mantle, and armature of the suckers, should not be broken up into genera in consequence of differences in the form only of the fins, especially when unsupported by corresponding internal differences of structure; for when we compare together the different species of the uncinated Calamaries, which form the well-marked genus Onychoteuthis of Lichtenstein, we find that scarcely two species agree in the precise contour of the fins; and if we examine, with the same view, the numerous members of the group Loligo, as it is now restricted, we shall find several, as the Lol. piscatorum, Lapilaye; Lol. Duvaucellii, D’Orbigny; Lol. brecepinnia, Lesueur; and especially the Lol. brevis of De Blainville, which closely approximate the Cranchia scabra in the rounded contour and dorsal position of the terminal fins; so that were it not for the difference in the connections of the anterior margin of the mantle, the latter Cephalopod, notwithstanding its singular form, could not be separated generically from the Loligines on external characters alone.

This condition of the mantle, however, has scarcely been sufficiently attended to in the subsequent location of species in the genus Cranchia. In M. Féruillac’s description of one of the most remarkable of these recent additions, e. g. the Cranchia Bonelliana, it is to be regretted that no mention is made of the adhesion or otherwise of the mantle to the posterior part of the head. The same doubts apply to the claims of the Cranchia cardioptera of Péron, and the Cranchia minima of Féruillac, to rank in the genus in which they have been placed: in the figures given of them by Féruillac, the anterior margin of the mantle appears to be free on the dorsal aspect, as in Loligo. In justice, however, to the lamented zoologist who first described the Cranchia Bonelliana, and to whom the scientific world is indebted for a most splendid monograph on Cephalopoda, now in progress of publication, it must be observed, that the limited nature of the observations on the characters of Cranchia, and the imperfection of the specimen upon which Dr. Leach

founded the genus, render it a matter of difficulty and doubt to refer subsequently discovered species satisfactorily to it. The desire expressed by M. de Ferussac, that additional observations should be made on the typical species, I shall therefore endeavour to fulfil to the best of my ability, from the specimen which Mr. Bennett has transmitted to me.

This specimen is smaller than the one described by Dr. Leach, but presents the same enlarged, expanded, flaccid bag-like form of the mantle, terminated at one extremity by a disproportionately minute pair of fins, and at the other by a head and arms of almost equally diminutive size; so that when the tentacles are retracted, as was the case in Mr. Bennett’s specimen, very little of the ordinary facies of a Cephalopod is presented to the observer.

The dimensions of this specimen are as follows:

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Inches</th>
<th>Lines</th>
</tr>
</thead>
<tbody>
<tr>
<td>From the posterior end of the body to the end of the tentacle outstretched</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Root of the tentacle</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Length of the longest arm</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Shortest ditto</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Fins</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Breadth of the two united fins</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Circumference of the thickest part of the body</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Breadth of the head</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

The body or mantle is wrinkled and flaccid, in consequence of the very small space occupied by the viscosa; and these are situated at its anterior part, and not at the bottom of the sac, as in Loligopsis. It is probable that at the reproductive season the enlarged ovarium may fill more or less of the pallial cavity; but in the ordinary state of Cranchia scabra the disproportion of the mantle to the contained parts is very remarkable, and unique in the class Cephalopoda; but a similar disproportion between the viscosa and pallium is found in some of the Pteropoda.

The surface of the mantle in Cranchia scabra is uniformly beset with small round spots,

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1 The following are the observations which M. Ferussac makes on the distinguishing characters of the genus Cranchia:—"Pour fixer toutes les incertitudes à l'égard du genre Cranchia, et pour lui rapporter sans hésitation l'espèce que nous faisons connaître, il faudrait que celles qui ont été décrites par le Dr. Leach fussent retrouvées et mieux connues. Le caractère principal qui leur a été assigné consiste dans la forme et position terminales des nageoires. Sous ce rapport, ce genre se confond presque avec les Calmats, mais ceux-ci en sont bien distingués par la forme de leurs bras tentaculaires. Il n'est séparé des Calmats que par la forme de ces mêmes nageoires, qui sont réunies à leur extrémité et semblent dépasser celle du sac. Dans les espèces que nous y rapportons et que nous avons pu observer, le port et l'ensemble des formes les distinguent bien plus encore des Calmats; mais nous ne pouvons faire la même observation au sujet des espèces signalées par le Docteur Leach, parce qu'il a négligé de nous donner une description complète et détaillée, reproche qu'on peut faire quelquefois à cet habile observateur sans porter atteinte à sa réputation bien acquise."—Ibid., p. 346.
the dark red colour of which had changed in the spirit to a dingy brown; these spots occur also, but of more minute size, on the fins, and on the exterior of the arms and tentacles. A narrow line extends down the middle of the back of the mantle, through the whole length; this line, when viewed by transmitted light, is transparent, the parietes of the mantle being at that part extremely thin, and containing a colourless pelliculid style of gelatinous consistency, pointed at both extremities, but of almost uniform breadth through the whole length, being very slightly contracted in the middle. The diameter of this representative of the gladius is \( \frac{1}{5} \) th of an inch; its length is equal to that of the mantle.

The surface of the mantle, from which the trivial name of the present species is derived, next claimed attention; on viewing this part under the microscope, it was seen to give off innumerable small flattened processes, varying from a thirtieth to a fiftieth of an inch in breadth, and about a fiftieth of an inch in length, and terminating in two, three, or four sharp-pointed processes; these give to the outline of the mantle, under the microscope, an irregularly denticulated appearance. The surface of the skin, though generally smooth, presents several remarkable irregularities in other species of Cephalopods; thus it is beset with branched papillæ in the Sepia papillata, with more simple obtuse eminences in Sepia mammillata, with tubercles in Sepia tuberculata, with sharp-pointed tubercles in Octopus aculeatus, &c., to which the aculeated lamellæ of our subject make a near approach; it is highly probable that these different cutaneous processes serve to indicate to the Cephalopods possessing them the nature of the surfaces with which they may come in contact, and augment their sense of touch.

The terminal fins, which appear to have been lacerated in Cranch’s specimen, were entire in ours; they are of a regularly rounded form, approximated on the dorsal aspect, and united at their bases, the united part extending about a line beyond the end of the mantle; they are not supported by cartilages, as in Loligo, but appear to be mere reduplications of the integument.

The head is principally composed of the large lateral prominent eyes; the circumference of the cornea is marked with a circle of closely approximated large dark spots.

The arms have the usual conical form; the first or dorsal pair is the shortest, as in most Decapods; the second and fourth nearly equal, and rather longer than the first; the third pair is double the length of the first.

The first, second, and third pair of arms are united at their bases by an intervening web of greater proportional extent than is usually met with in the Decapodous Cephalopods, and which is entirely wanting in the Loligines. In the Cranchia Bonelliana a similar web extends between the corresponding arms for full two thirds of their extent. Between the third and fourth pair of arms there is no connecting web, the interspace being occupied by the thick round stems of the elongated peduncles. All the arms are connected together by the external membranous lip, which gives off eight pointed processes; but these, instead of projecting freely, as in most of the Loligines, the Sepioteu-
this, and *Sepia*, are tied down or inserted at the internal surface of the base of each arm; the intermediate portions of the lip form an internal and smaller uniting web, of which the portions between the third and fourth pair of arms are the widest. With respect to the outer web, we may, I think, justly infer, that since in the *Octopodous* tribe of *Cephalopods* it forms, in the total absence of the mantle-fins, the sole organ of swimming, so here it is developed, though in an inferior degree, to compensate in some measure for the feeble condition of the terminal fins; and we may consequently conclude that the locomotion of the *Cranchia* in the watery element is principally in the retrograde direction.

The brachial suckers are pedunculate, and arranged in a double alternate series along the margin of each arm; the interspace is wider than usual, and from the semitransparency of the part in this small *Cephalopod*, the gangliated nerve which supplies the part was beautifully distinct, as seen by transmitted light under the lens, running along the centre of this part. The tentacles are relatively thicker than in any other *Decapodous Cephalopod*, forming a remarkable contrast to the extremely slender and elongated ones in the genus *Loligopsis*. The suckers, which are irregularly clustered at the slightly expanded extremities, are much smaller than those of the arms, but are also pedunculated; the extremities of the tentacles are fringed on both sides with a thin entire narrow membrane: the nerve which runs along the middle of these parts is a simple opaque chord where it is lodged in the stem, but becomes enlarged and knotty at the acetabuliferous extremity.

The mandibles were protruded in our specimen to an extent which seemed to have been produced by accidental compression. They were composed of a thin horny substance, of a brown colour, at the sharp-pointed extremities, and along the smooth trenched margins, but elsewhere colourless. The jaws were surrounded by a thick, plicated, but not papillose, internal lip, and by the outer thin membranous fold above mentioned. The *infundibulum* was of small size, and projected in the usual situation from the mantle; it differed from the same part in the genus *Loligo*, in being obliquely truncate at the extremity, in such a direction that the dorsal parietes were folded down at this part, and overlapped the ventral, as shown in the magnified figure. On laying open the ventral parietes of the mantle, we found that the base of the funnel was not articulated by lateral moveable ball and socket joints to the internal surface of the ventro-lateral parts of the mantle, but that its ventral parietes became expanded, thin, and transparent, and were inserted into, and became continuous with, the corresponding parts of the mantle. According to Rathké, the funnel is attached in a similar manner by the adhesion of the ventro-lateral parts of its bases to the corresponding parts of the mantle in the genus *Loligopsis*. In all the other genera of *Decapodous Cephalopods* the funnel is articulated to the mantle at the exterior part of its base by two enarthrodial joints, the projection being on the mantle, and the socket on the funnel; both parts of the joint are composed of cartilage, covered by a fine smooth synovial membrane; but here we have a
singular exception to all other enarthrodial joints, for the synovial membrane does not form a shut sac, but is continuous with the mucous membrane lining the interior of the mantle. The convex cartilage is of an oval form in the Cuttle-fish; in the Calamaries (Loligo) it forms an elongated ridge; in the genus Onychoteuthis the articular ridges commence at the anterior margin of the mantle, and extend one third of the way down the sac, being formed by two thin lateral cartilaginous laminae, placed rather towards the ventral aspect of the mantle; an elevated groove in the corresponding side of the funnel plays upon each of these ridges; but in the genus Loligopsis the sides of the funnel adhere to the corresponding cartilaginous laminae; these which have been supposed to be anomalous and peculiar to that genus differ from the lateral cartilages of other Decapodous Cephalopods only in their greater length and tuberculated form. In the Cranchia these cartilages are entirely wanting, as in the Octopodous Dibranchiata.

With respect to the anatomy of the Cranchia, I can only state that it possesses two gills, which are provided with branchial ventricles, but that these are without fleshy appendages; and that it has two large inferior salivary glands. The decomposed state of the digestive and generative viscera in the present specimen prevented any satisfactory observations being made upon them.

From the preceding description it will be evident that the genus Cranchia differs from Loligo in particulars of sufficient importance to justify a generic separation, and that in the attachment of the funnel to the mantle, and in the absence of appendages to the branchial ventricles, it is allied to the genus Loligopsis, which it also resembles in the rounded form and terminal position of the fins. From this genus, however, it is distinguished by the adhesion of the mantle to the head, by the presence of the infundibular valve, by the comparative strength and shortness of the tentacles, and by the webs extended between the first, second, and third arms.

The four specimens of the small species of Loligo, which is the second on the list of Mr. Bennett’s Cephalopods, belong to a species hitherto undescribed, and which, from the peculiar breadth of the head, I propose to call laticeps. The diminutive size of these specimens, the largest of which measures only 1½ inch from the extremity of the mantle to the end of the outstretched tentacle, suggested at first a denomination indicative of that particular; but when we reflect that in other genera, as Octopus, there have been found species of still smaller dimensions than the one now described, it may ultimately be discovered, even if adult, to be not the smallest of its genus. Mr. Bennett gives the following note relative to the capture of these small Calamaries:—“April 5th, fine weather; wind east by north; light and moderate breezes; thermometer 68° to 72°, lat. 29° 17’ north; longitude 46° 57’ west: at noon, among a mass of ‘Sargasso weed,’ took, in my towing net, small Sepiae of a fine purple colour with dark red spots.”

1 Pl. XXI. figs. 6—11.
The specimens now present numerous spots of a deep purplish brown colour; according to the number and aggregation of which, the skin is darker or lighter. They occur in greatest number on the back part of the head and trunk; are wanting on the fins, and on the under surface of the third and fourth pair of arms; and are very sparingly distributed on the under part of the head and mantle, which are consequently of a light colour: the most remarkable disposition of the dark pigment is that which the inner surface of the 1st, 2nd, and 3rd pair of arms presents in the interspace of the suckers, where it is disposed in broad, irregularly shaped, transverse stripes, corresponding to each pair of suckers.

As the dimensions of the arms, tentacles, head, body and fins, are accurately represented in the figures (Pl. XXI. figg. 6 & 7.) subjoined, which is taken from the largest of the four specimens, they need not here be detailed.

The head is slightly compressed, but broad; supporting anteriorly, arms which are relatively longer than in the Calamaries generally, the second and third pair being nearly equal to the trunk in length. Laterally the head supports a pair of large and well-developed eyes. The orifice in the integument leading to the capsule of the eye is spherical, proportionally large, as in Loligo vulgaris, and in the axis of vision: the sclerotica is perforated by a smaller aperture immediately behind the preceding, so that the capsule of the lens is immediately exposed to the external surrounding medium; the lens is proportionally small, but attached to the ciliary body as in the Sepia: the pigmentum appeared to be disposed in thick detached portions; it was lined anteriorly by an opaque white substance, which I conceive to be the true retina, although the principal expansion of the optic filaments is posterior to the pigment. The hyaloid membrane was, as usual in this class, a strong and very distinct transparent coat.

The body of the Lol. laticeps is subcylindrical and conical, gradually diminishing in circumference till it terminates in a point at the posterior margin of the fins, which do not extend conjoined together beyond this part, as in the Cranchia. The anterior margin of the mantle is free in the whole of its circumference, as in the rest of the genus Loligo. The muscles which connect the head to it posteriorly have their origins extended along a pair of approximate cartilaginous styles placed at the back of the neck: the anterior part of the mantle is secured by the two strong pillars of the funnel.

On the inner surface of the mantle at its ventro-lateral aspects, are situated the two elongated cartilaginous ridges, which are articulated, as in other Loligines, to cavities of a corresponding form at the sides of the base of the funnel. The interior of the funnel is provided with the usual valve, attached at the dorsal aspect of the canal. Two thin membranes extend from the head to the back part of the funnel. The terminal orifice of the funnel is oblique, but not to the same extent as in Cranchia scabra: in all the specimens I found four large spots of pigment arranged transversely below this orifice. The fins are terminal and dorsal; a space of about \( \frac{1}{3} \) a line intervenes between their origin anteriorly, whence their bases converge and are united at the apex of the trunk;
their breadth and length are the same; their superior contour is an obtuse angle. Their inferior margin is rounded in the Cranchia cardioptera of Péron, to which the species under consideration has a superficial resemblance; the terminal fins have a semicircular contour, and their origins are widely separated anteriorly; they also extend beyond the termination of the trunk: the trunk is broader in proportion to the head, and does not diminish gradually to a point, but is rounded off at the posterior extremity. The Cranchia minima of FéruSSac may be at once distinguished from Loligo laticeps by the extension of the trunk beyond the small rounded fins, which gives a trilobate contour to the termination of the body.

The gladius is proportionally as well developed in this small species as in the larger Calamaries: it commences by a firm blunt anterior extremity, about one third from which the sides begin to dilate until within the same distance from the posterior end, towards which they converge to a point: the expanded part of the gladius is very concave towards the viscera.

The mandibles have the usual form, the lower one overlapping the upper; the dark-coloured exposed part is of greater extent than in the Cranchia. They are surrounded by a tumid inner circular lip, minutely plicated transversely; the external membranous lip presents a free and slightly indented internal margin; its external margin is produced into eight pointed processes, which, as in Loligo todarus and Lol. Piscatorum, are tied down to the inner surface of the arms, and are without rudimental suckers.

Of the arms, the 3rd pair are the longest; the 2nd, 4th, and 1st pair successively diminish in length, but in a very slight degree. The suckers are arranged at the margins of the inner surface in a double alternate series, attached by moderately long and slender peduncles, having a lateral insertion; the diameter of the suckers is half that of the part of the arm which supports them. In the tentacles the suckers are confined to the dilated extremities, as in Loligo vulgaris: they are here arranged in three or four irregular series, and present the following peculiarity:—the peduncles, which are at first filiform, dilate at their commencement, before they are attached to the sucker, like the calyx of a flower; and the cavity of the sucker is continued in this dilated part (Pl. XXI. figs. 8, 10.)

With respect to the anatomy of this minute species, we cannot be surprised that it is in every respect as complex as that of the largest of the genus of which it presents all the external character: just as in the highest class of animals, the harvest-mouse exemplifies as perfectly the mammiferous type of organization as the elephant. The gills in Loligo laticeps are attached through their entire length by a membrane to the sides of the mantle; the branchial hearts, to which the above connecting membranes have a relation of coexistence, are provided with small fleshy appendages, as in other Calamaries, and indeed as in all the Dibranchiata which have the funnel articulated with the mantle.

The divisions of the vena cava, and the extremities of the visceral veins, have thickened spongy coats, with a tolerably smooth and equal external surface: the systemic
ventricle is lozenge-shaped, and elongated in the direction of the axis of the body, but the two lateral angles which receive the branchial veins are not on the same plane, the right being most anterior. The digestive organs presented no deviation worthy of notice; the anus was provided with the two small aliform valves or appendages.

The small species of Octopus, which next comes under consideration, is, like the small Loligo above described, an inhabitant of the Sargasso or Gulf-weed. Two specimens of this Cephalopod were taken on the 5th of April, and the third on the following day, in latitude 30° 31' north, longitude 44° 7' west. Mr. Bennett mentions them as "small Sepia" of a purplish colour.

The Cephalopods of the genus Octopus are generally found near the coast, where they seek their prey among the rocks, creeping on their eight legs with the body carried above or behind the head; they are less calculated for living in the open sea than the Decapods, which are provided with an additional pair of fins. That singular oceanic phenomenon, the Sargasso or Gulf-weed, serves however, in place of a shore, as a resting-place to the small species now under consideration, and affords food and shelter to innumerable other curious Invertebrata: indeed an accurate fauna of this floating mass of marine vegetables would be a most interesting addition to Zoology.

The largest of the three specimens of Octopus collected by Mr. Bennett measured from the extremity of the sac to the end of the longest arm exactly an inch and a half, the length of the sac or body being barely half an inch. The first peculiarity which may be noticed is in the position and attachment of the eyes, which, instead of being contained in a capsule as in the common Poupy, project uncovered from the sides of the head in the form of large dark-coloured spherical bodies: in this structure we are reminded of the Nautilus, in which the organs of vision not only project from the sides of the head, but are supported on peduncles: the prominence of the eye-balls in the Argonauta, and still more in the Octopus hyalinus, is an approximation to the structure just described in the present species. Those alone, who have witnessed the persevering activity, power, and velocity of motion exercised by the Octopus when engaged in its destructive practices amongst a shoal of fishes, and who have seen it with its beak buried deep in the flesh of a victim held fast in the irresistible embrace of its numerous arms, in an instant simultaneously dissolve the attachment of its thousand suckers, and, disengaging itself from its prey, dart like an arrow from the net that has been cautiously moved towards it for its capture, can form an adequate idea of the acuteness of visual perception and powers of action with which this singular and unshapely Cephalopod is endowed.

In the present species the form of the body is ventricose, but slightly tapering to its extremity; the mantle is connected by a broad continuation of the integument to the back

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1 Pl. XXI. figg. 12, 13.
of the head; the greatest breadth of the body is 4 lines; the breadth of the head, including the eyes, is half an inch. Of the eight arms which radiate from the anterior part of the head, the first or dorsal pair is the longest, as is the case in many species of *Octopus*; the second pair is nearly the same length as the first; the third pair, which is commonly the longest in the *Decapods*, is here scarcely half the length of the first; the fourth pair is nearly two thirds the length of the first.

The musculo-membranous web which is usually extended between the bases of all the arms in the *Octopi*, is in this species developed to the ordinary extent between the four dorsal arms only: the webs between the second and third, and the third and fourth arms are very short; that between the fourth pair is wanting. From this peculiarity I propose to name the species *Octopus semipalmatus*. The suckers are sessile, and are arranged in a double close-set alternate series on the margins of the internal surface of the arms, with a broader interspace than is usually observed (figs. 12, 13. Pl. XXI.)

The eyes are of proportionally large size, and present a dark colour, in consequence of the pigment shining through the sclerotic coat. The sclerotic is perforated by a circular aperture in the usual situation; and as the dermal *cornea*, which covers the anterior part of the *sclerotica* in the common *Poulp*, is absent in this species, the capsule of the crystalline lens is exposed, as in the *Nautilus*, to the sea-water. The funnel has the usual exterior form: it is without a valve; but at the sides of its base there is a structure approaching to the articulation by which it is united to the mantle in the *Decapodous* tribe of *Cephalopods*. Immediately above the insertion of each lateral pillar there is a small transverse crescentic ridge which rests upon a similar ridge projecting from the side of the mantle (see *a*, *b*, fig. 13. Pl. XXI.); neither of these prominences however is supported by cartilage, as in the *Decapoda*. In the *Octopus ecutenulatus* there is a similar structure, but the projection on the mantle is shorter and more prominent; in the *Argonauta* the articulation of the sides of the funnel is still more complete, and is constant in all the known species of that genus.

With respect to the anatomy of this small *Cephalopod* it may be observed, that in the presence of a crop, in the lateral insertion of the gullet into that receptacle, in the muscular stomach, the spiral laminated bag, and the folded intestine, it accords with the generic type of structure presented in the common *Poulp* (*Octopus vulgaris*, Cuv.). The ink-bag is similarly buried in the anterior part of an undivided large liver: the biliary ducts are without glandular appendages: the follicles appended to the branchial divisions of the *vena cava*, are elongated, and hang from the exterior of the vessels; the branchial hearts are without fleshy appendages; the *branchiae* are connected by membranous bands to the sides of the mantle; the branchial *laminae* present a zig-zag folding, as in

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1 The preceding examples of the infundibular joints in the genus *Octopus* diminish the value of that character as distinguishing *Octothorpe* from *Octopus*. See Dr. Leach’s account of *Octothorpe crateria*,—Phil. Trans. 1817, p. 295.
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the Argonaut; there are fifteen pairs in each gill. The peritoneum, or external membrane of the viscera, was remarkably mottled with large purple-red spots: I have observed the same disposition of a brown pigment on the peritoneum in the Argonauta.1

The pigment which gave the purplish tint to the skin when the animal was alive, appeared to have been driven from the surface; for on removing the cuticle, which was remarkably thick and elastic in this small Cephalopod, only some small brown spots were perceptible in the vesicular rete mucosum: these were aggregated chiefly on the dorsal aspect of the body and head.

As the generative organs were scarcely developed in either of the specimens, it is probable that they may not have arrived at maturity, and the species consequently may be assumed to attain a greater size than that of the largest individual in the collection, which measures only 1½ inch from the bottom of the sac to the extremity of the longest arm. The prominence of the eyes, the structure of the funnel, the proportions of the arms, and the partial development of the interbrachial web, will however afford the means of distinguishing this species when it is again met with.

The very interesting specimen of the Paper Nautilus, or Argonaut, which forms part of Mr. Bennett's collection of Cephalopoda, is thus noted in his journal:—

"March 7th. Fine weather; light and moderate south-east trade breezes; therm. from 81 to 84; lat. 4° 43' south, long. 17° 37' west. I did not capture a single specimen with the net during the day; but at 8 p.m. I procured some small specimens of Exocatus, and also an excellent specimen of an Argonauta: on placing it in sea-water it expanded its tentacula, but did not attach itself to the glass, or move about. Early on the following morning I found the animal dead in the glass of sea-water in which I had placed it on the previous night, and on moving the shell to take it out, the soft parts fell out. After the animal was out of the shell, a cluster of ova was seen attached to the involuted part of the shell; somewhat resembling, but in the recent state more beautifully shown than in, the engraving of apparently a similar specimen in the Appendix to Tuckey's Narrative of the Congo Expedition. On placing the shell in spirits, the cluster of ova floated out like a diminutive plant of a pure white colour, presenting a very elegant appearance. After being preserved a day in spirits, much of this beautiful appearance was lost. The body of the animal was of a dark reddish colour, which colour was also given to the upper part of the shell, either naturally or imparted to it by the animal; the remainder of the animal was of a dirty white with minute purplish dots; and the arms were also speckled underneath of a similar colour: the suckers were white. These cephalopodous animals are not (and I consider correctly) regarded as the true inhabitants of the shell, but merely parasitical inhabitants; and the animal not having

A development of pigment on the serous membrane of the abdomen is observable in many fishes, and in some reptiles, as Anguis fragilis, Ophisaurus ventralis, and some species of Lacerta, Cuv., and in Agama atra, where the peritoneal pigment is almost black.
the power of either producing or reproducing the shell, must be sufficient to decide that the one usually found in it, is not the original inhabitant of the shell."  

With respect to the remark with which my friend concludes his observations on the present specimens, I need scarcely observe that there is no doubt that the determination of the power possessed by the Ocythoe of reproducing, or otherwise, the Argonaut shell, would be an experimentum crucis, and settle the long-agitated question. I do not find, however, among the notes left by Mr. Bennett in my charge, any other observations respecting the Argonaut than those above transcribed; and the experiments hitherto recorded touching the reproduction of the shell by the Cephalopod inhabiting it, have been deemed by the experimenters as proving that the shell is the veritable production of the Cephalopod.

The shell of the specimen under consideration belongs to the species Argonauta hians of Solander, and the animal is the Ocythoe Cranchii of Dr. Leach, so called on the supposition of its being a parasitic inhabitant. It is worthy of remark, that in the present, as in every other instance of which I have cognizance, where the Argonauta hians has been taken with its inhabitant, the latter has invariably presented characters as specifically distinct from those of the Cephalopods inhabiting the Argonauta Argo and Argonauta tuberculata as are those of the latter from each other: and the same circumstance holds good with respect to a nondescript species of Argonaut, 1, taken by Capt. P. P. King in the South Pacific ocean; in which both the shell and its inhabitant differ specifically from the three recent species hitherto described. I am aware that it has been urged by the advocates of the parasitic nature of the Ocythoe, that the Argonaut shells taken possession of by different species of Ocythoe in different parts of the ocean would be most likely to be also of distinct species: but the constancy of the correspondence between the Cephalopod and the shell, both as to specific peculiarities and size, affords strong presumptive evidence of their relation to each other being something more than mere accidental adaptation. 2

1 This species I have called, from the colour of the animal and its shell, Argonauta rufa.
2 Since the preceding observations were written, the following facts have been added to the natural history of the Argonaut. M. D'Orbigny states that he has observed specimens of the Ocythoe in Argonaut shells, of which the margin of the aperture was entire, and in a membranous or soft state; whence he concludes that the shell had recently received an addition at that part, and that this addition was due to the Cephalopod inhabiting it. It is difficult to asssent to the explanation of this fact offered by M. De Blainville*, viz. that the true constructor had been very recently expelled by the Ocythoe, for in that case the very delicate margins of the shell would surely have been injured by the Cephalopod whilst violently expelling the rightful owner, and usurping possession of the fragile shell.

Two experimenters (Madame Power and M. Rang), at different periods, and in different places, have broken and removed portions of the Argonaut shell while inhabited by the living Cephalopod, and have observed that the latter repaired the breaches by a secreted substance, not indeed similar to the originally formed shell, but which one of the experimenters, M. Rang, compares in this respect with the shelly matter secreted by the

* Annales d'Anatomic et de Physiologie, Mai, 1837.
The most interesting circumstance to be noted in Mr. Bennett's *Argonaut*, is its diminutive size, in connection with the large mass of *ova* which it has formed, excluded *Limaces* to repair accidental breaches in their shell, and which also differs from the originally formed shell. When, however, fractures occur near the margin of the shell, they are repaired by a substance identical with the rest of the shell, as has been shown by Mr. Charlesworth;* but whether these reparations are due to the Cephalopod, or to some yet unknown Mollusk, can of course only be determined when the question is decided respecting the real constructor of the *Argonaut*.

The true use and disposition of the palmed arms of the *Ocythoe* have been determined and described by M. Sander Rang. The base of each of these arms passes out of the shell at the angle between the summit and auricular process of the free margin, and the membrane expands upon the outside of the shell, and meets its fellow at the flattened keel. These expansions are transparent in the living *Argonaut*, and are compared by M. Rang to the thin lobes of the mantle which the living *Cowry* spreads over its shell. Thus, when the *Argonaut* creeps at the bottom of the sea, it carries the shell above it, supporting it by means of the palmed arms, and moves along, its head being downwards, by means of the other three pairs of arms. M. Rang, who has long devoted himself to the study of *Mollacologie*, and who is allowed by M. De Blancville to be 'parfaitement au courant de l'état de la question,' derives from the preceding observations a conviction that the *Ocythoe* is the true constructor of the *Argonaut*. M. De Blancville, however, sees in the palmed arms only the analogous organs of the claspers at the extremity of the tail of the parasitic *Paguri*.

I have frequently, however, seen *Paguri*, and especially young ones, in shells very disproportionante to their own size; but I have never observed an analogous disproportion between the *Argonaut* shell and its occupant. In a series of six small *Argonauts*, *Cephalopods* and shells, captured at the same time in the South Pacific Ocean, all individuals of the same species (*Arg. rufa*, O.), but all differing by slight gradations in size, and of which five are young, and without *ova*, and totally fill the shell, there is an exact accordance between the size of the shell and the size of the inhabitant; a corresponding gradation of size is maintained in both. In a series of several small and very young specimens of the *Argonauta Argo*, which I examined whilst they were temporarily deposited by Madame Power in the hands of Mr. Charlesworth, and which, from the slight difference of size, must have exhibited stages of growth differing at most by a few days only, there was the same exact correspondence between the size of the *Cephalopod* and that of its shell. Now to explain this accordance between the *Cephalopod* and shell on the parasitic theory, we must have recourse to the supposition that the *Argonauts* change their shell at very brief intervals: indeed the chief business of their lives would be in that case to hunt out, seize, and dispossess the (assumed, but yet unseen) true constructor of the shell, in order to present so constant a harmony in the relative proportion of the *Cephalopod* and shell which my observations on two series of two different species of *Argonaut* have shown to exist.

On the same occasion that I compared together the interesting series of the young specimens of *Argonauta Argo*, I examined the small vermiform bodies supposed by Madame Power to be the newly-excluded young of the *A. Argo*; these were, however, young specimens of the parasite of the *Argonaut* described by Cuvier under the name of *Hectocotylius*, which in the disposition of its numerous suckers, offers a remarkable resemblance to the arm of an *acetabuliferous Cephalopod*.

I cannot help further observing that the apparent strength of the main argument for the parasitic nature of the *Ocythoe*, is its real weakness, since it arises from a view of analogy contracted within the artificial limits of the systematist. The argument runs thus: Because the *Ocythoe* has no muscular attachment to its shell, and because it is said to leave it and return to it at will, and to have no fixed relative position (?) to the shell, and because there is no other testaceous *Mollusk* in the same predicament, therefore the occupant of the *Argonaut* shell is a parasite. But surely we are justified in extending our views of analogy in such a question beyond the limits of an artificial group, and we have not to look very far into the animal series before we find, in the *Ser-
from its oviducts, and attached to the shell. When first captured, the ova were pressed down into the back part of the shell; but upon the removal of the superincumbent weight of the animal, it would appear that their own elasticity, combined perhaps with the absorption of fluid, and the coagulation of the albumen by the alcohol, had tended to occasion their protrusion forwards.

The longest diameter of the shell is nine lines; the transverse diameter six lines: the length of the animal, from the fundus of the sac to the end of the longest arm (the second), one inch four lines; the length of the sac, from its fundus to the free margin at the base of the funnel, five lines. The funnel extends beyond the base or uniting membrane of the ventral pair of arms; it is, as in the other genera of Octocera, unprovided with an internal valve; but is articulated at its base by two lateral joints to the mantle. The account of this structure in the Philosophical Transactions does not convey an adequate or correct idea of what the present specimen of Ocythoe Cranchii presents; there appears indeed to be a typographical error in Dr. Leach's description. I find on each side of the base of the funnel, immediately above the insertion of the lateral muscular pillars, a small firm fleshy tubercle, above which there is a small depression; on the inside of the mantle immediately opposite, there is a corresponding tubercle and cavity, but their positions are reversed, the tubercle being above the cavity; thus the prominences in the funnel and mantle are reciprocally received into the opposite depressions, and the funnel and mantle are locked together by a double ball and socket joint, in the degree of apposition necessary for the complete fulfilment of the vigorous alternating muscular actions on which the respiratory function depends (a, b, fig. 14. Pl. XXI.)

The arms in Mr. Bennett's Argonauta hians were not rigidly contracted, as happens generally with those specimens which are immersed alive in spirits; but were flaccid and flexible, and well adapted for determining their exact proportions and form. The length of the first pair was nine lines; the number of suckers on each of these was thirty-six; they extend, as in Argonauta Argo, along the circumference of the terminal membrane, but not to the same distance. I could not trace them with the microscope further than about one third of the way down from the anterior margin of the membrane; while in Arg. tuberculata they may be traced along more than half the circumference of the velum;

pulae, e. g., instances of soft-bodied invertebrates secreting as true a shell as the calcareous Argonaut, yet having as little of a muscular attachment or uniform position to the shell, and as much freedom of quitting their shell and returning to it, as the Argonaut.

With respect to another argument*, in favour of the parasitism of the Cephalopod of the Argonaut, which, from an imperfect knowledge of the circumstances attending the development of the ova of the Mollusca, was supposed to be afforded by a difference in the size of the ova of the Ocythoe, and of that which Mr. Gray regards as the nucleus of the Argonaut shell; I refer to it only because it has been adopted by M. De Blainville in his résumé of the Argonaut question as valid in favour of the parasitism of the Ocythoe: it has, however, since been abandoned by its promulgator, being founded on erroneous premises. (See the Magazine of Natural History, 1837, New Series, p. 247.)

* See Proceedings of the Zoological Society for September, 1834.
and in *Arg. Argo* they are visible to the naked eye, and extend round the whole of the circumference of the same part. From this disposition of the suckers it would appear as if the characteristic structure of the first pair of arms arose from their extremities being bent back upon themselves and united to the stem by means of a thin membrane. These membranes are most developed in the Mediterranean species, the *Argonauta Argo*, and have been described by naturalists and poets from Aristotle and Callimachus down to Cuvier and Byron, as serving the office of sails; the animal being supposed to have the power of rigidly extending the soft fleshy arms which support the membranes, and of maintaining the latter tensely outstretched to meet the breeze. It is scarcely necessary to observe, that the structure of the parts in question is incompatible with this hypothesis of the use of the *vela* in navigating the frail boat of the *Argonaut*.

In the present species the terminal membranes of the first pair of arms are relatively smaller than in *Arg. Argo* or in *Arg. tuberculata*; in the latter they are broader than they are long; in the *Argonauta hians* they present contrary proportions. In the present specimen in which the *vela* are beautifully entire, they measure from the commencement of the reflected portion of the arm, (or what would be considered as the end of the arm) to the lower margin of the web, four lines, their breadth is three lines. The length of the second pair of arms is ten lines, the number of suckers, fifty-six; the length of the third pair eight lines, number of suckers fifty-two; the length of the fourth pair seven lines, the number of suckers twenty-eight.

Dr. Leach observes, in his description of *Ocythoe Cranchii*, that "all the internal organs are essentially the same as in the *Polypus*." (*Octopus* of Cuvier, loc. cit., p. 294.) We found, however, that the *Argonauta hians*, like the *Argonauta Argo*, receded from the naked *Octopods*, *Octopus* and *Eledone*, and approached the *Decapods* in the structure of the branchial hearts, which are provided with a fleshy appendage; and in the form of the appendages to the *vena cava* which are shorter and thicker; and in the relative position of the lozenge-shaped *ink-bag*, which is not buried in the substance of the liver, but lies in its anterior concavity. The inferior salivary glands are also relatively smaller.

The following differences, as compared with the *Octopus*, occur in other internal organs which adhere to the type of structure which characterizes the *Octopodous* tribe of *Dibranchiata*. The crop increases in width as it approaches the stomach. The laminated pancreatic bag is of a triangular form, and not spirally disposed; the two simple biliary ducts enter at its apex. The two oviducts are devoid of the circular laminated glands which surround them about the middle of their course in the *Octopus*; they are also disposed in four or five convolutions as they pass behind the roots of the branchiae, and they terminate at a greater relative distance from the base of the funnel.

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1 Since the above was written, it has been ascertained by direct observation, that these *vela*, or rather *velamenta*, have not only a relation of coexistence, but one of direct physiological import, to the development of the shell in the *Argonaut*, serving as the organs both of secreting and of retaining this part. See the observations of M. Rang, *Comptes Rendus de l'Acad. des Sciences*, Avril 24, 1837.
The affinity of the *Argonauta* to the *Decapodous Cephalopods* is further indicated by the inferior development of the mediastinal *septum* which divides longitudinally the branchial chamber. This *septum* in *Eledone* is complete and muscular throughout, excepting a very small proportion of its inferior part. In the *Octopus*, in which this *septum* is well described and figured by Cuvier, as the "*bride antérieure qui lie la bourse à la masse viscérale*", a greater proportion of the lower part is membranous than in *Eledone*. In the *Argonauta* the muscular part of the *septum* is reduced to two narrow and delicate strips, which arise from the posterior part of the cranial cartilage, descend obliquely forwards, intercept the termination of the *rectum* and ink-passage, to which they serve as a sphincter, and then expand in the vertical direction, to be inserted along the middle line of the internal surface of the anterior part of the mantle: a membrane is continued from their upper part to within a short distance of the margin of the mantle; and another from their lower part extends downwards, and terminates opposite the base of the gills; the branchial chambers intercommunicate both above and below this *septum*. In *Sepiola* the muscles corresponding to the *bride antérieure* of the *Octopus* are developed in the same degree as in the *Argonauta*; but the membranous part of the *septum* above them is wanting, while that which is continued from their inferior margins is more complete. In the *Calamaries* both these muscles and the *septum* of the branchial chamber are wanting.

With respect to the nervous system of the *Argonauta*, I find in a large specimen of the *Argo*, that the brain, when viewed from the superior or dorsal aspect, presents, as in *Octopus*, an anterior, white, flattened, transversely oblong band, and a posterior raised convex semilunar mass, which terminates by a semicircular border posteriorly, the extremities of which are directly continued, to form or join the posterior nervous collar of the *oesophagus*. The great lateral nerves of the mantle come off from the posterior suboesophageal mass, precisely as in *Octopus*; and instead of extending down in a parallel direction as low as the roots of the gills, as represented in the splendid figure by Delle Chiaie, they diverge, penetrate the short muscles, analogous to the *brides latérales* in the *Poulp*, and terminate in the stellated ganglions opposite the upper extremities of the gills, and immediately below the base of the funnel: by some unaccountable error, these nerves, in Delle Chiaie's figure, which some of our compilers have copied, are made to come off from the optic ganglions. The lateral muscles above mentioned are the analogues of the great shell-muscles of the *Nautilus Pompilius*; they are more strongly developed in *Loligo* and *Sepia* than in *Octopus*, but have the same origin in each, the same attachment to the capsule containing the rudimental shell, and are always perforated by the great lateral nerves of the mantle: they are perforated by the corresponding divided and ungangliated nerves in the *Nautilus*, in which these muscles acquire the *maximum* of development. In the *Argonauta*, which has no muscular attachment to its shell, and has no internal *testsceous* rudiment, the corresponding

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1 Poli, *Testacea Utirisys Sicillie*, vol. iii, pars 1st, posthuma, 1826.
muscles have the smallest development, and the mantle-nerves which perforate them are, prior to the formation of the ganglion, relatively the shortest that are met with in the Dibranchiate order.

I carefully examined the ova of Mr. Bennett’s small specimen, but obtained no results bearing upon the interesting question before alluded to, the development of the embryo not having proceeded to the degree necessary for the appearance of the shell, supposing it to be formed in ovo. The observations recorded in the ‘Philosophical Transactions,’ by Mr. Bauer (1817), and in the ‘Zoological Journal,’ by Mr. Broderip, (vol. iv. p. 57.) are, for the same reason, inconclusive as to this point.

The ova of the Argonauta hians were nearly of the same size as those of the Arg. Argo at a similar stage of development, viz. $\frac{4}{10}$ inch in length, and $\frac{7}{10}$th in diameter; but they are of a more regular oval form, not tapering to the end opposite the attachment of the peduncle. Examined with transmitted light, they are composed of an exterior, smooth, colourless, transparent, tough, elastic, cortical tunic; next of a more delicate membrane (the chorion), containing a straw-coloured transparent albuminous fluid: in this fluid there was an irregular mass of semi-opaque granules, in which was imbedded an opake dark vitelline body, surrounded by a membrane and pellucid fluid. The form and proportion of the opake vitelline body and its transparent investing membrane varied in size and shape in different ova: I have carefully figured one of the most remarkable in this respect (fig. 15), in which for a moment I entertained the exhilarating idea, that the nucleus of the real shell was contained within it: on tearing open the external tunic, however, the contained substance turned out to be nothing more than the yolk, separated by an intervening stratum of clear fluid from the transparent membrana vitelli, and the whole substance of the opake mass separated into the flakes, granules, and globules of oil, of which the vitellus is usually composed: there was not a trace of any consistent parts of an embryo, nor the slightest particle of calcareous matter.

The mutilated Decapodous Cephalopod, obtained at Port Jackson, New South Wales, and transmitted to me by Mr. Bennett, consisted only of the head and principal viscera, and was consequently too imperfect to allow of its being satisfactorily determined, even as to its genus. But as the suckers were arranged in a double alternate row on each of the short arms, it was evidently not a Sepia of Cuvier, while the denticulated margins of the horny rims of the suckers show that it may have belonged either to the genus Sepioteuthis, Fér., or Loligo, Cuv. As in some species, both of Sepioteuthis and Loligo, the outer lip gave off eight short processes, on the inner surface of which, near their extremity, were three or four small suckers, attached by peduncles, and having precisely the same structure as those of the eight large exterior arms. In this repetition of the ordinary series of cephalic prehensile processes, we may perceive an evident analogy to the internal series of processes (labial tentacles) which exist in the Nautilus. In some species of Calamary, indeed, as in the Loligo Pealii, Le Sueur, the acetabuliferous labial
processes are more developed than in the present specimen from Port Jackson. In *Loligo corollifera*, Tiles, these labial processes have been compared by Bojanus to the internal shorter series of tubercles of a *Medusa*. But this structure illustrates only in a very remote degree the relation of analogy subsisting between the *Cephalopods* and *Radiaries*.

The structure of the tongue, *pharynx*, and glandular appendages, presented nothing remarkable. The *asophagus* was slender, and continued of uniform breadth, as in the *Decapods* generally, to the stomach, which presented the usual gizzard-like structure. In the *Octopods*, as in the *Nautilus*, the *asophagus* dilates into a crop.

The *rectum* in this *Cephalopod* was furnished with two lateral processes (fig. 16. pl. XXI.), of a flattened triangular form, and evidently adapted to constitute a valvular apparatus for the protection of the anal aperture. They are attached at opposite sides of this transversely extended orifice by their acute angles, from which a ridge is extended to the middle of the opposite base, so that when the valves are folded down upon the vent (as in the figure above the number of reference,) the ridges fit into the aperture, and accurately close it. In the *Cuttle-fish* (*Sepia officinalis*, Linn.) the corresponding processes are of a rhomboidal form, with a thicker ridge on the side next the anal aperture, which they are thus adapted to defend against any foreign substances which may obtain entry into the pallial cavity. In *Onychoteuthis* and in *Loligopsis* the anal appendages are long and slender: in the latter genus *Rathke* compares them to *antenne*; and since in these *Cephalopods* they cannot act the part of mechanical guards, it may be inferred that they perform the function of instruments of sensation, and convey the stimulus to contract, to the muscular sphincter which closes the outlet of the alimentary canal. It is interesting to notice the relation of coexistence which these appendages bear to the lateral fins; for they are only present in those *Cephalopods* which have the power of propelling themselves forward, and in which their use is therefore obvious, as the orifices of the branchial cavity, in which the intestine terminates, are directed forwards. In the *Octopods* the *anus* is not provided with these appendages.

Of the remaining *viscera* of the *Decapod* in question I have only to notice the reproductive organs: these were of the female sex, and exhibited the *ova* both in the ovary, where they were inclosed in reticulate *calyces*, as in most *Cephalopods*, and in their passage through the branchial cavity, in which the intestine terminates, are directed forwards.

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1 It is evident from this difference of structure in the two groups of *Dibranchiata*, that Aristotle took his excellent description of the digestive organs of the *Makdia* either from a *Sepia* or *Teuthis*; he says, “Μέγας ὁ τὸ στόμα ἔχον τον αἰβάραν μακρόν καὶ στενόν, ἔχθενον τῇ τοιοῦτῳ πρόλογῳ μέγαν καὶ περιφέρη ὀμφαλόν.”—Hist. de Anim., lib. iv. c. 19.


3 I am not aware of any modern account of the mode in which the *ova* of the *Cephalopoda* are impregnated, taken from actual observation. Aristotle, whose History of Animals is still the richest in details of the habits
The female organs of generation in the Cephalopodous class present five principal modifications of structure. The ovarium is single in all, but sometimes, as in the Cuttle-fish, it is divided by a septum.

1. In the Nautilus there is one oviduct, which traverses an elongated gland at its extremity: there is also a superadded nidamental gland, which has no connection with the oviduct, but is attached, as in the Pectinibranchiate Gastropods, to the parietes of the branchial chamber.

2. In Sepia, Sepiola, Rossia, Sepioteuthis, and some species of Loligo, there is also one oviduct with a glandular termination; but the nidamental glands are two separate bodies, detached from the mantle, and having no communication with the oviduct.

3. In Onychoteuthis, Loligo sagittata and some other Calamaries there are two distinct oviducts, each terminated by a glandular organ, and also two separate nidamental glands.

4. In the Octopii and Eledonae there are two oviducts, each of which traverses a glandular organ, situated about the middle of its course: there are no detached nidamental glands.

5. In the Argonaut the two oviducts are convoluted, and have glandular coats throughout their extent, but without partial enlargements: there are no separate nidamental glands.

and economy of the Cephalopods, gives two descriptions of the act of impregnation. In the fifth book of the Historia Animalium it is stated that the Polypus (Octopus or Poulp), the Sepia (Cuttlefish), and the Teuthis (Calamary), all copulate in the same manner; the male and female having their heads turned towards one another, and their cephalic arms being so coadapted as to adhere by the mutual apposition of the suckers. In this act the Poulps are described as seeking the bottom, while the Cuttles and Calamaries are said to swim freely about in the water, the individual of one sex moving forwards, the other backwards. Aristotle also observes, that the ova are expelled by the funnel, which the Greeks call φαγρήρ; and some, he adds, assert that the coitus takes place through this part. From the position of the terminal orifice of the oviduct at the base of the funnel, and the inclination of the penis towards the same part, the latter supposition derives some probability, especially with respect to the Sepia and Sepioteuthis, in which the male organ is well developed; but in these, as in all other Cephalopods, true intromission is physically impossible. From the dense nature of the external covering which the ova derive in their course along the efferent passages, it is very improbable that they can be impregnated otherwise than internally, and before the nidamental covering is laid upon the thin smooth chitinous which invests the ovum externally, prior to its escape from the oviduct: the descriptions of Aristotle may therefore relate to some such imperfect connexion as takes place in the Salamanders, &c. It is worthy of remark, indeed, that the differences in the situation in which the coitus is said to take place in Aristotle's description corresponds with the modifications of the locomotive powers in the three genera treated of. It is only, for example, in the Sepia and Loligo that posterior fins exist, enabling the individuals to swim forwards. The second account of the impregnation of the Malakian ovum occurs in the 12th Chapter of the 8th Book of the Historia Animalium, where the generation of fishes is treated of. "When they (fishes) bring forth, the male, following the female, sprinkles the ovum with his semen. The same thing happens to the Malakia, for in the genus Sepia, wherever the female deposits the ovum the male follows and impregnates them: this possibly happens in like manner to other Malakia, but hitherto it has been observed in the Sepia alone." The ovum of the Sepia, however, are precisely those which, of all Cephalopods, from the density and thickness of their coats, are the least likely to receive the impregnating influence after having been excluded.
The Decapod here described presented the second type of the generative organs. The ovarium was of an elongated form, and of great extent; it was filled with reticulate ovisacs, containing ova in all stages of development, and must have occupied nearly the whole of the posterior half of the abdominal cavity. The single oviduct came off from the middle of the left side of the ovary, and descended obliquely to the bottom of the ovary, where it was dilated by a cluster of smooth and polished ova; it was then bent suddenly upon itself, and near the anterior extremity of the ovary entered the terminal gland, which was expanded at its commencement, and after suddenly contracting, gradually tapered to its free extremity. The ova presented an oval form, and were three lines in length. The first or membranous portion of the oviduct had thin, semitransparent, and very dilatable coats. The two detached nidamental glands were of a longer and narrower form than in the Sepie, but thicker, and of greater relative size, than in the Loligines. They presented the usual transversely laminated structure and anterior longitudinal fissure, in which the glutinous secretion is moulded into the thread-like form, adapted to connect the ova together as they escape from the true oviduct, with which these glands have often been confounded. But besides the above parts, which are evidently subservient to the generative function, I found two small, round, flat, fleshy bodies attached to the anterior extremity of each of the two nidamental glands. They had no cavity, and were destitute of any duct or outlet, and had no other connection with the nidamental glands than by the cellular tissue. Their texture was compact, with a few minute cellular cavities about the centre: they were of an orange colour. In the Cattle-fish there is a corresponding body, similarly situated, but single and trilobate, consisting of two lateral slightly compressed conical portions, united by a middle oval lobe (see fig. 19. pl. XXI.). The dorsal surface of the lateral lobes is flattened; the opposite side excavated to receive the superincumbent extremities of the ovarian glands: to these glands the trilobed body is attached by a tough connecting membrane. On making a section of a lobe of the body in question (as in fig. 20.), its texture appears to be dense, and somewhat granular, with minute cells at the centre, which contain a caseous substance. In Sepiolu the corresponding body is single, as in the Sepia, and is similarly attached to the anterior extremities of the nidamental glands. In the Loligines, and in the Cephalopod taken by Captain Ross on the shore of Boothia, and which, being the type of a new genus, I have described under the name of Rossia, there are two fleshy bodies, as in Mr. Geo. Bennett's Cephalopod. Each body in Rossia (see fig. 18. k k pl.XXI.) is attached by cellular tissue to the anterior part of the corresponding nidamental gland (g g), and is excavated by a deep groove, situated close to the aperture of the gland. From this structure, and the position of the glands, we might infer that they assisted in moulding the nidamental secretion, or in applying it to the ova.

If we take into consideration the texture of these enigmatical and hitherto undescribed

1 Zoological Appendix to Capt. Sir John Ross's Voyage.
bodies, their bright colours, and their relative position to the generative apparatus, we may perceive an evident analogy between them, and the *corpora succenturiata*, or suprarenal bodies of the vertebrate animals.

The preceding dissections, combined with those which I have made from time to time on other *Cephalopods*, belonging to the genera *Sepiola*, *Rossia*, *Loligo*, *Onychoteuthis*, *Sepia*, *Octopus*, *Eledone*, *Argonauta*, and *Nautilus*, have, in connection with physiological views, suggested ideas of the natural affinities and formation of the different groups of *Cephalopods*, which differ in some respects from those expressed in the previous classifications of these highly organized invertebrate animals; and I am induced to offer them to the consideration of zoologists, as they appear to me to be more in accordance with the best principles now recognised in the subdivision of other *molluscan* classes.

The systems of classification of the *Cephalopods* existing in the best works of the present day differ from each other in some material points. In one, e. g., no characters of ordinal importance are recognised; but the class is immediately subdivided into several minor groups, of the value of tribes or families: in other classifications, where a primary division of the class into two or three orders is adopted, the characters are derived sometimes from modifications of the locomotive organs, but more frequently from different conditions of the shell: and one can scarcely suppress a feeling of surprise that the modifications of the tegumentary system, the low relations of which are so generally recognized in the subdivision of other classes of *Mollusca*, should be adopted for the classification of the *Cephalopods* by so many systematic writers of authority on *Malacology*.

Lamarck (*Philosophie Zoologique*, 1809,) divides the *Cephalopods* into three orders; first, into those which have a multilocular shell; second, those which have a unilocular shell; and third, those which are without either.

It is obvious also that the modifications of the dermal system mainly govern the distributions of the *Cephalopoda* in both editions of the *Règne Animal* of Cuvier. In the edition of 1817 the *Naked Cephalopods* or *Seiches* constitute the first family, to which the *Nautili*, *Bellemnites*, *Hippurites*, *Ammonites*, *Camerines*, and even the *Argonauts*, are severally regarded as equivalent groups. In the edition of 1829 considerations of the affinities indicated by internal organization prevail so far as to lead to the suppression of the group of *Argonauts*, and its union with the *Seiches*. The other modifications consist of the additions of families, including the later discovered chambered shells presenting new modifications of structure, such as the *Actinocamax* of Miller, and the *Camarines*, or microscopic chambered shells.

In 1821 Mr. Gray proposed a classification of the *Cephalopods* in which a primary division into three orders was distinctly recognised, and names applied to them indi-

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1 Cuvier makes no mention of them, and they appear by subsequent anatomists to have been confounded with the nidamental glands.

2 London Medical Repository, 1821.
cative of modifications of the shell, which he terms 'Protector'. The Seiches, or Naked Cephalopods of Cuvier, are subdivided into two orders, of which the first, under the name of Anostophora, corresponds with the Poulpes of Cuvier, and with the Octopoda of Dr. Leach's arrangement of 1817, presently to be noticed; while the second order, Sepiophora, is equivalent to the Decapoda of Leach, or to the remaining Seiches of Cuvier's system. All the Cephalopods with chambered shells are collected together into a third order, under the name of Nautilophora.

The reformed classification of the Cephalopoda contained in the Malacologie of M. De Blainville (1825)\(^1\), though much more truly expressive of the natural affinities of its objects than that proposed by Mr. Gray, still repose on the insecure basis of tegumentary modifications. The whole of the Seiches of Cuvier are here raised to the rank of an Order, under the name of Cryptodibranchiata; and the author, guided by the knowledge of their internal organization, rightly uses the characters derivable from the modifications of their internal shell, as indicative merely of the subdivisions of this order. M. de Blainville made also another important step in advance, by separating the Cephalopods with microscopic chambered shells, under the name of Cellulacea, from those with siphonated shells, which he terms Polythalamacea. Subsequent researches have since proved that the Cellulacea of M. De Blainville ought to be removed altogether from the class Cephalopoda. The classification of the Cephalopods adopted by M. Férussac in the great work still in progress of publication is essentially the same as regards its primary divisions as that of M. de Blainville, but the nomenclature of M. D'Orbigny is preferred. All the Cephalopods, e.g., without chambered shells, form the first order, under the name of Acetabulifères; all those having siphonated chambered shells form a second order, termed Siphonifères; and the non-siphonated microscopic chambered shells constitute a third order, under the name of Foraminifères.

Now in consequence of the subordinate character on which all the preceding classifications are founded, there is a violation of natural affinities in the formation of the primary groups. The genus Spirula, e.g., as well as the Belemnites, and other congeneric extinct Cephalopods with internal chambered shells, are united, solely on account of the polythalamous structure of their shell, with Cephalopods of an inferior grade of organization, as the Nautilites, while they are separated from those which possess the dibranchiate or higher type of structure,—a type of structure which the laws of coexistence all but demonstrate to have been exemplified in the Cephalopods with internal chambered shells, first quoted, viz. Spirula and Belemnites.

The natural affinities of the Cephalopods seem to have been still less regarded in that distribution of the species in which the Dibranchiate Decapoda are joined with all those Cephalopods possessing chambered shells in one primary division of the class, which M. de Haan\(^2\) terms Adharentia; and in which the Dibranchiate Octopoda are raised to

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\(^1\) In 1815 this author proposed a binary division of the Cephalopods, which he preferred to term Cryptodibranches, into Cryptodibranches aus and Cryptodibranches testacies.—Journal de Physique, t. lxxxiii. p. 244.

\(^2\) Monographia Ammoniteorum, &c., 8vo, 1825.
the rank of an equivalent section, under the name *Libera*. The primary division of *Cephalopods*, proposed by M. Deshayes⁰, into the two orders *Octopodes* and *Decapodes*, is essentially the same as that of M. De Haan, as the latter group combines the naked or *dibranchiate* species with the *Nautilacea* of De Blainville.

Thus it will be seen that most of the preceding schemes are based on the modifications of the shell or its analogue, and some of them, as that proposed by M. Férussac, have been published since the modifications of structure in those *Cephalopods* which inhabit an *external* chambered shell have been pointed out. It is this circumstance which has chiefly induced me to state here my views of the distribution of the *Cephalopods*, founded in part on the dissection of the *Nautilus Pompilius*, and on a comparison of its organization with that of the *Cephalopods* with *internal* shells, so far as indications of their structure can be obtained from the hitherto imperfect descriptions of the recent *Spirula*, and from the remains of the *Belemmites*. But before I proceed to detail these views I shall briefly adduce the few examples of the classification of the *Cephalopods*, in which an attempt is made to distribute these highly organized *Mollusks* into groups founded on considerations of structure of higher importance than tegumentary or testaceous characters.

The first classification of this nature is due, as might have been expected, to a highly accomplished classical Naturalist, well versed in the zoological writings of Aristotle. This Naturalist, Schneider, to whom we owe the best translation of the ‘Historia Animalium,’ is the first of the moderns who attempted to revive the philosophical views which guided the Father of Natural History in his distribution of the *Malakia* or *Cephalopods*. For this group of *Cephalopods* Schneider proposed the name of *Octopodia*, comprehending therein the species in which two superadded elongated slender arms are present, but which were distinguished by Aristotle from the ordinary eight arms, under the name of ‘Proboscides.’ Schneider⁸ divides the class into two groups, which are characterized as follows:—


2. *Pedes octoni longi basi palmati, abaque promuscidibus, pinnis et osse dorsali*. Ex. *Polyanus, Moschites, Nautilus* (or *Argonauta*); and indicates a third, founded on Rumphius’s description of the *Nautilus Pompilius*, with the following character: *Pedibus lobatis, seu digitatis abaque acetabulis*.

The classification proposed by Dr. Leach⁹, which in one respect is inferior to Schneider’s, is also essentially based on the modifications of the organs of locomotion. In this scheme Dr. Leach leaves entirely out of consideration the *chambered* shells, and apparently restricts the class *Cephalopoda* to the *naked* species. These he divides into two

⁰ *Encyclopédie Ménard*. 1830.
⁸ *Sammlung Vermischter Abhandlungen der Zoologie*, &c., 8vo. 1784.
⁹ *Zoological Miscellany*, vol. iii. 1817.
orders, according to the number of cephalic appendages, the presence or absence of pali-
lial fins, and the connexions of the mantle to the neck.

The same principles are adopted in the present classification of the Cephalopods in our
National Museum; a third order being added to the Octopoda and Decapoda of Leach,
corresponding with the Polythalamacea of M. De Blainville, and characterised, according
to the structure of the Nautilus Pompilius, by many short arms destitute of suckers.
Weigman, also, in his Handbuch der Zoologie, (1832,) makes each of the two divi-
sions of Leach's Cephalopods equivalent to the Polythalamacea of De Blainville, which
he terms Nautilacea.

But the general organization of the Octopodous and Decapodous Cephalopods, and espe-
cially their respiratory and circulating systems, correspond so closely, and both at the same
time deviate so widely from the condition of the corresponding systems in the genus Naui-
tilus, that the inequality of the value of the three primary divisions of the Cephalopods
adopted in the synopsis of the British Museum must be obvious: characters, moreover,
taken from modifications of the locomotive and prehensile organs alone, or associated
with such minor particulars of organic structure as are applied by Dr. Leach in his
subdivision of the Naked Cephalopods, can only be viewed as indicative of secondary
subdivisions of the class.

A mature consideration of the relations subsisting between the modifications of the
Cephalopodic type of structure presented by the Pearly Nautilus, and the siphonated
chambered shell, has led me to perceive that the presence of a siphonated chambered shell
of itself is not a character of ordinal importance: the organic conditions which may
justly be regarded as indicating ordinal distinctions relate rather to the amount of de-
velopment of the chambered shell, and to its relative position, either as protecting, or
protected by, the soft parts of its fabricator. Where the chambered shell is limited to
its hydrostatical functions, and is buried, like an air-bladder, in the interior of the Ce-
phalopod, and is no longer subservient to its defence, we may infer that an ink-bag will
be superadded to compensate for the absence of a large defensive case; and, at the same
time, that the relief from the incumbrance of a shell so developed will be accompanied
by an increase of locomotive powers, demanding those modifications of the respiratory
and circulating functions which are undoubtedly of ordinal importance.

Now as the Nautilus Pompilius presents an inferior or subdivided type of the respir-
atory organs, and as the function of respiration in this species has not the advantage
of those superadded hearts for accelerating the course of the venous blood through the
gills which the naked and more active Cephalopods possess, and as these most inter-
esting physiological modifications are related to the size and external position of the
shell, I feel myself justified in grouping with the family represented by this existing Si-
phoniferous species, the extinct Orthoceratites, Ammonites, and all other Siphonifera of
which the soft parts were, in like manner, contained in and protected by a chambered
shell. To the group thus characterised I have applied the term Tetrabranchiata, derived
from the number of the gills in the *Nautilus*\(^1\). The *Cephalopods* with internal chambered shells, heretofore classed with the *Siphoniferous Cephalopods* which constitute the preceding order, I would join with all the other *Naked Cephalopods*, to form a second order, under the term *Dibranchiata*\(^2\), having reference to the number of gills, viz. two. This number is constant in all the "Sciches" of Cuvier, and is associated with the presence of two branchial hearts, besides the single systemic heart, and with an ink-bag: there can be little doubt that the same type of structure is exemplified in the *Spirula*, from what has been determined respecting its external characters\(^3\).

The subdivision of the *Tetrabranchiata* must necessarily be determined by the modifications of the shell and calcareous parts of the beak, since, excepting in one genus, no other parts of the animals now remain for the study of the naturalist. With reference to the higher or *Dibranchiate* order, as extended by the admission of the *Spirulidae* and *Belemnites*, we may with propriety adopt the character afforded by the number of cephalic arms as indicative of a primary subdivision, and include the *Dibranchiata* having internal chambered shells, with the *Calamaries* and *Cuttle-fishes* in a tribe called *Decapoda*, or those which have two long peduncles superadded to the eight ordinary arms. The character afforded by the internal chambered shell seems hardly of sufficient value to separate the *Cephalopods* having that part, as a third tribe distinct from the ordinary *Decapods*; for the difference is at least as great between the minute horny style of the *Sepiola* and the *sepium* of the *Cuttle-fish*, as between this latter and the internal calcareous apparatus of the *Belemnite*. Moreover, Lamarck's figure and the descriptions of the *Spirula* demonstrate so close a resemblance between its locomotive organs and those of the *Cuttle* and *Camaras*, as to afford additional reasons for not placing them further apart than as families in the same tribe.

The tribe *Decapoda* of the *Dibranchiate* order of *Cephalopods* may be subdivided into four families. Of these the *Spirulidae*, represented by the *Spirula australis*, Lam., must be regarded as next in the order of affinity to the *Tetrabranchiata* group. The *Belem-

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\(^1\) Memoir on the *Pearly Nautilus*, 1832, p. 56.

\(^2\) The introduction of these new words for the primary divisions of the *Cephalopods* into a science already overloaded with Greek compounds, requires perhaps some apology or explanation.

The groups which the terms *Dibranchiata* and *Tetrabranchiata* respectively indicate are not equivalent to the orders or primary divisions in any previous classification of the *Cephalopods*, and I could not, therefore, have adopted the ordinal names of my predecessors without the hazard of ambiguity or error.

The order *Dibranchiata*, e.g. differs from the *Cryptodibranchiata* of M. De Blainville, and from the *Aectobulifera* of M. D'Orbigny, in the addition of the families *Spirulide* and *Belemnide*; and my *Tetrabranchiata* differs from the *Polythalamia* and the *Siphonifera* of the same authors, in the absence of those genera in which the chambered and *siphonated* shells are internal. Under these circumstances, therefore, where a presumed deeper insight into the organization and affinities of a class of animals leads to an actual modification of its subdivisions, new terms for such modified groups seem preferable to the risk of confusion which would arise from applying the same name to two different collections of objects.

\(^3\) The discovery by Dr. Duckland, of the remains of the ink-bag in the extinct *Belemnites*, justifies the conclusion from the laws of coexistence, that these *Cephalopods* also possessed two gills and two branchial hearts.
*nitidae,* including the genera *Belemnites, Actinocamax, Pseudobelus,* &c., offer the transition from the *Spirulidae* to the *Cephalopods* in which the internal shell is still calcareous, but in which the traces of the camerated structure become very obscure. Such is the condition of the shell in the *Sepiidae,* or third family, represented by the common *Cuttle-fish* (*Sepia officinalis,* Linn.). Besides the character derivable from the modifications of the shell, the species hitherto observed of this family present lateral fins, extending the whole length of the mantle; and the marginal horny lining of the suckers is entire, or only minutely denticulated; but this latter is a character rather of generic than of family importance.

The fourth family of *Decapodous Dibranchiata,* I propose to term *Teuthidae,* from the name τευθος, applied by Aristotle to the *Calamaries* or typical genus of the family. The principal character of this family reposes on the horny condition of the shell, the rudiment of which exists as a single lamina, more or less developed, and encysted in the substance of the dorsal aspect of the mantle: the form of the body in this family is mostly elongated and cylindrical, and the pallial fins are generally broad, shorter than the body, and terminal. The genera included in this family may be arranged in two groups, according to the structure of the funnel. In section A, or those in which the funnel is articulated at its base to two internal ventro-lateral cartilaginous prominences of the mantle, may be ranked the genera *Sepioteuthis,* Bl.; *Loligo,* Cuv.; *Onychoteuthis,* Lichtenstein; *Rossia,* Owen; *Sepiola,* Leach. In all these genera, moreover, the funnel is provided with an internal valve. In section B, or those in which the funnel is adherent at the ventro-lateral parts of its base to the mantle, may be ranked the genera *Cranchia,* Leach, and *Loligopsis,* Lam. The latter genus, besides the common absence or loss of its superadded tentacles, manifests an affinity with the *Otopodous Dibranchiatae,* in the absence of the valve of the funnel; and in both genera the transition to the same group is indicated by the absence of the fleshy appendages to the branchial hearts.

The uninterrupted continuation of the mantle with the posterior part of the head or neck, and the confluence of the pallial fins at their posterior extremities, which Dr. Leach uses as family characters, are indicative of generic distinctions only: the proportional length of the arms is even of still less importance.

The tribe *Octopoda,* besides the absence of the long peduncles, is characterised by the absence of the pallial fins, and infundibular valve. I subdivide this tribe into the families *Testacea* and *Nuda.* Of these the first is represented by the genus *Argonauta,* and its affinity to the *Decapodous* group is manifested by the presence of appendages to the branchial hearts, and by the ball and socket articulations of the funnel. The first or dorsal pair of arms support membranous expansions for secreting, repairing, and retaining the shell.

The naked *Otopods* have all or part of the arms connected at their bases by a broad web; the first pair being elongated, and gradually diminishing to a point. The funnel
is generally attached to the sides of the mantle; the branchial hearts are without fleshy appendages; the biliary ducts without follicular appendages; the shell is represented by two short, brittle, horny or gelatinous styles, encysted in the dorso-lateral parts of the mantle. This family includes the genera Octopus, Leach, and Eledona, Leach. The following is a tabular view of my classification of the Cephalopods:

<table>
<thead>
<tr>
<th>Classis</th>
<th>Ordines</th>
<th>Tribus</th>
<th>Familia</th>
<th>Genera</th>
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<td></td>
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<td>Octopoda</td>
<td>Nuda</td>
<td>Eledona</td>
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<td>Testacea</td>
<td>Octopus</td>
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<tr>
<td>Cephalopoda</td>
<td>DiBranchiata</td>
<td>Teuthida</td>
<td>a. Argonauta</td>
<td>Argonauta</td>
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<td></td>
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<td>Sepiada</td>
<td>Sepiola</td>
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<td>Belemnitida</td>
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<td>Spirulida</td>
<td>Belemnites, &amp;c.</td>
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<td>Anamnonida</td>
<td>Ammonites, &amp;c.</td>
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<td>Nautilida</td>
<td>Baculites, &amp;c.</td>
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<td>Nautilus, &amp;c.</td>
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<td>Orthocera, &amp;c.</td>
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PLATE XXI.

1. Cranchia scabra, dorsal aspect; natural size.
2. Cranchia scabra, ventral aspect; natural size.
3. Cranchia scabra, head, with the mantle, a, a, laid open to show the attachment of the funnel b, by means of the muscular membranous processes or 'brides', c, c. Magnified.
4. Head and mouth of Cranchia scabra, showing the webs, a, connecting the six dorsal arms; the outer lip, b, the inner lip, c, inclosing the gaping mandibles. Magnified.
5. A small portion of the skin of Cranchia scabra, showing the denticulate processes, highly magnified.
6. Loligo laticeps, dorsal view; natural size.
7. Loligo laticeps, ventral view; natural size.
8. A sucker of one of the short arms, magnified.

1 The subdivision and grouping of the very numerous members of this order must repose entirely on a study of the modifications of the shell and other enduring parts; and I have here introduced provisionally the two principal divisions as proposed by M. D'Orbigny, merely for the purpose of citing the principal genera in exemplification of the Tetrabranchiate Order.
Fig. 8 & 10. A sucker of one of the peduncles, magnified.
12. *Octopus semipalmatus*, dorsal view; natural size.
13. *Octopus semipalmatus*, ventral view, with the mantle laid open, magnified; *a*, the crescentic ridge on the side of the base of the funnel, articulating with *b*, the corresponding cavity in the mantle: the other parts correspond with those in the common *Poulp* (*Octopus vulgaris*).
14. *Argonauta hians*, Sol., withdrawn from the shell; (three times the natural size of the specimen figured). The mantle is laid open to show the vertical *septum*, and *a* and *b*, the dislocated joint of the funnel of the right side.
15. An *ovum* of the same specimen, magnified.
16. The anal valves of a *Decapodous Cephalopod* (an *Sepioteuthis species*?) from Port Jackson. The upper figure shows them closed; the lower figure, open. Natural size.
17. The organ of hearing of the *Cuttle-fish* (*Sepia officinalis*): both vestibular cavities are laid open, showing the obtuse elastic processes which are in contact with the capsule of the otolithe or calcareous body; the capsule is laid open on one side. Natural size.
   *a*. *Ovum* in its reticulate ovisac or *calyx*.
   *b*. Ovisac, in the act of discharging its *ovum*.
   *c*. Discharged ovisacs.
   *d*. Oviduct.
   *e*. Terminal gland of the oviduct.
   *f*, *f*. Ova passing through the oviduct.
   *g*, *g*. Accessory ovarian or nidamental glands.
   *h*, *h*. Corpora succenturiata.
19. *Corpus succenturiatum* of the *Cuttle-fish* (*Sepia officinalis*).
20. The same; one lobe bisected, to show its structure.

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1 As this sheet was going through the press, I received from Mr. George Bennett three entire specimens of the *Cephalopod* from Port Jackson, of which the *viscera* are described in the preceding pages, proving it to be a species of *Sepioteuthis*. 

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Read December 13th, 1836.

Des Gerboises.

Des circonstances particulières, ayant depuis quelque temps appelé mon attention sur l'ordre des rongeurs, je n'ai pas tardé à reconnaître de nouveau tout ce qui manque à cette branche si importante et si étendue de la zoologie, pourquoi les éléments qui la constituent aujourd'hui puissent être coordonnés avec régularité ; pourquoi dans la classification des nombreuses espèces de cet ordre, on puisse appliquer ces règles de la méthode naturelle, hors des quelles il n'y a que confusion et obscurité dans l'étude philosophique de ces animaux.

Si l'on voulait rechercher la raison d'un état de choses si peu favorable à la connaissance de ces mammifères, tant multipliés par la nature, et qui occupent une place si élevée dans ses vues, on ne la trouverait assurément pas dans les difficultés que ces animaux oppo- sent à leurs observations ; car il n'y en a guère qui ait moins de moyens qu'eux d'échapper à des recherches assidues. On la reconnaîtrait plus sûrement dans l'influence qu'exercent encore sur les meilleurs esprits les systèmes artificiels de classification, et dans l'ignorance où beaucoup d'entr'eux sont restés des principes de la méthode naturelle ; qu'ils paraissent même regarder comme un vain objet d'étude.

Nous ne comprenons pas cette persistance dans une voie qui n'a point d'issue, à une époque où la philosophie de son côté, et l'histoire naturelle de l'autre, ont jeté sur les méthodes une lumière si vive. Si l'induction est la source la plus féconde de toutes les sciences d'observation, quelle vérité pourrait-on tirer d'un rapprochement de faits particuliers, sans analogies naturelles entr'eux, et tel qu'il existe dans ces systèmes imaginés, lorsque la science ne faisait encore que de commencer ? Evidemment aucune ! Aussi toutes les fois qu'en histoire naturelle des vérités d'un ordre élevé ont été conçues, c'est lorsqu'on a eu recours à des rapprochemens fondés sur de véritables analogies. Quand Linnaeus formait des familles naturelles dans les plantes ce n'était pas à cause de son système, mais malgré son système. Buffon, Storr, Bodaert, Vicq-d'Azir, auraient appliqué toutes leurs forces à extraire le moindre rayon de lumière des genres où ils plaçaient les Gerboises, qu'ils n'en seraient pas venus à bout.

Vicq-d'Azir, par exemple, avait associé à l'Alactaga et à la Gerboise, le lièvre sauteur du Cap, le Kanguroo géant et le Potoroo, trois animaux qui sont devenus les types de trois genres, et les deux derniers ont du être transportés dans un autre ordre que celui
où il les plaçait, il ne reste donc plus de ce genre que les Alactagas et les Gerboises, et c'est en effet des rongeurs qui réunissent les caractères génériques de ces dernières espèces qu'il a fini par être formé, et qu'il nous est offert dans le meilleur travail qu'on ait publié sur les animaux qui s'y rapportent, celui de M. Lichtenstein, intitulé, *Ueber die Springmaisé*¹, &c.

Lorsqu'en 1829, je publiai mon ouvrage sur les dents des mammifères je n'eus à ma disposition qu'un Alactaga de Barbarie de la grandeur du rat, et je donnai ses dents comme type de celles du genre Gerboise, prenant ce genre tel qu'il se trouvait établi. Des lors cependant, il était difficile de se défendre de quelques doutes sur la légitimité de sa formation. On était peu habitué à voir réunis sous la même dénomination générique des animaux à cinq et à trois doigts aux pieds de derrière, comme le sont les Alactagas de Pallas, et la Gerboise proprement dite; et ce qui ajoutait aux doutes, c'est que Pallas nous apprenait, que sa petite variété d'Alactaga avait une dent de plus que les autres.

Je suis loin d'avoir pu faire une étude des nombreuses espèces de Gerboises, que M. Lichtenstein décrit et qu'il partage en trois sections d'après le nombre des doigts des pieds de derrière. Toutes n'ont à ces pieds que trois doigts à l'état normal, et qui, dans la marche ou le saut, portent sur le sol; mais il en est qui n'ont que ces trois doigts seulement; ce sont ceux de sa première section; d'autres, ceux de sa seconde section, ont du côté externe du tarse un doigt rudimentaire de plus, qui ne s'étend point jusques sur le sol, et ceux de la troisième ont deux de ces doigts en rudiments, un de chaque côté du tarse, qui ne prennent de part à aucun des mouvements de l'animal.

Les dents que j'ai donné pour type de celles des Gerboises, et qui m'avaient été fournies, comme je viens de le dire, par une petite espèce originaire de Barbarie à deux doigts rudimentaires, c'est-à-dire par un Alactaga, sont tout-à-fait semblables à celles du grand Alactaga de Pallas, ainsi que j'ai pu le vérifier, et les analogies permettent de penser qu'elles se retrouveraient avec les mêmes formes dans toutes les autres espèces de la troisième division de M. Lichtenstein. Il y a plus, c'est que les têtes osseuses de ces deux espèces présentent tout-à-fait la même structure.

Je ne connais point la Gerboise tétradactyle de M. Lichtenstein; mais j'ai pu me procurer les têtes osseuses de deux espèces à trois doigts; l'une vient de son *Dipus kirisipes* (Pl. XXIV. figg. 1—5.), et l'autre d'une Gerboise de Syrie indéterminée; or elles diffèrent autant par leur structure et par la forme de leurs dents, des têtes d'Alactaga (Pl. XXIV. figg. 6—9.), que les têtes de rongeurs d'une même famille puissent différer l'une de l'autre. Ce serait donc manquer à toutes les lois de l'analogie, à toutes celles de la méthode naturelle, que de ne pas séparer génériquement des animaux qui se distinguent par des modifications si profondes de leurs organes principaux, et l'induction nous autorise aussi à considérer toutes les autres Gerboises à trois doigts, comme semblables,

¹ J'ai eu le malheur et le tort de ne connaître que très tardivement ce travail, il m'aurait aidé du moins à rendre plus complet ce que j'ai donné d'historique sur la Gerboise dont j'ai publié la figure dans la 63e livraison de mes mammifères.
pour les caractères génériques, aux deux espèces qui nous sont connues, et à les reunir avec elles dans le même genre, auquel nous conserverons le nom de Gerboise (Dipus), comme nous conserverons celui d’Alactaga (Alactaga) aux espèces à cinq doigts.

Il nous reste actuellement à faire connaitre en détail les faits sur lesquels nos déterminations reposent.

On sait que les trois doigts principaux des Alactagas, ainsi que les trois seuls doigts des Gerboises, ne sont articulés qu’à un seul os métatarsien, et que les deux doigts anormaux des premiers ont chacun leur os du métatarsé, d’où résulte que cet avant-dernière partie du pied est composée de trois os chez les Alactagas et d’un seul chez les Gerboises. Les incisives supérieures et inférieures des Alactagas sont simples ; les supérieures des Gerboises sont partagées dans leur longueur par un sillon. Les dents molaires des premiers ont des formes compliquées qui rappellent peu les formes simples de celles des secondes. Elles sont au nombre de quatre à la machoire supérieure, et de trois à l’inférieure ; mais la première de la machoire d’en haut est une petite dent rudimentaire, qui disparaît probablement dans les vieux individus ; les autres, aux deux machoires, se font remarquer par les contours, les ondulations profondes ou superficielles et sans régularité, de la lame d’emaii que les enveloppe, et qui changent d’aspect suivant le degré d’usure des dents. Cette complication et cette irrégularité, rendent si difficile une description claire de ces machelières que je ne l’entreprendrai pas ; la figure de ces dents en fera comprendre les formes et les caractères beaucoup mieux que ne le pourrait faire mes paroles.

Il n’en est pas de même des machelières des Gerboises, au nombre de trois de chaque côté de l’une et de l’autre machoire. À la machoire supérieure elles présentent toutes un pli d’emai rentrant à leur face interne, et un à leur face externe ; mais ces plis ne se terminent pas directement vis-à-vis l’un de l’autre, ils se dépassent, et ceux de la face externe pénètrent derrière ceux de la face interne. La première de ces dents est un peu plus grande que la seconde, qui l’est elle-même un peu plus que la troisième. Quelques différences se font remarquer entre les dents de la machoire inférieure ; la première des machelières n’est pas plus grande que la seconde, et celle-ci au lieu d’un pli en présente deux à son côté externe, et la dernière n’en présente qu’un seul qui est de ce même côté ; elle n’en a point du côté opposé. Nous ajouterons que pour une tête de Gerboise, d’un quart plus grande qu’une tête d’Alactaga, les dents de la première sont d’un quart plus petites que celles de la seconde. Toutes ces dents machelières sont à racines distinctes de la couronne.

La structure générale de la tête des Gerboises et des Alactagas est évidemment la même, et se caractérise par la grandeur du crâne, la brîveté du museau, et surtout la grande largeur du trou sous-orbitaire, ou plutôt de l’ouverture ante-orbitaire ; mais les têtes de ces deux genres diffèrent les unes des autres par des points importants. Ce qui frappe au premier regard lorsqu’on les compare l’une à l’autre, c’est la grande largeur postérieure de celles des Gerboises, causée par le développement énorme de la caisse, et
de toutes les parties osseuses de l'oreille: cette caisse en effet dépasse de beaucoup l'occipital et s'étend latéralement jusqu'au niveau de l'arcade zygomatique, ce qui n'est pas à beaucoup près chez les Alactagas, où toutes les parties de l'oreille sont réduites à des dimensions assez petites. Une autre différence, est la grande largeur de l'arc maxillaire qui circonscrit extérieurement le trou sous-orbitaire et celle de la portion du jugal qui borde cet arc, et qui servent l'un et l'autre d'attache aux muscles du nez et des lèvres. Chez les Alactagas toutes ces parties sont en quelque sorte linéaires, et n'offrent que d'étroites surfaces aux muscles qui y prennent leur point d'appui.

Mais ce n'est pas seulement la partie postérieure du crâne qui, chez les Gerboises, sur-passe celle des Alactagas; toute la capacité cérébrale a chez les premiers une étendue sensiblement plus grande que chez les seconds; ce qui rend toute la partie antérieure de la tête des uns plus large que celle des autres.

Enfin nous noterons encore l'effet de la proportion des machelières sur le développement des mâchoires inférieures qui sont comparativement beaucoup plus courtes chez les Alactagas que chez les Gerboises.

Nous terminerons ces notes sur les Gerboises et les Alactagas par la description d'une espèce d'Alactaga de Barbarie, peut être déjà indiquée mais non encore admise; car toutes celles de M. Lichtenstein sont Asiatiques.

Shaw, parle sous le nom de Jerboa 1 d'une petite espèce de rongeur, fauve en dessus, blanche en dessous, à museau obtus, à très longue queue terminée par une mèche de poils noirs, vivant dans des terriers et sautant plutôt qu'elle ne marche, dont les très longues jambes de derrière auraient eu quatre longs doigts et deux très courts, et dont les pieds de devant n'en auraient eu que trois. À ces traits, tous les naturalistes ont reconnu ceux des Gerboises; mais comme il y avait évidemment erreur dans le nombre que Shaw donnait des doigts, toutes les Gerboises en ayant cinq aux pieds de devant et trois ou cinq à ceux de derrière (trois longs et deux très courts) on peut faire plusieurs suppositions pour expliquer cette erreur. Je pensai qu'elle tenait sur-tout à une faute de typographie; que le nombre des doigts des pieds de derrière avait été indiqué comme étant celui des doigts des pieds de devant, et je regardai ce Jerboa comme une véritable Gerboise. D'autres ont pensé qu'il y avait erreur dans le nombre des doigts des deux pieds, qu'il n'y avait d'exact que les deux doigts rudimentaires des pieds de derrière, et que par là ce rongeur ne pouvait être qu'un Alactaga; et aujourd'hui qu'il est certain qu'une espèce d'Alactaga existe en Barbarie, cette conjecture me paraît la mieux fondée. On peut donc regarder Shaw, comme étant le premier auteur qui ait parlé de cette espèce. Il ajoute à la description qu'il en donne et que nous venons de rapporter, qu'elle se trouve le plus ordinairement dans les sables du Sahara, qu'elle aime les roseaux, et que partout où on les trouvait, on était sur de la rencontrer. Cette dernière circonstance nous a déterminé à désigner cette espèce par le nom d'Alactaga des roseaux (Alactaga arundinis).

Sa longueur de l'origine de la queue à l'extrémité du museau est de cinq pouces. La

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1 Voy. en Barbarie, trad. Francaise, tom. i. pag. 321 et 322.

Des Gerbilltes.

A côté des Gerboises, viennent assez généralement se ranger dans les Catalogues Méthodiques, des rongeurs de petite taille, à longues jambes de derrière, terminées comme les antérieures par cinq doigts plus ou moins développés. Ces rongeurs se trouvent designés collectivement par les noms de Jerboïdes, de Gerbilltes, de Meriones, et plusieurs d'entre'eux ont été considérés comme de véritables Gerboises.

Les Jerboïdes forment la première division des rats de Pennant, ils viennent immédiatement après les Gerboises, et parmi les quatre espèces que cette division contient, nous trouvons le Mus tamaricus de Pallas, le Mus labradorius de Pennant, et le Dipus Canadensis de Davies, qui depuis ont été classés par plusieurs auteurs au nombre des Gerbilltes.

En formant ce genre Gerbille, M. Desmarest y admit le Dipus Canadensis dont nous venons de parler, et il lui adjoignit le Dipus gerbillus d'Olivier, le Mus longipes ou meridians de Pallas, et le Dipus pyramidum de M. Geoffroy.

Illiger n'indiqua comme Meriones que le Mus tamaricus et le Mus meridiannus.

Dès les premiers moments ce genre fut également admis, et les espèces que dès lors

1 Pennant, Hist. of Quat., T. ii, p. 172.
3 Illiger, Prodromus, p. 82. Berlin, 1811. La contestation qui s'est élevée pour refuser à M. Desmarest la première idée du genre Gerbille n'est point fondée. C'est en 1804 qu'il a proposé le genre, et qu'il l'a nommé; et ce n'est qu'en 1811 qu'Illiger l'a établi, en le nommant Meriones. Cette double formation d'un genre qu'avait déjà pressenti Pennant n'a rien qui doive surprendre à une époque où il n'existait aucun rapport scientifique entre la France et l'Allemagne. Illiger ignorait donc ce qu'avait fait M. Desmarest; mais ce naturaliste, enlevé si jeune à la science, a rendu assez de services à la zoologie pour que la perte d'un nom générique n'annihile en rien la reconnaissance que lui portent les naturalistes.
4 Glires, p. 322, pl. xix.
7 Bulletin de la Soc. Phil., No. 40, Voy., T. iii. p. 157, pl. xxviii. fig. a, b, c.
8 Glires, p. 314, pl. xviii. B.
on a cru devoir y rapporter ont été désignées tantot sous le nom générique de *Meriones*, tantot sous celui de Gerbille.

Lorsqu'on cherche à se rendre compte des motifs qui ont conduit à séparer des Gerboises, auxquels ils avaient été réunis, les rongeurs que nous venons d'indiquer, pour en former un genre à part, on n'en trouve d'autres que ces différences de physionomie, qui sont toujours pour le naturaliste expérimenté des indices fidèles de différences plus caractéristiques, que l'organisation mieux connue dévoilera quelques jours.

En effet, Pennant ne fait pas connaître les caractères communs aux rats de sa première division, autrement que par ce nom de Jerboïde, que indique des rapports entre ces animaux et les Gerboises ; et M.'Desmarest ne donne à son genre Gerbille, comme Illiger à ses *Meriones*, que des caractères pris de la forme du museau, des modifications des doigts, de la queue, des oreilles, &c. C'est à dire, que des caractères qui, pour ces animaux, ne sont rien moins que génériques, zoologiquement parlant.

Plutard M. Desmarest ajouta aux caractères qui avaient été donnés aux Gerbilles, le nombre des os du métabasarse, égal chez ces animaux à celui des doigts; par là il distinguait profondément les Gerbilles des Gerboises ; mais il ne les distinguait pas essentiellement des rats, et elles redevenaient, ou plutôt restaient de véritables Gerboïdes.

Ce ne fut que lorsque la forme des dents machelières commença à prendre le rang élevé qu'elle occupe aujourd'hui parmi les caractères zoologiques, que M. Desmarest la donna pour nouveau caractères à ses Gerbilles; il l'observa, dit-il, sur la Gerbille Égyptienne ; mais il n'eut point l'occasion de l'observer sur les autres espèces qu'il admettait dans ce genre, et comme il n'en donna pas la figure, ou fut dans l'impossibilité de se la représenter fidèlement, et d'en avoir conséquemment une conception bien claire.

Depuis la première formation de son genre Gerbille, M. Desmarest a réuni aux espèces dont il le forma d'abord, le *Mus tamaricius* de Pallas, et le *Dipus indicus* de M. Hardwicke, du quel plutard nous avons fait connaître les dents qui sont en effet celles des Gerbilles ; mais alors il ne distinguait plus spécifiquement les *Dipus gerbillus* et *Pyramidum*, les confondant dans l'espèce qu'il nomma *Egyptium*. Il avait aussi admis comme Gerbille le rongeur que M. Rafinesque nomme *Soricinus* ; mais ensuite il le retrancha de ce genre pour le ranger parmi les rongeurs Américains, indiqués par ce dernier auteur comme des Gerbilles sous les noms de *Leonurus*, de *Megalops*, de *Hudsonius*, de *Macourus* et de *Brachyurus*, lesquels ne sont vraisemblablement pas des Gerbilles. Les espèces introduites secondairement dans ce genre par différents auteurs, avec plus ou moins de fondement, sont le *Meriones opimus*, décrit sommairement par M. Lichtenstein; le *Meriones apicallis* et *Musculus*, observés au muséum de Berlin, et brièvement décrits par M. Kuhl; le *Meriones lybicus*, dont le nom se trouve accompagné

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d’une phrase caractéristique dans la liste de doubles du cabinet de Berlin, par M. Lichtenstein¹; une Gerbille de Sénégal, et une espèce du Cap dont je fis connaître les dents²; le Meriones gerbillus, que M. Rüppell a décrit et figuré, et qu’il ne distingue pas du Dipus gerbillus d’Olivier³; le Meriones robustus, décrit et figuré par le même auteur⁴; le Gerbillus Afra de M. Gray⁵, qui en donne suffisamment les caractères principaux; et enfin le Meriones Schlegelii de M. Smutz⁶, que ce naturaliste nous fait connaître par une description détaillée, et d’assez bonnes figures.

Bientôt après son établissement incertain sur les bases qui lui avaient d’abord été données, le genre Gerbilles reçut des fondements plus solides. La description et la représentation des molaires de plusieurs espèces en lui assurant un caractère qui achevait de le circoncrire dans les limites positives, et de mettre à peu près hors de doute la légitimité de sa formation, fit reconnaître en même temps que quelques autres espèces y avaient été prématurément reuniès, et de ce nombre fut la Gerbille du Canada, que je considérail comme le type d’un genre nouveau, auquel je crus devoir exclusivement appliquer le nom de Meriones; mais ce travail n’a pu être encore général, et toutes les espèces qu’on classe encore aujourd’hui parmi les Gerbilles n’y sont pas reçues à beaucoup près à des titres égaux.

Il serait même fort à désirer que les recherches des naturalistes se portassent sur les différents systèmes d’organes de ces rongeurs, pour confirmer par des nouveaux rapports les conséquences auxquelles les premières observations ont conduit, et pour rendre plus complètes et plus exactes, les idées que nous devons nous faire de ces animaux.

On n’a point, que nous sachions, de représentation fidèle d’aucune Gerbille. Parmi les figures qui en ont été données, il n’en est point qui ait été dessinée d’après la nature vivante; toutes sont des copies de peaux, plus ou moins habilement préparées, et elles ne font connaître qu’approximativement la physionomie propre à ce groupe de rongeurs. Les figures les plus anciennement connues sont celles du Mus meridianus, et du Mus tamaricinus; mais quoique passables, elles n’ont point été faites d’après des individus vivans. La figure du Dipus gerbillus d’Olivier est une des plus artificielles qui aient jamais été donnée à l’histoire naturelle; celle du Dipus Indicus, meilleure que la précédente, n’est pas non plus exempte de graves reproches. Enfin, les figures des Meriones robustus et Gerbillus de M. Rüppell, quoique préférable aux autres, ne représentent cependant que des animaux factices, et ce défaut est plus sensible encore dans le Meriones Schlegelii de M. Smutz.

C’est pour remplir la lacune que ces figures ont laissées après elles que nous donnons celle de la Gerbille de Burton; elle a été faite d’après plusieurs individus vivans rapportés de la haute Egypte par ce voyageur et acquis par la ménagerie.

¹ Verzeichniss der Doobletten, &c., p. 5.
² Des Dents, &c., p. 172.
⁴ Idem, p. 75, pl. xxix.
⁵ Spicil. Zool., p. 10.
⁶ Enum. Mamm. Capensis, p. 41, pl. i. et ii. figs. 1—5.
Quant aux organes en particulier, on ne connaît encore des Gerbilles par des figures que la tête du Gerbille de Schlegel, et du Mus meridianus, les dents des Gerbilles du Cap, des Pyramides, du Sénégal et des Indes, et le canal intestinal des Mus meridianus et tamaricinus. On en a de plus décrit les membres, et on a dit quelque chose des sens et des muscles.

Pour ne point laisser notre travail préliminaire incomplet, nous rappellerons les caractères qui sont donnés, par ce qui est connu de ces différents organes.

Les traits caractéristiques de la tête osseuse, consistent principalement dans la forme oblongue des trou palatins et sous-orbitaux, dans la forme d'écaillée de la partie supérieure de l'os lacrimal, dans la minceur de l'arcade zygomatique qui n'envoie qu'une branche à la mâchoire supérieure, large, élevée, fléchie en dedans, et se terminant sur les côtés de la tête en une lame mince qui limite le trou sous-orbitaire. La caisse forme un bulbe beaucoup plus grand que chez les rats, &c. (Smutz).

Les dents ne présentent pas moins que la tête des caractères particuliers. Les incisives supérieures sont partagées dans leur longueur par un sillon, et leur racine a son insertion immédiatement en avant des premières molaires. Les incisives inférieures, sans sillon, prennent racine à peu près à moitié de la branche montante de la mâchoire. Les molaires, au nombre de trois de chaque côté des deux machoires, et qui ont des racines distinctes de la couronne vont en augmentant de grandeur de la première à la dernière. Dans les individus adultes, celle-ci est simple, celle qui la précède est composée de deux collines transversales, et l'intérieure de trois. Ces traits sont ceux des molaires des deux machoires, seulement, la première colline de la molaire antérieure à la mâchoire d'en bas, au lieu d'être allongée transversalement, n'a plus que la forme d'un simple tubercle. Dans les jeunes individus, la dernière molaire supérieure a la forme d'un trêfle, et les collines de toutes les autres sont partagées dans leur milieu par une échancrure peu profonde qui ne tarde pas à se trouver effacée. A la mâchoire inférieure, c'est la première colline tuberculeuse de la première dent, qui unie à la seconde, présente la figure d'un trêfle et quelquefois cette première colline est échancrée en avant (F. C.).

Le canal intestinal, chez le Mus meridianus a environ 16 pouces du pylore à l'extrémité du rectum, 10 pour les petits intestins, et six pour les gros ; l'estomac a trois pouces en suivant sa courbure du cardia au pylore ; sa courbure de droite, où le cul de sac, surpasse celle de gauche, et l'œsophage s'insère presque à sa partie moyenne. Le cæcum de la grosseur du petit doigt, est replié en demi cercle, il se termine par une pointe obtuse et d'une structure très simple. Le poumon gauche est simple, le droit a quatre divisions : enfin, les poils de ce Mus meridianus, étaient de deux sortes, laineux et soyeux. (Pallas.) Les clavicules sont rudimentaires : le péroné se confond avec le tibia dans toute leur moitié inférieure. (Pallas.) Le carpe se compose d'autant d'os qu'il y a de doigts, et il en est de même du tarse, c'est à dire, qu'il y en a cinq aux membres antérieurs comme aux postérieurs. (Desmarest.) Les yeux sont grands, les oreilles ovales, avec un repli transversal au devant du canal auditif,
les narines sont recouvertes par un repli épais et mobile, le carpe et le métacarpe sont nus et présentent cinq callosités ou tubercules. (Pallas.)

Quant aux mœurs, nous savons que les Gerbilles sortent principalement la nuit des terriers qu’elles se creusent qui leur servent de retraite, et où elles recueillent les épis d’orge et de blé dont elles font provision, et ne dépouillent des grains qu’ils contiennent, que quand toute autre nourriture leur est interdite; car elles se nourrissent aussi de racines. (Hardwicke.)

Les rongeurs parvenus à notre connaissance, qui jusqu’à ce jour ont seuls présentés les caractères essentiels du genre Gerbille, sont: la Gerbille des Pyramides, celle de l’Inde, une du Cap, et une de Sénégal; enfin, le Gerbillus Afra et le Meriones Schlegelii.

Des quatorze rongeurs donnés comme des Gerbilles, il n’y en a donc encore que six qui appartiendraient certainement à ce genre; les huit autres ne pourraient y être rapportée qu’à des titres plus ou moins douteux.

En effet, ce que Pallas nous apprend de son Mus meridianus, et de son Mus tamaricianus; c’est que le premier a ses incisives supérieures creusées dans leur longueur d’un sillon profond, et que les molaires sont au nombre de trois de chaque côté de l’une et de l’autre mâchoire; nous voyons en outre, par la figure qu’il en donne1 que la tête osseuse de cette espèce est tout-à-fait semblable à celles des véritables Gerbilles: or, ces rongeurs ont aussi des incisives supérieures sillonnées, et six molaires à chaque mâchoire: il est donc très probable que le Mus meridianus est une Gerbille. Les probabilités ne sont pas à beaucoup près les mêmes pour le Mus tamaricianus. Tout ce que Pallas en dit, c’est que ses incisives supérieures sont sillonnées, et nous voyons que son canal intestinal présente les mêmes formes, à la même structure que celui du Mus meridianus. Quant aux faits qui concernent les Meriones Lybicus, M. opimus, M. apicalis, et M. musculus, ils sont encore moindre que ceux qui nous sont connus sur le Mus meridianus. M. Lichtenstein se borne à indiquer quelques traits de la figure des deux premières, et M. Kuhl ne parle que des caractères spécifiques des deux autres, en outre, tous deux n’établissent les rapports de ces animaux avec les Gerbilles que par le nom de Meriones qu’ils leur donnent. Il en est à peu près de même du Meriones robustus et du Meriones gerbillus de M. Rüppell, qui se contente d’en donner la figure et de faire connaître leurs couleurs et leurs différentes proportions.

Malgré tout ce qui manque encore, et tout ce qui serait nécessaire pour établir avec certitude les rapports génériques de ces rongeurs, nous les admettrons, quoiqu’avec plus ou moins de doute, et à une exception près, comme des Gerbilles: tous, si ce n’est le Musculus, sont d’Asie ou d’Afrique, et l’ancien monde seul jusqu’à présent a donné des espèces à ce genre. C’est par ce motif que nous en retranchons cette dernière espèce qui est du Bresil. Les espèces de rongeurs Américaines qu’on a voulu rattacher aux Gerbilles, ont dû toutes en être retirées, et les analogies nous font présumer qu’il doit en être de même pour le Musculus.

1 Glüres, pl. xxvii. fig. xxv. 8.
Ces retranchements ne paraissent pas toutefois empêcher ce genre de devenir un des plus riches de l'ordre des rongeurs ; car le nord comme le midi de l'Asie nourrissent des Gerbilles, et on en rencontre dans les parties septentrionales, occidentales, et méridionales de l'Afrique ; mais il n'est pas aisé d'établir les rapports de ces animaux entr'eux, et de déterminer exactement les espèces entre lesquelles ils se partagent.

Comme dans tous les genres très naturels de rongeurs, les couleurs des Gerbilles ne présentent point de caractères tranchés, elles ne diffèrent guère que par de simples nuances du brun au fauve, et ne paraissent pas susceptibles de donner à elles seules de bons caractères spécifiques : il devient donc indispensable pour diviser les Gerbilles en espèces de recourir aussi comme M. Lichtenstein l'a fait pour les Gerboises, à la taille, aux proportions des membres, à celles des diverses parties de la tête, en un mot, aux modifications spécifiques des principaux systèmes d'organes. Si nous examinons sous ce point de vue, les différentes notions acquises à la science sur les Gerbilles, en nous aidant des faits qui nous sont particulièrement connus, nous distinguerons d'abord avec beaucoup d'autres auteurs, mais contre l'opinion de MM. Desmarest et Rüppell, le *Dipus gerbillus* du *Dipus pyramidum*, le premier ayant la taille d'une souris, et le pelage d'un jaune fauve, tandis que le second a la taille d'un lérot et un pelage brun légèrement roussâtre. D'ailleurs nous croyons retrouver le *Dipus gerbillus*, dans une dépouille de Gerbille, où la tête osseuse se trouve, et cette dépouille ne diffère en rien d'une peau préparée, envoyée au Muséum d'Histoire Naturelle, sous le nom de *Meriones quadrimaculatus* (Ehrenb.) par M. Lichtenstein. Le *Dipus pyramidum*, dont on trouve deux individus dans les collections du muséum, a tant de rapports par les couleurs et la taille, avec le *Meriones robustus* de M. Rüppell, que s'il n'était pas nécessaire de les comparer par plus de points pour établir avec une entière certitude leur identité spécifique, nous ne balancerions pas à les réunir dans la même espèce ; nous devons donc regretter que M. Rüppell ne nous ait pas mis à même d'établir cette comparaison en ne se bornant pas à publier une figure et une description spécifique de le *Meriones robustus*, figure, que d'ailleurs, nous ne croyons pas très fidèlement enluminée.

Nous avons moins d'incertitude sur le *Meriones gerbillus* de ce savant voyageur ; il représente assez exactement l'espèce de Gerbille que nous avions désignée comme du Sénégal, en faisant connaitre les dents ; et notre opinion se confirme par la possession que nous avons acquise des dépouilles et de la tête osseuse d'une Gerbille qui, comme celle de M. Rüppell, vient aussi de Nubie, et ne diffère par aucun point de celle du Sénégal.

La Gerbille du Cap, dont nous avons fait représenter les dents, le *Gerbillus Afra* de M. Gray, et le *Meriones Schlegelii* de M. Smutz appartiennent vraisemblablement à la même espèce. Les trois individus qui ont été désignés de ces trois manières venaient de l'extrémité méridionale de l'Afrique, ils différaient assez peu par leurs proportions et leurs couleurs, et ils se ressemblent par les formes de la tête.

Quant à la Gerbille de l'Inde, elle ne paraît point avoir reçu plusieurs dénominations
spécifiques; et si le Mus meridianus a paru se réunir à d'autres espèces, c'est sur des fondemens si légers que nous ne croyons pas devoir nous y arrêter.

Il résulte de cet examen que les Gerbilles dont les caractères ne laissent que peu d'incertitude, ou n'en laissent pas du tout, se groupent en six espèces.

1°. La Gerbille d'Olivier, qui ne diffère point du Meriones quadrifasciatus d'Éhenberg. 2°. La Gerboise des pyramides, à laquelle se rattache peut-être le Meriones robustus de M. Rüppell. 3°. La Gerbille que je nommerai 'pygargue,' et qui est le même que le Meriones gerbillus de ce dernier. 4°. La Gerbille Africaine, que je ne distingue pas de celle de Schlegel. 5°. La Gerbille de l'Inde; et, 6°. Enfin, la Gerbille du midi ou Zird. Nous ajouterons à ces six espèces anciennes, la description des trois espèces nouvelles, la Gerbille à queue courte du Cap, la Gerbille otarie de l'Inde, et la Gerbille de Burton du Sennard; et, enfin, nous donnerons l'indication de deux autres remarquables par leur grandeur; mais dans une note seulement et avec une figure. Nous laisserons comme douteuse toutes celles qui n'ont point été suffisamment caractérisées, pour qu'aucune incertitude ne subsiste sur le genre auquel elles doivent appartenir, et sur leurs différences avec celles qui sont bien connues.

Actuellement, et pour terminer ce travail sur les Gerbilles, nous allons faire connaître les observations que nous avons recueillies sur les espèces que nous venons de nommer, à l'exception toutefois du Mus meridianus qui ne nous est connu que par ce qu'en a dit Pallas.

1°. La Gerbille Égyptienne. G. Egyptius, Desmarest. Dipus Gerbillus, Olivier. Meriones quadrifasciatus, Éhenberg. (Pl. XXV. figg. 1—5.)

Cette espèce est en effet, comme le dit Olivier, à peu près de la taille de la souris, la longueur de son corps, du bout du museau à l'origine de la queue est de trois pouces trois à quatre lignes, et sa queue est de trois à quatre lignes plus longue. Sa couleur aux parties supérieures est d'un beau fauve clair, elle est d'un blanc très pur aux parties inférieures; les côtes des joues, les membres, une tache au dessus de l'œil et une au côté de l'oreille sont également blancs. Les poils fauves sont tous gris à leur origine; mais ces deux couleurs finissent par s'effacer et par faire place à la couleur blanche; toutefois le gris disparait plutôt que le fauve, comme on le voit sur les poils de côtés du corps. Les poils très courts de la queue sont fauves à sa partie supérieure et blancs à l'inférieure; ceux de l'extrémité en dessus, s'allongent et prennent une teinte noircrète. De grandes moustaches blanches garnissent les côtés du museau, et quelques soies s'élèvent au dessus de l'œil. Ce pelage est entièrement soyeux. La tête osseuse et les dents ont tous les caractères propres à celles des espèces de ce genre, comme on le voit par les figures que nous en donnons, seulement, elles sont moins grandes que celles des autres espèces. La Gerbille Égyptienne étant jusqu'à ce jour avec la Gerbille otarie une des plus petites du genre.


L'individu type de cette espèce et rapporté d'Égypte par M. Geoffroy se trouve
M. F. Cuvier sur les Gerboises et les Gerbilles.

encore dans les galeries du muséum, et un second individu recueilli plus récemment en Egypte, s'y trouve également.

En établissant les caractères de cette espèce d'après ces deux individus, on trouve que la longueur du corps du bout du museau à l'origine de la queue, est de cinq pouces, que la queue a cinq ou six lignes de plus, que le pelage des parties supérieures est brun, et celui des parties inférieures blanc, que la teinte brune des flancs est plus pâle que celle du dos ; que la queue couverte de poils très courts est brune en dessus et blanche en dessous, et qu'elle se termine par des poils plus longs que les autres et noirs, mais à sa partie supérieure seulement ; enfin que les poils bruns sont gris à leur base, ce qui n'est pas pour les blancs. Tous ces poils sont exclusivement soyeux. M. Geoffroy n'avait donné que quatre doigts aux pieds de devant à l'individu qu'il décrivait, parcequ'il ne tenait point compte du ponce en rudiment ; mais ce doigt existe chez cette espèce comme chez les autres Gerbilles.

Aux traits que nous venons de présenter, nous ne pouvons méconnaître l'intimité des rapports du Gerbille des pyramides avec le Meriones robustus. C'est la même taille, ce sont les mêmes proportions et les mêmes couleurs, à quelques exceptions près, que nous serions tenté de n'attribuer qu'à l'enlumine du dernier. En effet, la queue de celui-ci est brune en dessous comme en dessus, et les tous jaunâtres de ses teintes brunes semblent repoussés par les analogies. Ces teintes, de plus ne sont pas conformes à ce que dit M. Rüppell de la couleur des parties supérieures du corps de son Meriones robustus. Voici au reste ce qu'il nous apprend à ce sujet. "Meriones corporis colore suprâ ex griseo et ochraceo fuscescente, notae obscuriori, laterum candidiori. Gastraeum crura et brachia parte interna sicut podia sordide albescunt. Auricula oblonga, acuminata; cauda crassa, apice sublobosa, fusca. Pili subhirsuti."

Cet animal avait six pouces six lignes du bout du museau à l'origine de la queue, laquelle avait cinq pouces six lignes.

3°. La Gerbille pygargue. G. pygargus. Meriones gerbillus, Rüppell. (Pl. XXV. figg. 10—14.)

Je suis malgré moi obligé de changer le nom que cette espèce a reçu de M. Rüppell qui, le premier l'a complètement décrit ; mais le nom de Gerbille étant celui du genre, ne peut plus être celui d'une espèce de ce genre. D'autre côté, cette Gerbille représentait pour M. Rüppell, celle d'Olivier, et celle de M. Geoffroy, ce qui certainement est inexact ; mais la figure de son Meriones gerbillus est assez fidèlement celle d'une Gerbille du Sénégal dont nous avons fait connaître les dents, et dont nous avons la dépouille sous les yeux, et nous retrouvons aussi ce Meriones dans une Gerbille qui, comme celle de M. Rüppell, vient de la haute Egypte, et dont nous possédons aussi la dépouille.

Il y a entre cette espèce et la Gerbille Egyptienne de grands rapports par les couleurs ; mais elles diffèrent par la taille, et aussi par quelques unes des proportions de la tête. La Gerbille pygargue a cinq pouces quatre à cinq lignes, du bout du museau à l'origine de la queue, et celle-ci a huit à neuf lignes de plus, tout son pelage est de nature soyeuse.
Les parties supérieures de son corps, y compris la tête et le museau, sont d’un beau fauve clair qui pâlit un peu sur les flancs. Toutes les parties inférieures et les côtés des joues jusqu’au dessous des yeux, sont d’un blanc pur, et une tache blanche se remarque au dessus de chaqueceil et derrière chaque oreille. La queue couverte de poils très courts, est fauve en dessus et blanche en dessous; mais elle se termine par des poils longs qui sont restés blancs dans cette dernière partie, et qui dans l’autre sont devenus bruns. Les poils fauves ont leur moitié inférieure grise, à l’exception de ceux des flancs qui sont blancs à leur origine; les poils blancs sont entièrement de cette couleur, et ceux qui sont aux parties postérieures des cuisses débordant de chaque côté de la queue font paraître le bord des fesses blanc, d’où j’ai cru pouvoir tirer le nom de cette espèce.

On verra comme pour les espèces précédentes, que celle-ci n’est pas moins une Gerbille par les proportions des diverses parties de sa tête osseuse que par la forme de ses dents.


J’ai peu de choses nouvelles à dire sur cette espèce. A en juger par un assez grand nombre d’individus déposés dans les galeries de muséum; cette grande Gerbille, dont tous les poils sont soyeux passerait d’un brun assez foncé à un brun plus clair teinté de fauve, et par le dessin que nous donnons de sa tête osseuse, on acquiert la preuve que sous cet important rapport elle ne diffère point génériquement des autres Gerbilles.1


C’est de cette espèce dont je crois avoir parlé en décrivant les dents comme ayant été rapportée du Cap de Bonne Espérance par Lalande, qui en avait déposé plusieurs individus au muséum d’histoire naturelle; mais c’est M. Gray qui me semble avoir donné le premier une description reconnaissable, quoique trop sommaire, et c’est cette même espèce que M. Smutz, qui ne la connaissait qu’imparfaitement par quelques mots de l’Isis, me paraît avoir décrit avec un soin et des détails parfaits sous le nom de *Schlegelii*.

Cette Gerbille, dont je possède plusieurs individus, a cinq pouces six lignes du bout du museau à l’origine de la queue, celle-ci a cinq pouces sept à huit lignes. Le

1 A en juger par deux têtes qui se ressemblent absolument, provenant, suivant toute apparence, de deux espèces rapportées par M. Ehrenberg, l’une de Syrie, l’autre d’Egypte, et auxquelles ce savant voyageur aurait donné le nom de *Mus ruficaudatus* à la première, et celui d’*Hyphodus obsesus* à la seconde, il existerait encore deux grandes Gerbilles, qui, par leur taille, surpasseraient celle de l’Inde, mais que je ne puis faire connaître autrement que par la figure que je donne de l’une de ces têtes avec ses dents, ne possédant rien autre chose de ces animaux. Voyez Gerbille indéterminée. (Pl. XXVI. figg. 1—4.)

8 C’est avec raison que M. Smutz se demande ce qu’est cette Gerbille de M. Gray; car outre la description peu circonstanciée que celui-ci fait de cette espèce, il donne comme synonome le *Mus sericeus* de M. Temminck, qui n’était point encore connu, et qui n’est peut-être point une Gerbille.
pelage entièrement soyeux est en dessus d’un brun foncé qui prend une teinte fauve sur les flancs. Les parties inférieures, les tarses, la face interne des cuisses, le carp et la face interne du bras, les côtés de la tête et le dessus des yeux sont blancs. Les poils des parties brunes sont gris à leur moitié cachée, et leur autre moitié est annelée de fauve et de noir, ceux des parties fauves ne diffèrent des premiers qu’en ce que les anneaux noirs paraissent. Ceux de parties blanches ne sont que d’une seule couleur. Tous ces poils sont longs, doux et exclusivement soyeux. La queue revêtue de poils courts et serrés est brune en dessus et blanchâtre en dessous. De grandes moustaches noires garnissent les côtés du museau, et de plus petites se montrent au dessus des yeux. Les oreilles semblent proportionnellement plus étendues qu’elles ne le sont chez d’autres espèces.

Quoique M. Smutz ait donné de bonnes figures de la tête osseuse de son Meriones Schlegelii, je ne me crois pas dispensé d’en donner une moi-même, ne fut ce que pour faciliter la comparaison des espèces entre elles; c’est même par ce seul motif qui j’ai cru devoir rapporter les caractères spécifiques de ce Gerbille Africain, quoique M. Smutz les ait décrit avec tous les développements nécessaires.


Cette espèce, dont les dépouilles ont été envoyées du Cap en 1834 par M. Verreaux, et qui sont aujourd’hui en ma possession, diffère sur-tout de l’espèce précédente par une taille beaucoup moindre et une queue proportionnellement plus courte; mais elle en diffère aussi par les couleurs. Cette Gerbille a trois pouces six lignes du bout du museau à l’origine de la queue, et celle-ci n’a que deux pouces et demi. Sa couleur en dessus est d’un fauve mélangé irrégulièrement de gris par la disposition particulière des couleurs sur les poils; chaque poil est gris d’ardoise dans les trois quarts de sa longueur, et d’un beau fauve à sa pointe. Lorsque les poils se recouvrent régulièrement les uns, les autres, le fauve domine, et le gris ne paraît qu’où ces poils s’écartent; mais comme le fauve est peu étendu, le plus léger écartement des poils met le gris à nud, et il en résulte ce mélange par taches de fauve et de gris qui constitue la couleur habituelle de cette espèce sur la tête, le cou, le dos, et une partie des flancs. Toutes les parties inférieures et les côtés de la tête sont blancs, et une bande fauve marque la séparation sans toutefois être tranchée, des parties supérieures aux inférieures, et ce qui caractérise encore cette espèce comparativement à la précédente, c’est que les poils fauves des flancs sont uniformément colorés, et n’ont point de gris à leur origine. La queue est d’une teinte blonde en dessus et blanchâtre en dessous. Tout le pelage de cette espèce est soyeux.

On verra que cette Gerbille ne diffère pas moins par sa tête osseuse de l’espèce précédente que par ses couleurs.

7°. La Gerbille otarie. *G. otarius*. (Pl. XXVI. figg. 14—18.).

Jusqu’à présent les parties méridionales de l’Asie ne nous avaient encore donné

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1 J’ai reçu comme originaire de la presqu’île de l’Inde, une Gerbille qui ne me paraît différencier en aucun point de celle-ci.
qu'une seule espèce de Gerbille. Nous en avons reçu une seconde de la presqu'île de l'Inde: elle y a été recueillie par M. Verreaux, à qui nous la devons. Elle se caractérise par la petitesse de sa taille, par la brièveté de sa queue, et sur tout par celle de ses oreilles, d'où nous avons tiré le nom d'Otarie par lequel nous la désignons. La longueur de son corps, du bout du museau à celle de la queue, est de trois pouces, et la queue a dix-huit lignes; les oreilles ont à peine deux lignes en hauteur et en largeur. Sa couleur, semblable à celles de toutes les Gerbilles, est fauve mélangé de gris en dessus et blanche en dessous, ainsi que sur les côtés de joues et sur les membres, la queue qui n'est couverte que de poils fort courts est entièrement fauve. Les poils fauves sont gris dans la plus grande partie de leur longueur, le fauve se montre ensuite, et la pointe d'un grand nombre est noire. Les poils blancs le sont entièrement. Les uns et les autres sont soyeux; il n'y en a point de laineux.

La tête osseuse de cette espèce se fait remarquer pour la grande largeur de la partie postérieure du crâne, comparée à l'étroitesse de la partie antérieure des frontaux.


Cette espèce nous paraît entièrement nouvelle, et comme nous la possédons vivante, nous en publions une figure (Pl. XXII.) exacte, afin qu'on puisse se faire une idée fidèle de la physionomie générale des espèces de ce genre; nous pouvons également en faire connaître la tête, les dents et le canal intestinal.

Elle a été acquise par notre ménagerie de M. Burton, qui l'a découverte dans le Dahrfur, et nous croyons devoir donner à cette belle Gerbille le nom de ce savant voyageur par reconnaissance des soins qu'il a mis à enrichir la Mazologie de plusieurs espèces tout-à-fait nouvelles et fort curieuses.

Cette Gerbille a quatre pouces de l'extrémité du museau à l'origine de la queue, celle-ci en a trois environ; la hauteur de l'oreille est de six lignes; la distance du bout du museau à l'angle antérieur de l'œil est de huit lignes; la longueur de l'avant bras est également de huit lignes, et il en est de même de la longueur du tarse. Toutes les parties supérieures du corps, le sommet de la tête, le dessus des cuisses, sont bruns; le dessus du museau, les côtés du cou et les flancs sont fauves jaunâtres. Le dessus de l'œil, les côtés du museau jusqu'au dessous de l'œil, la mâchoire inférieure, la gorge, le cou, la poitrine, le ventre, la face interne des cuisses et les quatre membres sont d'un blanc pur; la queue épaisse et couleur de chair, est revêtue uniformément de poils rares et courts, brunsâtres en dessus, blanchâtres en dessous. Il n'y a partout que des poils soyeux. Chaque poil des parties brunes est gris à sa moitié inférieure, et partagé en larges anneaux noirs et fauves à son autre moitié. Aux parties fauves, les poils ne sont partagés qu'entre le blanc qui occupe leur moitié cachée et le fauve qui couvre leur partie visible. Les poils blancs sont entièrement de cette couleur. Les oreilles entièrement nues sont couleur de chair. De très longues moustaches, quelques unes blanches, la plupart noires garnissent les côtés du museau, et on en voit quelques unes au dessus de l'œil. La tête osseuse et les dents, comme on peut le voir par les
figures que nous en donnons, ont tous les caractères du genre. (Pl. XXIII. figg. 1—5.). Les dents appartenaient à un jeune individu, et leur usure n'avait point encore été portée fort loin.

Le canal intestinal (Pl. XXIII. fig. 6.) d'égal diamètre dans toute sa longueur a environ dix-huit pouces du pylor à l'extrémité du rectum; quatorze pour les petits intestins et quatre pour les gros. L'estomac a quinze lignes de longueur et quatre et demi dans sa plus grande largeur. Son cul de sac, ou sa grande courbure diffère peu en étendue de la petite, ce qui fait que l'œsophage s'insère à peu de chose près à sa partie moyenne. Le caecum, qui va en diminuant graduellement de son origine à son extrémité, se termine d'une manière obtuse; il a dix-huit lignes de longueur et trois et demi à quatre à sa naissance.

Chaque pied a cinq doigts, les trois moyens sont à-peu-près de la même longueur aux deux pieds et les deux externes sont les plus courts; le pouce des pieds de devant n'est même qu'en rudiment, et son ongle est plat. Des poils courts et raides garnissent les doigts de chaque côté.

L'oreille ovale est garnie d'un épais bourrelet à l'entrée du canal auditif, et une lame saillante se montre au dessus. Les narines consistent en deux ouvertures ovales qu'un très petit mufle environne. La verge épaisse et obtuse se dirige en arrière, et les testicules acquièrent un volume monstrueux.

Cette Gerbille, par sa physionomie générale, rappelle singulièrement celle des loirs, elle en a le corps ramassé, la tête arrondie et fine quoique un peu plus lourde, les grands yeux, et presque les grandes oreilles; mais sa queue n'est point couverte de poils longs et épais, et sans être aussi nue que celle des rats et écailleuse comme la leur, elle s'en rapproche par les poils très courts qui la revêtent uniformément; ses allures sont aussi plutôt celles des loirs que celles des rats; tous ses mouvements sont vifs et prompts; jamais elle ne marche qu'à quatre pattes; ce que Pallas rapporte déjà de son Mus meridianus; mais dès qu'elle s'arrête elle se tient debout sur ses longs tarses, sans pour cela s'aider de sa queue comme les Gerboises, et en retirant contre soi les pattes de devant. Ces pattes ne lui sont point nécessaires pour manger, elle saisit les alimens avec ses dents, rongeant ceux qui sont trop volumineux pour sa bouche, et faisant passer de suite sous ses molaires, les petites graines et tous ceux enfin qu'elle peut moudre immédiatement. J'ai tout lieu de penser que ses membres antérieurs, outre leur usage dans la marche, ne lui servent qu'à fourir. Sa vie est toute crépusculaire; de jour elle se tient soigneusement cachée, c'est lorsque la nuit arrive qu'elle satisfait à ses besoins, qu'elle cherche sa nourriture; et comme les loirs et les rats, elle peut se nourrir à-peu-près indifféremment de substances animales et de substances végétales. Plusieurs individus de cette espèce, vivant dans la même cage, s'étaient mangé mutuellement une partie de la queue. J'ai lieu de penser que ces animaux vivent plutôt par paires que par troupeaux. Tant que les individus réunis par M. Burton ont été plus de deux, ils ont vécu en grande méseintelligence, et se sont constamment battus; la paix a régné dès qu'ils ont été
réduits à un mâle et à une femelle, et lorsqu'on partageait en deux le coton dans lequel ilspassaient la journée, ils travaillaient de suite à le réunir pour n'en faire qu'un seul nid.

Ces animaux montraient de la curiosité et beaucoup de crainte; mais ils ne s'apercevaient pas des mouvements qui se faisaient même à une faible distance d'eux; ceux au contraire qui avaient lieu près de leur cage, leur causaient un grand trouble et beaucoup d'agitation; mais à l'instant même ils s'approchaient du point où le mouvement s'était manifesté, en cessant même pour cela de manger, s'ils s'occupaient à satisfaire ce besoin, et à la répétition du plus léger mouvement, ils fuyaient de nouveau.

Au total, ce sont, comme à-peu-près tous les rongeurs, des animaux d'une intelligence excessivement bornée.

L'ensemble des faits que nous venons de rapporter et qui renferme, nous le croyons du moins, les principaux de tous ceux qui sont connus, nous montre d'abord, que sur quatorze espèces, treize appartiennent aux contrées chaudes, soit de l'Asie, soit de l'Afrique, une seule vient du nord de l'Asie; aussi est elle la seule qui ait deux sortes de poils, des laineux et des soyeux; toutes les autres ne sont revêtues que de poils soyeux. Nous voyons en suite que les différences dans la taille et dans les proportions de diverses parties sont, comme celles des couleurs renfermées dans des limites assez étroites; en troisième lieu, il devient évident, par les figures que nous donnons des têtes, qu'à l'exception du développement de la caisse qui peut-être extrêmement étendue, comme dans la Gerbille à courte queue, où beaucoup plus restreinte, comme dans la Gerbille pygargue, la forme générale des têtes, et les rapports de leur différentes parties sont absolument les mêmes; et enfin les figures des dents nous démontrent que les seuls changemens importants qu'elles éprouvent, consistent dans la disparition graduelle des sillons qui partagent dans leur milieu chacune des collines dont elles se composent.

Terminons par quelques mots sur les rapports naturels de ces animaux.

Les tarses un peu plus longs chez ces animaux que chez les rats, l'instinct qui les porte à se tenir debout sur leurs jambes de derrière, les terriers qu'ils se creusent, leur vie nocturne, mais sur-tout ce que quelques auteurs, trompés par de fausses apparence, on dit de leurs allure, et des rapports qu'ils ont cru apercevoir entr'eux et les Gerboises, ont jusqu'à présent déterminé beaucoup de naturalistes à regarder les Gerbilles et les Gerboises comme appartenant à une même famille. Or pour peu qu'on étudie avec quelque attention ces animaux, on reconnait bientôt que les rapports des Gerbilles avec les Gerboises est bien moindre que ceux qu'elles ont avec les rats et les loirs. Indépendamment de ce que nous venons de dire de la manière d'être des Gerbilles, de leurs allure, de leur mode de progression qui n'ont rien de commun avec ce qui s'observe chez les Gerboises, nous ferons remarquer que les formes et les rapports des différentes parties de la tête osseuse, ressemblent autant à ce qu'en ce genre on trouve chez les rats, qu'ils ressemblent peu à ce qu'on trouve chez les Gerboises. Chez celles-ci en effet, autant os du nez et les frontaux sont raccourcis, autant ils sont allongés chez

les Gerbilles. Chez les premières le trou sous-orbitaire, ou plutôt l’ouverture antéro-orbitaire, d’une grandeur peu commune et d’une forme circulaire à cause du grand écartement de l’arc que forme le maxillaire est linéaire chez les secondes ; chez ces dernières ce déploiement du maxillaire, en arc extrêmement élargi offre une très grande surface à l’attache des muscles des lèvres et du nez, tandis que son extrême étroitesse chez les Gerboises ne permet à ces muscles qu’un faible développement, du moins en épaisseur ; et toutes ces particularités propres aux Gerbilles, se retrouvent à peu d’exception près chez les loirs, et surtout chez les rats. Si on ajoute à ces considérations, que la structure des membres, et le canal intestinal des Gerbilles, diffèrent peu ou point de ce qui s’observe chez les rats ; que les yeux, et le développement de toutes les parties des oreilles des premières rappellent ce que nous voyons chez les loirs, on ne balancera pas à rétablir les rapports naturels des Gerbilles, en les rapprochant de ces derniers animaux et des rats, comme au reste l’avait déjà fait en partie mon frère dans la dernière édition du Règne Animal.—Tom. i. p. 203.

PLATE XXII.

PLATE XXIII.
Fig. 1. Le crane de la Gerbille de Burton vue de profil.
2. Id. vue en dessus.
3. Id. vue en dessous.
4. Les dents de la machoire supérieure.
5. Les dents de la machoire inférieure.

PLATE XXIV.
Fig. 1—5. Le crane et les dents de la Gerboise à pieds hérissés.
6 et 7. Le crane de l’Alactaga, ½ plus grand que nature.
8 et 9. Les dents du même animal, cinq fois plus grand que nature.

PLATE XXV.
Fig. 1—5. Le crane et les dents de la Gerbille Egyptienne.
6—9. Id. de la Gerbille des Pyramides.
10—14. Id. de la Gerbille pygargue.
15—19. Id. de la Gerbille de l’Inde.

PLATE XXVI.
Fig. 1—4. Le crane et les dents d’une Gerbille indéterminée.
5—9. Id. de la Gerbille Africaine.
10—13. Id. de la Gerbille à courte queue.
14—18. Id. de la Gerbille otarie.
1-5. Depus kertopas  
XI. Description of a new Genus of Mammiferous Animals from Australia, belonging probably to the Order Marsupialia. By George R. Waterhouse, Esq., Curator to the Zoological Society. Communicated by the Secretary.

Read December 13, 1836.

Having, at different times, brought before the notice of the Society two specimens of a small quadruped, apparently undescribed, I will now endeavour to point out its generic and specific characters; but before I proceed, it will be as well, perhaps, to state what is known of the history of the two specimens in question.

The first was procured by Lieutenant Dale, of Liverpool, whilst on an exploring party in the interior of the country at the Swan River settlement, and was discovered about ninety miles to the south-east of the mouth of that river.

"Two of these animals," says Lieutenant Dale, "were seen within a few miles of each other; they were first observed on the ground, and on being pursued, both directed their flight to some hollow trees which were near. We succeeded in capturing one of them; the other was unfortunately burnt to death in our endeavour to dislodge it by fumigating the hollow tree in which it had taken refuge. The country in which they were found, abounded in decayed trees and ant-hills." The second individual, I am informed, was found in Van Diemen's Land; and others similar to it have been seen in the act of burrowing or digging at the roots of trees in search after insects. The favourite haunts are stated to be in those situations in which the Port Jackson willow abounds.

To the genus of which the present animal constitutes the type, I propose the title of Myrmecobius*.

Genus Myrmecobius.

Dentes incisores $\frac{3}{6}$, canini $\frac{1}{1}$, pseudo-molares $\frac{3-3}{3}$, molares $\frac{5-5}{3}$ = 52.

Pedes antici 5-dactyi; digitis tribus intermedii longioribus; postici 4-dactyi; digitis duobus intermedii interiore longioribus; externo brevissimo; unguibus longis, subacutis, subfalcariibus; scelides antepedibus longiores. Caput elongatatum, rhinariae producto. Auriculae mediocres, ad apicem angustiores et subacutæ. Corpus gracile. Cauda mediocris. Digitii liberi.

* I cannot help suspecting there is some mistake in this statement, which, if not observed, I have not received directly from the person who first procured the specimen; indeed it has probably passed through many hands. Accompanying this specimen there was a skin of another animal (the Perameles Lagotis of Reid) a specimen of which is in Lord Derby's Museum. This his Lordship received from Swan River.

# Mörmen, an ant; Bōs, life, food, &c.
The upper jaw is furnished with eight minute, pointed, and slightly compressed incisors, the anterior pair of which have their apices only apparent, being on a level with the gum; the three next pairs project slightly from the gum: after these follow two canines, which are of a compressed and pointed form, and have their posterior outline somewhat recurved. The false molares are also compressed; their form approaches to that of a triangle, having the apex recurved. The first two on each side have an obscure notch anteriorly and posteriorly; in the next pair these notches are more distinct, but the central lobe is less than in the foregoing false molars.

The first pair of true molars are small and compressed, they have two minute tubercles anteriorly, and two posteriorly; these two pairs of tubercles are separated by a considerable chasm, on the inner edge of which, and in the centre, another small tubercle is perceived. The second pair of molars are of a larger size than the last-mentioned; their crown presents nearly a semicircular figure, and consists of several obscure blunt tubercles, arranged in three principal masses; one placed anteriorly, another posteriorly, and the third internally. The third pair of molars are shorter and broader than the second; their crown consists of three large blunt tubercles arranged in a triangle, and disposed in the same manner as the three masses of tubercles of the preceding pair of molars. The fourth pair of molars are of the same general character as the third. The fifth and last pair are very small; their crown is of a triangular form, and consists of three obscure blunt tubercles, two of which are placed in a line parallel to the occipital portion of the skull.

In the lower jaw the incisors are about the same size and form as those of the upper, if we except the front pair, which are large and compressed; they project forwards, and are somewhat recurved at the apex. The canines and false molars of the lower jaw are also of the same size and form as those of the upper; the last pair of false molars, however, are similar to the preceding pairs. The first pair of molars are minute and compressed, and the portion above the gum consists of three sharply-pointed tubercles arranged in a line. The second pair exceed the first in size, and exhibit three tubercles as before. The three following pairs of molars are of the same character, but they have each four sharply-pointed tubercles, arranged in a line, and some blunt tubercles situated at their base on the external side. The last pair of molars resemble the preceding, excepting that they are of a smaller size, and possess only three sharp tubercles.

In the lower jaw the posterior false molars have somewhat of an inward inclination, but in the true molars this inclination is more evident; indeed it appears as if the external sides of the lower teeth were opposed to the crowns of the upper; but upon examination we find that the inner side only of each tooth is properly developed, and constitutes the sharply-pointed tubercles above described; the outer side of these teeth consists only of blunt tubercles, which are scarcely elevated above the gum. This form of tooth evidently arises from the inward inclination of the edge of the lower jaw.

Owing to the narrow and elongated form of the snout, the incisors are placed late-
rally and remote from each other. The space on each side between the last pair of incisors of the upper jaw and the canines is very considerable, and when the jaws are closed is occupied by the lower canines. The false molars of both jaws are also remote from each other and from the canines; in fact, the only teeth which are in positive contact are the two last molars of the upper jaw, and the three posterior molars of the lower.

The molar teeth are so little produced that their apices are scarcely visible until the gum is removed; they are very weak, and the part protruded through the gum consists of small tubercles.

**Species. Myrmecobius fasciatus.**

*Myrm. colore ochraceo-fulvo, pilis albis sparsim intermixtis; dorso dimidio posteriore fasciis transversalibus nigris atque albis alternatim ornato; guld, pectore, abdomen, artibusque internè subflavescentibus; artibus externè fulvis; tibiis antlicè albescentibus; caudà fere corporis longitudinem aequante, indutū pilis nigris, albis, atque fulvis commixtis.*

The reddish hue of the fore part of the body is gradually blended into the black, which is the prevailing colour of the posterior half, and which is adorned with nine white fasciae. The first, which is indistinct, commences about midway between the head and the root of the tail, and is interrupted on the back by the ground colour of the body, and so likewise is the second fascia. The third and fourth fasciae extend uninterrupted from side to side of the body; the four following are interrupted on the back by the dark colouring of the interstices, which divides them in an oblique manner, so that they appear to dovetail with each other. The ninth fascia is uninterrupted.

The fur consists of two kinds of hair; the under hair is scanty, and of a whitish-grey colour: the upper hair is rather coarse, short and adpressed on the anterior parts: long on the posterior and under parts of the body; the longer hairs on the back are for the most part of a flattened and pointed form; those on the anterior part of the back are generally black at the base, and of a fulvous colour at the apex. The hair on the head is very short, and of a brownish hue above, being composed of a mixture of black, fulvous, and a few white hairs; there are a few black hairs springing from the sides of the muzzle and from under each eye. The hair on the tail is long and rather bushy; most of the hairs on the under part are fulvous at the base and white at the tip; on the upper side of the tail they are generally black at the base and white at the apex.

In the second specimen which I had an opportunity of examining the colouring is not so bright, and the markings are less distinct, and differ in their disposition. The

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1 Having found in the animal said to have been brought from Van Diemen's Land four more molars (two in each jaw) than in that brought by Lieutenant Dale, I thought it advisable to take the former as my guide in describing the dentition.
two foremost fasciae extend, over the back, from side to side of the body, and are rather indistinct, especially on the back; behind these fasciae there is a single pale line on one side of the body, which extends to the middle of the back, where it is met by two similar lines, or fasciae, which have their origin on the opposite side: behind these, again, there are three distinct uninterrupted fasciae, the last of which is about half an inch from the root of the tail.

All these fasciae are of a deep cream-colour; and it must be observed that anterior to the foremost of them, there are some very obscure indications of fasciae, consisting only of a few white hairs arranged in lines on the side of the body.

The latter half of the back in this animal, as in the last, is black, but it is more thickly interspersed with white and reddish hairs; the anterior portion of the back is interspersed with black and white hairs (or, rather, the hairs are spotted with those colours), but its general hue is fulvous. The legs are of a buff colour. The chin, throat and under parts of the body are of a dirty yellow-white tint, approaching to a pale buff colour, on the posterior part.

In. Lin.

<table>
<thead>
<tr>
<th>Description</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length from nose to the root of the tail (measuring along the curve of the back)</td>
<td>10 0</td>
</tr>
<tr>
<td>Length of tail (measured to the end of the hair)</td>
<td>7 0</td>
</tr>
<tr>
<td>Length of hind foot, to the end of the claws</td>
<td>2 2</td>
</tr>
<tr>
<td>Length of the longest claw (which is that next the inner one)</td>
<td>0 4 1/2</td>
</tr>
<tr>
<td>Length of fore foot to the end of the claws</td>
<td>1 4</td>
</tr>
<tr>
<td>Length of the ear</td>
<td>0 9 1/3</td>
</tr>
<tr>
<td>Width of ditto at the base</td>
<td>0 7</td>
</tr>
<tr>
<td>Length from the nose to the anterior portion of the ear</td>
<td>1 10</td>
</tr>
<tr>
<td>Length from the nose to the eye</td>
<td>0 0</td>
</tr>
</tbody>
</table>

With respect to the affinities of the genus Myrmecobius, I have much satisfaction in finding that my original conjecture¹ (as to its being allied to the genus Phascogale) is in a great measure borne out by the structure of the skull, which I have since had an opportunity of examining, and have compared with drawings of that of the latter genus.

Viewing the skull of Myrmecobius and that of Phascogale from above, we perceive a considerable degree of resemblance: the skull of Myrmecobius, however, differs in several points from that of Phascogale. But let us in the first place compare the skull of this latter animal with the crania of other species of the Dasyuridae,—a group in which I include the genera Thylacinus, Dasyurus, and Phascogale.

If we place side by side the skulls of the various species of these three genera (com-

mencing with the skull of *Thylacinus*, and ending with that of *Phascogale*), we can trace in the teeth a gradual blending of the carnivorous structure into the insectivorous; and as the skulls are modified accordingly, I shall confine my observations to the latter, my object being to show that the skull of *Myrmecobius* differs from that of *Phascogale*, chiefly in those points of structure, to which a gradual approach may be traced through species allied to the latter genus.

In *Thylacinus* we perceive a great width and strength in the zygomatic arch, a considerable contraction of the cranial cavity (especially at its posterior part), a great development of the interparietal ridge and an abrupt termination of the skull immediately behind the zygomatic arch. In *Dasyurus Ursinus* the same general characters also obtain, but the parietals extend somewhat further back. In *Das. Maugei* we have still a considerable contraction of the skull in the centre of the temporal fossa, but there is a much greater lateral development of the parietal bones, indicating a more voluminous cavity for the reception of the brain; they also extend further beyond the zygomatic arch, and dilate at their junction with the occipital bone; the interparietal ridge is also comparatively feeble. In the genus *Phascogale* this ridge is quite lost, the skull is less contracted in the middle, the parietal bones are more developed, and the cranial cavity is still more voluminous; the upper surface of the skull is therefore more evenly convex. In the genus *Myrmecobius* the interparietal ridge is also wanting; the frontal bones are very broad, and together form almost a square, and the cranial cavity exceeds that of *Phascogale*; the posterior ridge of the orbital margin forms an acute process, which is not seen in the last-mentioned genus, but which occurs both in *Dasyurus Ursinus* and *Thylacinus cynocephalus*, although in these species the temporal bones are remarkably contracted. The hinder angle of the lower jaw in all these animals is produced into an elongated process.

Although in the structure of the skull the animal here described evinces an affinity to *Phascogale*, it differs from that genus in the want of a thumb to the hind feet, and in the strength and larger size of the claws of the fore feet, which are shaped somewhat like those in the genus *Herpestes*, and are evidently suited to burrowing. The forelegs are also stouter in proportion, and the feet are stronger. In their narrow and pointed shape, the ears resemble those of *Perameles nasutus*, and differ from those of *Phascogale*; they also differ in being tolerably well clothed with hairs both externally and internally.

I imagine that in the present animal I can perceive a slight approach to the *Edentate Marsupialia*, or the Monotremes of Cuvier, and think that, analogically, it may be compared to the genus *Tupaia* among the true *Insectivora*, bearing a somewhat similar connection with *Echidna* and *Ornithorhynchus*, to that which exists between the last-mentioned genus and the genera *Erinaceus* and *Mygale*. That there is a greater dissimilarity in structure between the genus *Myrmecobius* and the Monotremes, than between *Tupaia* and *Mygale*, must be allowed; we are, however, in a measure prepared for this,
by the comparatively sudden transitions from one form to another which we find in the Marsupialia, which group, we must also bear in mind, stands low in the grade of organization among Mammalia.

Plate XXVII.

*Myrmecobius fasciatus.*

Plate XXVIII.

Fig. 1. *Cranium* of *Myrmecobius fasciatus* seen from above.
2. *Cranium* seen laterally.
3. Palate and teeth of upper jaw.
   a. Posterior molar of upper jaw magnified.
   b, c, d, and e. The four preceding molars magnified.
4. Teeth of the upper jaw magnified.
5. Teeth of the lower jaw magnified.
   a. Last molar but two seen from above.
6. Half the lower jaw seen from above, with the teeth as seen in first specimen.
7. Side view of the same.
8. Under side of left fore foot.
   a. Side view of claw of fourth toe.
9. Under side of right hind foot.
   a. Claw of the inner toe.
XII. Descriptions of several new Species of Insects belonging to the Family of the Sacred Beetles. By J. O. Westwood, Esq., F.L.S. Sc., Secretary to the Entomological Society. Communicated by the Secretary.

Read January 24, 1837.

The family of the Sacred Beetles has attracted the attention of the admirers of Nature from the earliest ages, not only on account of the circumstance of the insects of which it is composed having formed portion of the many objects "qualia demens Egyptus coluit," but also from the extraordinary habits of the insects themselves, which were indeed the cause of their being selected by the Egyptians as objects of worship. But this group of insects has, in more recent times, been regarded by naturalists with interest, from its having led to the publication of the most philosophical work which has for a great length of time appeared upon the relations and natural distribution of the Animal Kingdom, the 'Horsæ Entomologicae;' in the preface to which work the author expressly states that it was with the view ofascertaining the real situation in nature of the Scarabæus sacer, that he undertook the task of endeavouring to arrange animals upon a plan which appeared more in harmony with their real relations, than that developed in any previous system.

How far this has been effected time and a more perfect acquaintance with the objects of the animated world will prove. It will be sufficient here to state, that the genus Scarabæus of Linnaeus was strictly analysed and divided into two parallel columns, each containing five families, and that two genera composing the restricted family Scarabæidae were also analysed, namely, Scarabæus and Phaneus, the former being divided into five types of form, and the latter (as far as was then known) into four, an evident hiatus existing between two of the types of form, which it was supposed by the author would eventually be filled up by insects possessing certain characters, which he therein indicated.

The two groups thus analysed have been subsequently held up by the supporters of the doctrines of the Horsæ Entomologicae as evidences of the correctness of such doctrines, and as illustrations of the practical application of the theory to the lowest groups, namely, genera and subgenera. Confining ourselves to the restricted family Scarabæidae of MacLeay, it will be seen that this author gives no indication of the five, or other number of genera, of which he considers that the family consists; and it is only by looking through the various observations upon the family in different parts of his work, that we find, in addition to the two genera mentioned above (Scarabæus and Pha-
naeus), the genera Onitis, Onthophagus, Copris, Canthon and Ateuchus casually noticed; there being no analysis of the family Scarabeidae itself.

The genus Scarabaeus itself, as restricted in the Hora Entomologica, has for its essential characters, the tibia of all the legs furnished with a single spur; the head subtrigonal or, rhomboidal, never cornuted; theclypeus radiated, bidentate or emarginate; the thorax elliptical, margined, often impressed on each side with a puncture, which is occasionally indistinct; broader than the abdomen; the anterior tarsi often obsolete, &c. The genus thus characterised is divided into the five following subgenera or types of form: 1. Heliocantharus; 2. Mnematium; 3. Pachysoma; 4. [Wanting]; 5. Gymnopleurus.

Since the publication of the Hora Entomologica the family has received but little addition. It will be essential, however, with a view to the discovery of the relations of the insects about to be described, that the student should be put in possession of what has been done by subsequent writers. The description by Mr. Kirby of a remarkable insect from Soudan, "forming a distinct and new type in the genus Scarabaeus" of MacLeay, under the name of Scarabaeus femoralis, in the 'Zoological Journal,' must be regarded of the first importance, as interfering with the distribution of the types of form composing that genus given in the Hora Entomologica; whilst the same author, whose knowledge of the Scarabaei is fully admitted by Mr. MacLeay, observes that "in Copris, MacLeay, I seem in my own cabinet to possess ten or twelve distinct types; and in Phanaeus, the fifth type, which Mr. MacLeay regards as containing insects resembling all the other types, appears to me rather divided into two; one formed by Phan. carnifex, vindex, igneus, &c., and the other by Phan. splendidulus, floriger, Kirbi, &c."

Latreille has done little towards the recent elaboration of this group of insects. The following short synopsis will show his distribution as given in the Second Edition of the Regne Animal.

Coprophagi.

Sect. 1. Corresponding with the family Scarabeidae, MacL.

A. Corresponding precisely with the genus Scarabaeus, MacL., containing the genera Ateuchus, Weber, with Heliocantharus and Pachysoma as sections, but entirely omitting Mnematium.

1 Introduction to Entomology, vol. iv. p. 400.

2 The generic name Ateuchus, as proposed by Weber, was intended to designate all the unarmed, unscutellated, long-legged Coprides of Fabricius, including the sections in this Table indicated under the letters A and B, a; having the Scarabaeus sacer as the typical species (Ent. Syst. i. p. 62.). The genus having been subsequently dismembered, the name has properly been retained by the French authors for the Sacred Beetles; but as the names Scarabaeus and Heliocantharus ought to be given to those insects, the name Ateuchus must sink as a synonym, and not be employed as Messrs. MacLeay and Vigora (Zool. Journ. No. 8.) propose to employ it as the generic name for some of the species belonging to Section B, a, in the above Table.
Gymnopleurus, Illig.

B. Intermediate tibiae with two spurs, basal joint of labial palpi always larger than the following.
   a. Four posterior tibiae not dilated at the tip, nor in the shape of an elongated triangle.
      Genera Sisyphus, Latr.; Circellium, Latr.; Coprobius, Latr.; Cherridium, St. Farg. & Serv.; Hyboma, St. F. & Serv.; Eurysternus, Dalm. (Æschrotes, St. F. & Serv.).
   b. Four posterior tibiae dilated at the extremity, and of an elongated triangular form; head and thorax often cornuted in the males.
      Genera Oniticellus, Onthophagus, Onitis, Phaneus and Copris.

Sect. 2. Corresponding with the family Aphodiidae, MacL.

A modification of this distribution, arising from the discovery of another remarkable insect, Ateuchus Adamastor, is given in the Encyclopédie Méthodique by Messrs. Serville and Saint Fargeau as follows:

Coprophagi.

A. Corresponding with the Scarabæidae of MacLeay.
   * Scutellum wanting.
      † Four posterior tibiae subcylindric, not dilated at the tips.
         Genera Ateuchus, Gymnopleurus, Hyboma, Sisyphus.
      †† Four posterior tibiae, short, dilated at the tips.
         Genera Onthophagus, Phaneus, Copris, Cherridium.
      b. Scutellum small but distinct, or represented by a space.
         Genera Onitis, Oniticellus, Æschrotes.

B. Corresponding with the family Aphodiidae, MacL.

The genus Ateuchus, here no longer characterised by the presence of a single spur on each intermediate tibia, is thus distributed into sections.

I. Clypeus trilobed with six points, &c. (Heliocantharus, MacLeay.)
   1. Four posterior tibiae obliquely truncate, prolonged into an inarticulate spur. (Sacer, &c.)
   2. Four posterior tibiae truncated at the tips, the posterior pair having a single spur.
      A. Intermediate tibiae with a single articulated spur. (Semipunctatus, laticollis, &c.)

II. Clypeus not trilobed, four posterior tibiae truncated.
1. Four posterior tibiae, with a single spur to each. (Pachysoma, MacL.)
2. Intermediate tibiae with two spurs, posterior with one.
   A. Clypeus bidentate, thorax truncate behind, abdomen rounded. (Bacchus.)
   B. Clypeus 2—6—dentate, thorax rounded behind, abdomen square. (volvens, triangularis, &c.)

The establishment of the genus Anamnesis by Mr. Vigors (in the eighth Number of the ‘Zoological Journal’), and Deltochilum by Eschscholtz (in the Entomographien), have indicated the existence of two groups very nearly allied to Hyboma. Megathopa Eschscholtz, is closely allied to Cicellum; Scatonomus, Erichson, to Coprobius; Drepaphocerus, Kirby, to Eurysternus and Dendropoemon, Perty; Enicotarsus, Guerin, to Oniticellus. Such, as far as I am aware, are the only modifications suggested relative to the distribution of the Scarabaeidae, or additions made to the rest of its published genera since the publication of the Horæ Entomologicae.

From a review of the two tabular sketches of the family presented above, it will be seen that indications in both are given of the separation of the family into sections from the general structure of the four hind legs; and it appears to me that a distribution founded upon such a character must be strictly natural, that is, with reference to the natural economy of the species of which the two groups are composed, all the long-legged species being strictly “pilularii” or dung-rollers, the habit being as strongly developed in the Sisyphi and Coprobi as in the Scarabæ of MacLeay.

We have seen that the essential character of the genus Scarabæus consists in the intermediate tibiae being only provided with a single spur: it appears to me, however, that if this be really the character of the genus, those Scarabæi must be excluded which may be strictly said to have no spur on the intermediate tibia (Section I. 1. of Saint Fargeau and Serville). How far this observation, together with the description of the Scarabæus femoralis, may render necessary the modification of the characters of the genus Scarabæus, must be left for others more competent to the task than myself to decide. I will only observe that the Ateuchus adamas to of Saint Fargeau and Serville, and the insects hereinafter described, appear to be so intimately connected with species of the genus Scarabæus, MacLeay, that in my humble opinion the points of connexion between them and Scarabæus are far too numerous to be overweighed by their possession of a pair of spurs on the middle tibiae, which alone separates them from that genus; while at the same time the characters of Ateuchus adamas to and the insect first hereinafter described seem even to render necessary an extension of the characters of the subgenus Heliocanthus, with which they entirely agree, except in the possession of a pair of spurs on the intermediate tibiae. I have, however, provisionally regarded these, as well as the others, as distinct types, and which a further analysis of the long-legged Scarabæidae may perhaps prove to be essential.
SPECIES OF SACRED BEETLES.

Sceliages¹.

Corpus latum subdepressum.

Caput subtrigonum planum, clypeo trilobato, lobo intermedio valdè emarginato, apicibus emarginatur obtusis, lobis intermedii obliquis angulis haud productis. Antennae 9-articulatæ, clava subglobosa, articulo 1mo longissimo, 2ndo brevi, 3to paullo longiori, tribus proximis brevibus subæqualibus sed sensim latioribus, 7mo magno inferne producto, articulos duos terminales in sinu ejus includente, ultimo 8vo minori. Labrum membranaceum transversum ciliatum, lateribus incurvis. Mandibulae elongatæ, planæ, submembranaceae, intus ciliatae. Maxillæ elongatae ad apicem lobis duobus membranaceis terminatae, lobo supero maximo ciliato. Palpi maxillares breves subglobiformes, 4-articulati, articulo basali minuto, reliquis longitudine crescentibus, ultimo longo obovato. Mentum valdè pilosum oblongum antiquè attenuatum, margine antico fere rectè truncato. Labium bipartitum, ciliatum, membranaceum. Palpi labiales abbreviati, 3-articulati, pilis rigidos obtecti, articulis magnitudine decrementibus, ultimo minuto.


Abdomen depressum.

Sceliages Iopas.

Scel. ater, nitidus, lavis, clypei dentibus duobus intermedii obtusis subelevatis, capite antice punctatissimo, thorace laevissimo, elytris punctis nonnullis minutissimis irregularibus, striisque sex longitudinalibus simplicibus, fere obliterate; tibiis anticis intus et extus serrulatis, laterè externo obtuse quadridentatis; tibiis intermedii extus spinis duabus minus acutis, posticis tribus.

Long. corp. circiter 10 lin.

Habitat in Africa australiori.


Anomiopsis⁸.

Pedes elongati, tibiae intermediae curvatae bicalcaratae, calcaribus mobilibus interno elongatuis, cruris fractio.

¹ Sce, coryris fractio. ⁸ Ανόμιος, dissimilis; et Όφας, facies.

*Obs.* Species duas, hisce characteribus, in hac familia insolitis, gaudentes, adhuc vidi, attamen aliter inter se tantum discrepantes ut typi formarum diversarum forsan haberentur.

Sect. 1. *Clypeus* antice cornubus duobus porrectis depressis; *thorax* transversus linea impressa longitudinali et puncto utrinque ordinario, marginibus lateribus pilosis; *abdomen* parvum semicirculare. *Tibiae* antice dilatatæ obtusæ 4-dentæ.

**Anomiopsis Dioscorides.**

An. *ater nitidus punctatissimus, elytris 6-punctato-striatis, capitis thoracisque lateribus, femoribus antecis tarsisque quatuor posticis longe rufo-hirtis.*

Long. corp. 13 lin.

*Habitat* — — ?


Descr. *Caput* latum transversum, lateribus posticè subrotundatis; *clypeo* in lobos tres diviso, lateribus parvis; intermedio antice valde porrecto bifido, punctato, capitis parte postica sublævi. *Antennæ* longiores, 9-articulæ, clava elongata, sat gracili, articulis 3, 4, 5, et 6 longitudine decrescentibus; 6to interne subproducto, ultinis tribus subæqualibus; *Labrum* membranaceum antice emarginatum, dente parvo medio; lateribus incurvis; *Mandibulae* subtrigonæ obtuse planæ subcoriaceæ. *Maxillæ* cornææ, lobo terminali obtuso, palpis maxillaris 4-articulatis, articulo 1mo parvo, reliquis tribus filiformibus longitudine fere æqualibus. *Mentum* subconicum lateribus ad basin rotundatis apicè emarginato. *Labium* membranaceum ciliatum bipartitum; *Palpis* labialis subfornibus valde setigeris articulo 1mo obconico, 2ndo magno, externe valde producto obliquo, 3to minimo ovali ante apicem lateralem supra inserto, inde parte producta setisque articuli præcedentis subitus inconspicua est. *Thorax* transversus disco subconvexo, linea longitudinali centrali punctisque duobus lateralis impressus, punctatissimus, lateribus rufo-hirtis. *Elytra* thorace paullo angustiora, semicircularia, nigra nitida punctatissima striisque sex punctorum majorum in singulo impressis. *Tibiae* antice valide, obtuse 4-dentæ, apice calcari unico acuto instructæ, tarsis nullis; *tibiae* intermedie exutus curvatae, serrulatae, ad apicem calcari subobduos instructæ, calcari interno elongato acuto, externo obtuso spatuliiforme: *tibiae* posticae sublineares fere rectæ, externè serrulatae, ad apicem calcari unico elongato acuto internè instructæ: *tarsi* 4 postici compressi 5-articulati, longè rufo setigeri, articulo ultimo ovato; unguibus nullis.

Anomiopsis Sterquilinus.

An. ater nitidus punctatissimus convexus, elytris semicircularibus, striis sex simplicibus in singulo, thoraeis lateribus tibiisque quatuor posticis serrulatis; capite, thorace, tarsiisque breviter rufo-hirtis.

Long. corp. 10 lin.

Habitat — ?


Obs. The two insects last above described present such a total diversity of habit and form, that unless minutely investigated they would certainly be considered as two distinct types of form which ought to be placed widely apart. When, however, we examine them in detail, they are found to agree in several very remarkable peculiarities, such as the form of the labial and maxillary palpi, the structure of the middle and posterior tibiae, tibial spurs, and tarsi, so that it is impossible to do otherwise than place them in the same genus, although certainly differing far more widely from each other in habit than the other groups or types of form of Scarabeus, which are established almost entirely upon variations of habit. It must, therefore, be considered a very remarkable circumstance, that whilst amongst the Scarabaeidae in general, the uniformity in the structure of the trophi is so great that we find the remark applied to them, "Instrumentis in cibariis haud valida patet distinctio," these two greatly diversified forms should possess not only a similarity of organization in these parts, but that this organization should be so anomalous; for it is in vain that we look throughout the insect world for labial palpi of a form analogous to that in these two species; but it is
still more remarkable that the same identity should exist in several other curious characters of the two insects as above detailed.

In the former species (A. Dioscorides) we find a striking approximation to the form of the Pachysoma (Scarab, Æsculapius and Hippocrates); but the second species (A. Sterquilinus) recedes from every known species of long-legged Scarabeidae in having the head cornuted and the surface of the thorax irregularly channelled. In Hyboma carinata (Westw. in Mag. Zool. & Bot., October and December 1836), we indeed find the latter character, and this genus is also assimilated to Anomiopsis in the structure of the antennæ; but in comparing the figures which I have here given of Anomiopsis with those of Hyboma carinata, above referred to, and Hyboma Guildingii (Westw. in Brit. Cyclop., Pl. Beetles), it will be evident that the habit of Anomiopsis is decidedly towards Scarabeus.

I much regret that I cannot state with precision the real locality of these two perplexing insects, the late lamented Sir Patrick Walker, in whose collection they were contained, (and who kindly permitted me to describe and figure as well as to dissect the specimens, although uniques,) having purchased them from a dealer, with various miscellaneous exotic species, but including many Javanese insects.

PLATE XXIX.

Fig. 1. Sceliages Iopas, and details.
1. The insect, of the natural size.
   1 a. The same, seen laterally.
   1 b. The same, seen from beneath.
   1 c. Labrum.
   1 d. Mandible.
   1 e. Maxilla.
   1 f. Instrumenta labialia.
   1 g. Ditto, seen from within the mouth. m. Mentum. l. Labium. l. p. Labial palpi.
   1 h. Antenna, seen from below. i. Terminal joints of ditto, seen from above.
   1 k. Anterior tibia.
   1 l. Intermediate tibia and tarsus.
   1 m. Posterior tibia and tarsus.

Fig. 2. Anomiopsis Dioscorides, and details.
2. The insect, of the natural size.
   2 a. Labrum.
   2 b. Mandible.
SPECIES OF SACRED BEETLES.

2 c. Maxilla.
2 d. Instrumenta labialia, from beneath.
2 e. Labial palpus removed.
2 f. Antenna.
2 g. Anterior tibia.
2 h. Intermediate tibia and tarsus. 2 i. Tarsus detached.
2 k. Extremity of posterior tibiae and base of posterior tarsus.

Fig. 3. Anomoiopsis Sterquilinus, and details.

3. The insect, of the natural size.
3 a. The same, seen laterally.
3 b. Labrum.
3 c. Mandible.
3 d. Maxilla.
3 e. Instrumenta labialia.
3 f. Labial palpus detached.
3 g. Underside of meso- and metathorax.
3 h. Anterior tibia.
3 i. Intermediate tibia and base of tarsus.
3 k. Posterior tibia and tarsus.

Addend.—Since the preceding memoir was read I have seen three or four distinct species most closely allied to Anomoiopsis Dioscorides, in the Collection of Charles Darwin, Esq., by whom they were collected in the southern part of South America, at Bahia Blanca and Mendoza, where they reside in the excrement of the Rhea.

I have therefore no hesitation in now regarding A. Sterquilinus as a distinct subgenus, for which the name of Glyphiderus\(^1\) may be proposed, in allusion to the remarkable sculpture of the thorax.

\(^1\) Τλύψω, sculpō; et Δέρπη, colhum.
XIII. Osteological Contributions to the Natural History of the Orang Utans (Simia, Erxleben). By Richard Owen, Esq., F.R.S., &c., Hunterian Professor of Anatomy at the Royal College of Surgeons.

Communicated October 25, 1836.

The interest which is attached to the Orang Utans, their rarity and limited geographical distribution, and the obscurity which still envelopes the history of the species which appertain to the genus Simia as limited by Erxleben, induce me to offer to the Zoological Society some additional observations on that subject, which I hope may contribute to extend and establish our knowledge of those remarkable anthropoid inhabitants of the forests of the larger islands of the Indian Archipelago.

These observations relate only to the skull and teeth,—parts of the osseous system, however, which each day’s experience seems to indicate as the principal points from which the best and surest specific as well as generic differences may be derived. The descriptions are accompanied with drawings of the objects described of the natural size. The first part of this paper describes an interesting stage in the change of the teeth in the great Orang of Borneo (Simia Wurmbii); the second part relates to a skull of an Orang in which that change had been completed, but which retains proportions and presents a form apparently specifically distinct from those in any other known species.

Hitherto the proof of the immature state of the so-called Simia Satyrus has been derived from the discovery of the germs of large permanent teeth, hidden within the cavity of the jaw-bones. In the specimen now before the Society, (Pl. XXX., figg. 1, 2, 3.) some of the permanent teeth have come into use, and have displaced their puny predecessors.

Since this paper was read, the Livraison of the Monographies de Mammalogie of M. Temminck, containing the important observations of its distinguished author on the rich collection of osteological and stuffed specimens of the Simia Satyrus in the celebrated Museum at Leyden, has been published. The wrapper of the Livraison bears date 1835, but reference is made in the text, (p. 122) to a letter received by M. Temminck, from Borneo, bearing date the 5th of October, 1836. It would have been unpardonable in me to have neglected the writings of so great an authority on the subject of the Orangs, had they been accessible at the time when the abstract of the present memoir was published in the Proceedings of the Zoological Society.

The following is a summary of the observations recorded by M. Temminck on the progress of dentition in the Orang of Borneo.

In an individual, 1 foot 5 inches high, all the deciduous teeth are in place; they correspond in number and kind with those of the human subject; but the molars of the lower jaw are larger; none of the permanent teeth are developed.
My previous observations led to a knowledge only of the size of the permanent teeth, and opportunities like the present were wanting to gain an insight into the amount of deviation from, or resemblance to the human subject which the Orang presented in regard to the order of their development.

The skull of the Orang here described belonged to an individual measuring from the vertex to the heel two feet, eleven inches; its native habitat could not be ascertained with certainty, but I infer from the straightness of the contour of the skull between the orbits and intermaxillary bones, from the position of the foramen magnum occipitale, and the form of the zygoma and position of its suture, that this immature specimen must belong to the large species which inhabits the Island of Borneo (Simia Wurmbii).

By comparing the side view of this skull with that given in Pl. 55, fig. 2., of the First Volume of the Society's Transactions, it will be seen that a considerable change has taken place in the antero-posterior extent of attachment of the temporal muscle; the mastoid ridge has, as it were, shifted its place, and retreated, by progressive absorption and deposition, nearer to the occipital plane of the skull. The size of the cranial cavity remains unchanged, but its parietes are thickened, especially at the line of the lambdoidal suture, preparatory to the development of the great ridge which is continued from that part in the adult; the zygomatic arches are also strengthened, and the superior maxillaries more produced, while the intermaxillaries, having given passage to the crowns of large permanent incisors, appear to have fallen in; the rami of the lower jaw are widened and deepened, and the horizontal portions lengthened in correspondence with the growth of the upper jaw. The permanent teeth in place in the upper jaw are the two middle or anterior incisors, and the first and second molares; the remaining teeth, viz., the lateral incisors, the canines, and the molares, which occupy the place of the future bicuspides, belong to the deciduous series.

In the lower jaw both the middle and lateral permanent incisors are in place, as also the first and second permanent molares on each side; the rest of the teeth consist of the deciduous canines and molares, corresponding to those of the upper jaw, together with one of the lateral incisors which has not yet been shed, but which retains only an insecure attachment in front of the corresponding permanent incisor.

In two other individuals a little more advanced in age, the two middle permanent incisors of the upper jaw have come into place, together with the first permanent molar. M. Temminck describes the second molar in these examples as having four tubercles (p. 130.); it is therefore deciduous, and would be replaced by the second bicuspid: the third molar which he describes, is the first of the permanent true molares.

In a female Orang, 2 feet, 4 inches, 6 lines high, the following permanent teeth are in place; the four lower incisors, the two middle upper incisors, the first and second true molares. The permanent teeth yet concealed are the lateral upper incisors, the canines, the bicuspides, and dentes sapientiae.

In a male measuring 2 feet, 6 inches, 9 lines in height, probably younger than the preceding, the development of the permanent incisors is not so far advanced; the two middle ones of the upper jaw having scarcely penetrated the gum, the rest of the teeth are in the same condition.
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In the human subject the permanent teeth come into place and use in the following order: the first true molares (between the sixth and eighth year); the middle lower incisors, the middle upper incisors, the lateral lower incisors, the lateral upper incisors, the canines, the bicuspides, (between the seventh and ninth years); the second true molares (about the twelfth); the third molares (twentieth to thirtieth year).

In the Orang Utan we see that the second true grinders are in place before the canines, or bicuspides, or even the lateral incisors of the upper jaw are shed; but as regards the incisors, there is the same priority in the development of those of the lower jaw as in the human subject. The difference in regard to the development of the molares indicates the greater importance of the large grinders to the young frugivorous Orang, as compared with the higher and more omnivorous animal.

It still remains to be determined in what order the bicuspides, last molares, and canines succeed each other. Judging from the state of advancement which they respectively exhibit, I should suppose that the huge canines would be the last to acquire their full development in the Orang Utan. The intermaxillary bones are still distinct from the maxillaries, and it is probable that the suture is not obliterated until the vascular activity in the neighbouring bone is excited by the passage into place of the permanent canine teeth.

The following differences may be observed between the deciduous teeth of the Orang and those of the human subject: the first or front incisors of the upper jaw are twice as large, and the fangs are proportionally flatter and broader; the lateral incisors very slightly exceed in size those of the human subject, but are directed more obliquely inwards or towards the middle incisors. The four lower incisors of the Orang are nearly twice the size of those of the human subject, and differ in the relative position of the lateral pair which converge more obliquely towards the middle pair. The canines are also nearly double the size of those of the human subject, and project beyond the level of the cutting surfaces of the contiguous incisors, from which they are separated by a short diastema. The difference in size is much less considerable in the deciduous molares; it is most marked in the superior development of the second inferior molar of the Orang. The grinding surface of the anterior molars in the Orang is divided into two facets rising towards a middle transverse ridge, while the corresponding part of the grinding surface in the human first deciduous molar of the lower jaw is occupied by a depression.

Before proceeding to the description of the cranium of the adult Orang, which I take to belong to an unknown species of Simia, Erxl., I shall premise a few observations on those species, of the existence of which we have evidences from descriptions and specimens of the entire individuals, both young and full grown.

The two great islands of the Indian Ocean, Borneo and Sumatra, are each inhabited
by a large Orang or Pongo, alike in stature, which exceeds that of any other known quadrumanous animal: they are also similar in respect to the formidable nature of their dentition, but differ in the form of the cranium, and in some minor external characters.

The Bornean Pongo, if we may judge from the few specimens undoubtedly from that locality which exist in the Museums of this country, is clothed with loose long hair of a deep fuscous colour, approaching in some parts to black\(^1\), the Sumatran Pongo is covered with loose long hair of a reddish brown colour\(^2\). The adult male of the Bornean species has the countenance disfigured by large dermal callosities upon the cheek-bones\(^3\). These do not exist in either sex of the Sumatran species. The osteological differences relating to the structure and contour of the cranium have been described in my previous communication on this subject, and I now subjoin figures, of the natural size, of the cranium of an adult male, undoubtedly from Borneo, (Pl. XXXI. and XXXII.) a comparison of which with the figure of the (said to be Sumatran) Orang's cranium, (Pl. LIII. and LIV., vol. i. Trans. Zool. Soc.) will convey an adequate idea of the osteological difference alluded to. As the teeth in both these large species of Orang closely resemble each other both in form and size, it is impossible to determine from the germs of the permanent teeth in the numerous crania of immature Orangs in our Collections, to which of the species these crania should be referred. But this is certain, that the species called Simia Satyrus by Linneus, and which Fischer inserts in his "Synopsis Mammalium," in addition to the Simia Abelii and Simia Wurmbii, is an Orang Utan in the immature state, and with the deciduous teeth. All the crania of the young Orangs which I have examined contain in the substance of the maxillary bones, germs of permanent teeth, which from their magnitude prove that the crania must have belonged to one or the other of the two great species above mentioned; but the characters of the crania themselves are too feebly developed in the immature state to lead to more than a conjectural determination as to which of the species they may belong.

With respect, however, to the cranium, now to be described, (Pl. XXXIII. and XXXIV.) the case is different. The condition of the teeth, which are all of the permanent series and far worn down, testifies that it is not the skull of a young Orang; while the size of the cranium, and the size and proportions of the teeth, indicate plainly the existence in Borneo of a species of Orang distinct from the great Simia Wurmbii, and altogether of a more anthropoid character. In this species, which I propose to call Simia Morio, the canine teeth are relatively smaller than in the female Simia Wurmbii; the whole series of the grinding teeth are smaller, while the superior incisors are nearly as large, and the inferior incisors quite as large, as those of Simia Wurmbii.

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\(^1\) See the young of this species No. 3, Zoological Society's Museum, and the specimen in the College of Surgeons.

\(^2\) See the adult of this species, No. 2, ibid.

\(^3\) See the figure of the head of the male and female of this species, from specimens in the Royal Museum at Leyden, Saturday Magazine, No. 265, Sept. 12, 1835, p. 100.
The teeth in the jaws of a quadrumanous cranium may be known to belong to the permanent series, not only by their size and shape, but by the absence of the foramina, which, in an immature cranium, are situated behind the deciduous teeth, and which lead to the cavities containing the crowns of the permanent teeth. The character afforded by these foramina is well displayed on comparing together the cranium of the Simia Morio with one of a young Simia Satyrus, in which the deciduous teeth are present together with the first permanent molares. The deciduous teeth in the young Orang, besides their smaller size, have their fangs more or less protruded from their sockets, and they are thrust apart from one another by the interposition of the osseous particles which are deposited to enlarge the jaw for the lodgement of their large successors; while in the Simia Morio the teeth are lodged firmly in the jaws, and with the exception of the characteristic interval between the canines and incisors in the upper jaw, and the canines and bicuspides in the lower jaw, are compactly arranged in close contiguity with each other.

That the cranium of the Simia Morio here described, belonged to an adult, is proved by the small interval between the temporal ridges at the crown of the skull, corresponding to the extensive surface of origin of the crotophyte muscles; and by the obliteration of the intermaxillary sutures: that it belonged also to an aged individual is highly probable from the extent to which the teeth are worn down, and from the obliteration, notwithstanding the absence of interparietal and lambdoidal crests, of the sagittal and lambdoidal sutures.

The cerebral portion of the skull of Simia Morio equals in size that of the Pongo, and indicates the possession of a brain at least as fully developed as in that species, while the maxillary portion is proportionally smaller; so that, as the cranium rises above the orbits, and is, like that of the Pongo, more convex on the coronal aspect than in the Chimpanzee, and wants the prominent supraciliary ridge which characterizes the African species, it presents in the Simia Morio altogether a more anthropoid character.

There are, however, the rudiments of the ridges which so remarkably characterize the cranium of the mature Pongo. Those which commence at the external angle of the frontal bone pass backwards, upwards, and slightly converge, but do not meet; they gradually diminish in breadth, and, after passing the coronal suture, subside to the level of the skull; they are then only traceable by a rough line, which leading parallel to the sagittal suture, and gradually bending outwards, rises again to be continued into the lambdoidal ridges; thus circumscribing the origins of the temporal muscles. The lambdoidal and mastoid ridges are broader and more developed than in the Chimpanzee, but inferior in both respects to those of the Pongo. The inial region of the occiput is almost smooth, and is convex, without the mesial ridge, and strong muscular impressions observable in the Pongo, where a preponderating weight in front calls for the insertion of powerful muscles behind to counterbalance it.

The temporal bones join the frontal in Simia Morio as in the Troglodytes niger; but
this structure occasionally is present on one or both sides of the skull in *Simia Satyrus*.

The *additamentum surae lambdoidalis* is present on both sides in the *Simia Morio*, and the beginning of the lambdoidal suture may be faintly traced, but the remainder is obliterated.

Directing our attention to the base of the skull of *Simia Morio* we observe the occipital *foramen* to be less posteriorly situated than in the *Pongo*, but more so than in the Chimpanzee. The plane of the *foramen* is also less oblique than in the *Pongo*. The occipital condyles are as far apart anteriorly as in the Chimpanzee. The anterior condyloid *foramina* are double on each side as in the *Pongo*; the carotid and jugular *foramina* open within the same depression; they are relatively further apart in the Chimpanzee: the petrous portion of the temporal bone, as in the *Pongo*, is relatively smaller than in the Chimpanzee; and the articular cavity, or surface for the lower jaw, forms a larger proportion of the base of the skull.

The other characters of the *basis cranii* correspond with those of the *Pongo*; and the smaller size of the *meatus auditorius externus* is probably associated in both species with a smaller auricle as compared with the Chimpanzee.

On the bony palate the relative position of the *foramen incisivum* corresponds with the development of the incisive teeth, showing the intermaxillary bones to be of larger size in the *Simia Morio* than in the Chimpanzee: the situation of the sutures joining these bones to the maxillaries is indicated by vascular grooves, but otherwise obliterated; while in the cranium of a young *Pongo* of nearly the same size as that of the *Simia Morio*, the intermaxillary sutures still remain, corresponding to the non-development of the permanent laniaries. It will be interesting to determine at what period these sutures are obliterated in the more anthropoid *Simia Morio*.

The *os nasi* is a single narrow long triangular bone, slightly dilated at its upper end or apex, with the basal margin entire, presenting no indications of original separation into two parts, as has been observed in skulls of the Chimpanzee.

In the contraction of the interorbital space, and the general form of the orbit and its boundaries, the *Simia Morio* resembles the *Simia Satyrus*, but the orbital cavity, as before observed, is smaller. In the plane of the orbit and straight contour of the upper jaw, the *Simia Morio* resembles the Bornean species of *Pongo* or *Simia Wurmbii*, rather than the *Simia Abelii* or Sumatran *Pongo*.

The orbital process of the *os mala* is perforated in the *Simia Morio* as in the *Pongo*, by several large *foramina*. There are one principal and two very small infraorbital *foramina* on either side; the upper maxillary bones are relatively smaller, as compared with the other bones of the face, and especially the intermaxillaries, than in the *Pongo*; a structure which coincides with the smaller proportional development of the canine teeth. The nasal aperture has the same form as in the adult *Simia Wurmbii*, being more elongated than in the immature *Orang*. 
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The main and characteristic difference then between the *Simia Morio* and the *Pongo*, whether of Borneo or Sumatra, obtains in the size of the laniary or canine teeth, to the smaller development of which in the *Simia Morio*, almost all the other differences in the cranium are subordinate or consequent. The laniary teeth, it may be observed, have little relation to the kind of food habitual to the Orangs; had they been so related they would have been accompanied with a structure of the glenoid cavity fitting them, as in the true Carnivora, to retain a living prey in their gripe, till its life was extinguished or resistance effectually quelled. But the flattened surfaces on which the condyles of the lower jaw rotate are in subserviency to the broad tuberculate molars, showing the mastication of vegetable substances to be the habitual business of the jaws.

3 With respect to minor differences not noticed in the description, these may be deduced from the subjoined table of comparative admeasurements.

<table>
<thead>
<tr>
<th></th>
<th><em>Simia Morio</em>, adult</th>
<th><em>Simia Wurmbii</em>, adult male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of the skull from the vertex to the base of the occipital condyle</td>
<td>3 7</td>
<td>4 6</td>
</tr>
<tr>
<td>Length of the skull from the posterior plane of the <em>occiput</em> to the margin of the incisors</td>
<td>4 4</td>
<td>5 3</td>
</tr>
<tr>
<td>Length of the skull from the posterior plane of the <em>occiput</em> to the fronto-nasal suture</td>
<td>4 1 1/2</td>
<td>5 7</td>
</tr>
<tr>
<td>Length of the skull from the fronto-nasal suture to the margin of the incisors</td>
<td>2 4</td>
<td>2 9</td>
</tr>
<tr>
<td>Greatest lateral diameter of the skull (at the post-auditory ridges)</td>
<td>0 7</td>
<td>0 0</td>
</tr>
<tr>
<td>Smallest lateral diameter of the skull (behind the orbits)</td>
<td>5 1</td>
<td>6 3</td>
</tr>
<tr>
<td>Distance between temporal ridges</td>
<td>1 9</td>
<td>2 6</td>
</tr>
<tr>
<td>Diameter of the skull at the <em>zygomatica</em></td>
<td>3 6</td>
<td>4 6</td>
</tr>
<tr>
<td>Length of the <em>zygomatic fossa</em></td>
<td>0 4</td>
<td>0 7</td>
</tr>
<tr>
<td>Diameter of skull taken between the outsides of the orbits</td>
<td>1 3</td>
<td>1 6</td>
</tr>
<tr>
<td>Interalbital space</td>
<td>1 6</td>
<td>1 7</td>
</tr>
<tr>
<td>Transverse diameter of orbital cavity</td>
<td>1 1</td>
<td>1 6</td>
</tr>
<tr>
<td>Vertical diameter of orbital cavity</td>
<td>0 9</td>
<td>1 0</td>
</tr>
<tr>
<td>Vertical diameter of nasal aperture</td>
<td>1 7</td>
<td>2 0</td>
</tr>
<tr>
<td>Transverse diameter of nasal aperture</td>
<td>2 5</td>
<td>3 3</td>
</tr>
<tr>
<td>Interspace between infraorbital <em>foramina</em></td>
<td>2 3</td>
<td>2 10</td>
</tr>
<tr>
<td>Distance between the inferior margin of the nasal bone and the inferior margin of the intermaxillary bone</td>
<td>3 1 1/2</td>
<td>4 0</td>
</tr>
<tr>
<td>From the anterior margin of the <em>frontal foramen</em> to the posterior margin of the bony palate</td>
<td>0 10</td>
<td>1 3</td>
</tr>
<tr>
<td>Length of the bony palate along the mesial suture</td>
<td>0 6</td>
<td>0 7</td>
</tr>
<tr>
<td>From the anterior margin of the intermaxillary bones to the anterior palatal <em>foramina</em></td>
<td>0 3 1/2</td>
<td>0 4</td>
</tr>
<tr>
<td>Breadth of the crown of the first incisor, upper jaw</td>
<td>1 6</td>
<td>1 9</td>
</tr>
<tr>
<td>Breadth of the crown of the second incisor, upper jaw</td>
<td>2 2</td>
<td>2 5</td>
</tr>
<tr>
<td>Breadth of the four incisors, <em>in situ</em>, upper jaw</td>
<td>0 6 1/2</td>
<td>1 0</td>
</tr>
<tr>
<td>Length of the everted crown of the canine tooth, upper jaw</td>
<td>0 5</td>
<td>0 9</td>
</tr>
<tr>
<td>Breadth of ditto</td>
<td>5 7</td>
<td>7 4</td>
</tr>
<tr>
<td>Length of the <em>ramus</em> of the lower jaw</td>
<td>3 4</td>
<td>4 7 1/2</td>
</tr>
<tr>
<td>Greatest breadth of ditto</td>
<td>2 0</td>
<td>3 1</td>
</tr>
<tr>
<td>Interspace between the mental <em>foramina</em></td>
<td>1 8</td>
<td>2 1</td>
</tr>
</tbody>
</table>
and the application of the laniaries to be occasional, and probably defensive in most cases. The utility of formidable canine teeth to the Orangs, whose stature makes them conspicuous and of easy detection to a carnivorous enemy, is obvious; such weapons, in connexion with the general muscular strength of the Pongos, may enable them to offer a successful defence against a large feline antagonist; but in the smaller species, which we have been describing, to which concealment would be easier, the canines are of relatively smaller size, and those of the lower jaw are so placed as to be worn down by the lateral incisors of the upper jaw; they were reduced in the specimen described, to the level of the other teeth; and the points of the upper canines were also much worn. The size, forms, and proportions of the teeth which relate more immediately to the food of the Orangs, viz., the molars and incisors, show indisputably that the Simia Morio derives its sustenance from the same kind of food as the larger Orangs. The singular thickness or antero-posterior diameter of the incisors, which are worn down to a flattened surface, like molar teeth, show that they are put to rough work; and it is probable that their common use is to tear and scrape away the tough fibrous outer covering of the cocoa-nut, and, perhaps, to gnaw through the denser shell.

PLATE XXX.

Fig. 1. Side view of the cranium of an immature Simia Wurmbii, showing part of the permanent series of teeth in place.
2. Front view of the jaws of the same.
3. Grinding surface of the teeth of the lower jaw, (the mark X denotes the lateral deciduous incisor not yet thrust out.)

PLATE XXXI.

Side view of the cranium of the adult Simia Wurmbii; with a front view of the incisors and canines.

PLATE XXXII.

Base view of the cranium of the adult Simia Wurmbii.

PLATE XXXIII.

Side view of the cranium of Simia Morio, with a front view of the incisors and canines.

PLATE XXXIV.

Base view of the cranium of Simia Morio.
Simia Wurmbi
Semia Meru

Communicated March 28, 1837.

Ord. ACANTHOPTERYGIANÆ.

Fam. PERCIDÆ.

P. telescopium, Cuv. & Val. ii. 171. t. 24. Rariss.
Serranus Cabrilla, Cuv. & Val.—"Garoupa." Cuv. & Val. ii. 223. t. 29.
Perca Cabrilla, Linn. i. 488. No. 33.
The smooth Serranus, Yarrell's British Fishes, i. p. 9. Vulgatiss.

Is the West Indian appellation "Grouper," derived from the Portuguese name for this fish?

"Anthias sacer, Bl.," Cuv.
Labrus Anthias, Linn. i. 474. No. 3. Vulgaris.

Serranus fimbriatus, nob.—"Mero."


D. 11 + 15 v. 16; A. 3 + 8; P. 18; V. 1 + 5; C. $\frac{3}{3}^{\text{vel} 14 + \text{VIII}}$; M. B. 7; Vert. 24.


From one to two feet and a half long. In colour very like a Tench (Tinea vulgaris, Cuv.); but the sides are mottled, or irregularly spotted with yellow. I have reluctantly changed the name to avoid confusion with Serranus marginalis, Cuv. and Val. (Holocentrus marginatus, Lacep.).

Serranus fusces, nob.—"Badeijã," or "Badeijã."
S. fusco-nigricans, maculis griseis obscursis confluentibus subvariegatus s. marmoratus: pinnae caudali truncata, supra sublobata s. subemarginata, dorsalique postice angulata, analique postice truncata, nigris: spinis pinax dorsalis analisque simplicibus s. exappendiculatis: operculo spinis nigris; duobus inferioribus angustis; superiore obsoléta, rudimentali, squammiformi: preoperculo deorum subsinuato, obsolete dentículo: ossibus internaxillariibus deorum squamosis.

D. 11 + 15 v. 16; A. 3 + 11; P. i6; V. 1 + 5; C. $\frac{3}{3} + \frac{VII}{VI}$; M.B. 7; Vert. 24.


In size, habit, and general colour, very like the last; but the spots on the sides are light gray, and more confused or indistinct. An excellent fish for the table. Mr. Bowdich’s Chaetodon Leachii is a mixture or confusion of the present fish with the following.


Chaetodon Leachii, Bowd., Exc. in Mad. p. 124 (in part).

Couch’s Serranus, or Serranus Couchii, Yarr. i. 12. Vulgaris.

One of the commonest and generally most esteemed fish for the table. It grows to an immense size, often weighing from fifty to one hundred pounds or more. I have Mr. Yarrell’s concurrence to the above reference of Mr. Couch’s Stone-Basse; from which this common Mediterranean and Maderan species appears occasionally to visit the coasts of Cornwall, following pieces of floating wreck or timber.

Priacanthus fulgens, nob.—“Alfaraz,” or “Realista,” or “Alfonsin de Rolo.”

P. caudae integrae, truncata: pinnae dorsali et anali postice rotundatis; ventralibus corpori adnatis.

D. 9 v. 10 + 13; A. 3 + 14 v. 15; P. 17—19; V. 1 + 5; C. 18 v. 19; M.B. 6; Vert. 23.


An P. macrophthalmus, Cuv. & Val. iii. 97?

An P. boops, Eorund. iii. 103?

Serranus rufus, Bowdich, Ex. in Mad. p. 122, note? Rarior.

Beryx splendens, nob.—“Alfonsin.”

B. ruber: pinis ventralibus, radiis mollibus duodecum: membranae branchiostegae novem-radiatae.

D. $4 + 14$ v. 15; A. $4 + 30$; P. $1 + 17$; V. $1 + 12$; C. $\frac{5}{5} + \frac{X}{IX}$; M.B. 9; Vert. 24.

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I have reason to suspect the existence of another species in these seas, con-

founded under the name of *Alfonsin*, which may perhaps prove to be the true

*Ber. decadactylus* of Cuvier and Valenciennes.


Trachinus *vipera*, *Cuv. & Val.*—"*Aranha,*" *Cuv. & Val.* iii. 234.


Sphyraena *vulgaris*, *Cuv. & Val.*—"*Bicuda,*" *Cuv. & Val.* iii. 327.


This is the *Spet* of Languedoc; the Sea-pike (*Luccio marino*) of Italy. It is

unknown in Britain.


Striped Red Mullet, *Yarr.* 1. 27. Sat frequens.

**Fam. Triglide.**

Trigla *Cuculus*, *Linn.*—"*Cabara,*" or sometimes "*Ruivo,*" *Syst. Nat.* 1. 497.—*Cuv.* &

*Val.* iv. 26.—"*T. pini, Bloch,*" *Cuv. & Val.*


The Red Gurnard, Cuckoo Gurnard, *Yarr.* 1. 34. Rarior.

Pennant's figure of his "*Grey Gurnard,*" t. 54 (1st edition) appears to have

been taken from a gray variety of this species, rather than from the true Gray

Gurnard (*Trigla Gurnardus, Linn.*) ; which has the pectoral fins short, and the

sides of the dorsal groove unarmed. But neither this variety nor species occurs in

Madera. However, in April 1827 I once saw several specimens of another gurn-

ard, taken in a sean upon the sandy beach of the Picdade, near Canical, at the

east end of the island, which, from their large blue pectoral fins, were probably

the *Trigla Hirundo, L.*, or Saphirine Gurnard. But at the time I unfortunately

neglected to examine or preserve them, and the species has neither since occurred
to me, nor do the fishermen appear at all acquainted with it.


Sebastes imperialis, *Cuv. & Val.* ?—"*Boca negra,*" or "*Pai de Gato.*"

*S. rostro subproducto, acuto: corpore oblongo, rubro, fasciis quinque verticalibus oper-

culique fuscis; gula intus nigra: spinis preoperculi marginalibus 4 v. 5 validis,

subuncinatis, distinctis, subaequalibus: costá suborbitáli aequali, subinermi s. obsolete
dentatá: pinnarum pectoralium radiis duobus primis octoque ultimis simplicibus; no-

vem intermediis ramosis.

D. 12 + 13; P. 19; V. 1 + 5; A. 3 + 6; C. 16; M.B. 7; Vert. 25.

Sebastes imperialis, *Cuv. & Val.* iv. 336?


2 A 2
Of the five nearly equal preopercular spines, the uppermost but one is still decidedly the largest. In almost every point, indeed, the Maderan fish answers to the description above referred to in the *Histoire Naturelle* of MM. Cuvier and Valenciennes. A specimen examined had, however, seven cecal appendages; and the number of vertebrae is certainly only twenty-five in the Maderan fish; whilst the remark at p. 339 of Cuvier and Valenciennes upon their *Sebastes imperialis*, "Son squelette ressemble à celui de la sébaste du Nord, à l'exception des lègers détails de la tête," seems to intimate that the number of the vertebrae in their fish, (*Seb. imperialis*) was the same as in *S. Norvegicus*, namely thirty-one.

*Sebastes Kuhlii*, nob.—"Requeime."

*S. rostro subproducto, acuto: corpore subovali; dorso antice gibbo; rubro, maculis olivaceo-flavis, capiteque striis flavis picto: ore intus carneo; guld superne maculâ rubrâ: spinis praeperculi subquinis, inæqualibus, abbreviatis: costâ suborbitali inæquali, dentatâ: spinâ solitarid in corpore supra basin pinnarum pectoralium; harum radiis omnibus simplicibus.

D. 12 + 10; P. 17; V. 1 + 5; A. 3 + 6; C. 16; M.B. 7; Vert. 24.


A very handsome, though extremely common fish: its usual size is about a foot long.

*Sebastes Maderensis*, nob.—"Rocaz."


D. 12 + 10; P. 15; V. 1 + 5; A. 3 + 6; C. \(4 + 5\) \(3 + 7\); M.B. 7.


A small pretty species, four or five inches long; found very commonly in pools left by the tide amongst the rocks.

**Fam. Scleniïde.**

Pristipoma Bennettii, nob.—"Roncador," "Roqueirão," or "Salmão."

*P. dorso pinnisque maculâque operculari olivaceo vel æreo-fuscis: lateribus chalybeis; ventre argenteo: membrâ brachiiostegâ operculoque intus aurantis: caudâ furcatâ.

D. 12 + 16; A. 3 + 12 v. 13; P. 17; V. 1 + 5; C. \(4 v. 5 + IX\) \(3 v. 4 + \text{VIII}\); M.B. 7; Vert. 26 Rarior.

From eight to ten or twelve inches long. Except the spot above the angle of
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the operculum, immaculate; the dorsal and caudal fins being of the same uniform, rich olive or yellowish-brown umbre, as the back. The anal fin is paler, and the pectorals are brighter, but of the same tint, which also in some specimens spreads quite down the sides of the body. The sixteenth ray of the dorsal fin, and twelfth or thirteenth of the anal, are double, or forked to their base.

Notwithstanding the external differences just indicated, I should scarcely have ventured, in the absence of better materials for comparison, to found upon them a new species, in a genus so intricate as Pristipoma, had they not been corroborated by certain important anatomical characters, at variance particularly with those assigned by MM. Cuvier and Valenciennes to their P. Rogerii (Hist. Nat. v. p. 254), the species which in other respects appeared most nearly allied to the Maderan fish. Its name is a tribute due to the memory of my much-regretted friend, E. T. Bennett, Esq., late Secretary to this Society.


The above slight modification of the name "Heliases" is proposed, in deference to the common rules of Greek derivatives.

Fam. Sparidæ.


Charax cervinus, nob.—"Sargo Veado."


D. 11 + 12; A. 3 + 11; P. 15; V. 1 + 5; C. \( \frac{4 + IX}{3 + VIII} \); M.B. 6; Vert. 24.

Rarior.


The Braize or Becker, Yarr. i. 102. Vulgaris.


The Sea Bream, Yarr. i. 107. Vulgariss.


Pagellus rostratus, nob.—"Bica."

P. roseus, immaculatus; corpore ovali, subanguloso; dorso elevato, carinato: rostro
subproducto, ore prominente; dentibus molaribus biseriatis: praecoperculo basi angulato; limbo punctato et striato, striis rectis, aequidistantibus: lineae laterali utrinque curvata, antice inmaculata.

D. 12 + 10; A. 3 + 9 v. 10; P. 15; V. 1 + 5; C. $\frac{3 \times 4 + IX}{3 \times 4 + VIII}$; M.B. 6; Vert. 24.

Rara.

The teeth are truly those of a Pagellus, those in front exactly resembling the front teeth in Pagell. centrodontus. In other respects it much resembles Pagrus orphus, Cuv. & Val. vi. 150. t. 149.

Canthus griseus, Cuv. & Val.—“Choupa,” Cuv. & Val. vi. 333.


The Black Bream, Yarr. i. 114. Sat frequens.

Box vulgaris, Cuv. & Val.—“Boga,” Cuv. & Val. vi. 348. t. 161.

Sparus Boops, Linn. i. 469. Vulgatiss.

Box salpa, Cuv. & Val.—“Salam,” Cuv. & Val. vi. 357. t. 162.

Sparus Salpa, Linn. 470. Vulgaris.

One of the handsomest but most worthless of fishes.

Oblada melanura, Cuv. & Val.—“Dobrada,” or “Dobradica,” Cuv. & Val. vi. 366. t. 162 bis.

Sparus Melanurus, Linn. i. 468. Vulgaris.

This fish has the rather anomalous character of having the lower lobe of the caudal fin larger, or with one more long ray than the upper.

Fam. Menidae.

Smaris Roycri, Bowd.—“Bocairão,” or “Boqueirão.”

Sm. Royeri, Bowd. Exc. in Mad., p. 123. f. 26.—Cuv. & Val. vi. 421.

Sm. insidiator, Cuv. & Val. vi. 414.

Sm. angustatus, Cuv. & Val. (Sciaena angustata, Soland. Park.) vii. 421. Vulgatiss.

There can be little doubt that the above three synonyms belong to one and the same species, viz. the very common Bocairão of Madera, of which the following is the correct fin-formula:

D. 13 v. 12 + 10 v. 9; A. 3 + 10; P. 18 v. 17; V. 1 + 5; C. 17; M.B. 6; Vert. 24.

The Portuguese name, signifying “a gulph, whirlpool, pit, abyss, or swallow,” (Vieyra), is probably derived from “Boca,” “a mouth, hole, or opening,” V., and no doubt refers to the peculiarly protracile mouth, instead of “denoting that it is found in deep waters,” as supposed by Bowdich.

Fam. Bramidæ, nob. in Trans. of the Cam. Phil. Soc.

Gen. Polymixia, nob.

Corpus elliptico-oblongum compressum; squamis asperrimis, sat magnis.

Pinna dorsalis et pinna analis nudae, antice elevatæ, spinis debilibus, inconspicuis, brevis, paucis; basi in sulco sita, squamisque marginalibus sulci utrinque celata. Pinœ ventrales septem-radiatæ; radio primo simplici, at molli, articulato.

Cauda furcata.

Membrana branchiostega quadriradiata.


This curious new genus is perhaps more closely allied to the Percidae than to the true Chaetodontidae. Viewed as one end of an osculant group, connecting these two families together, by means of the old-established genus Brama, Bl., and the following new one Leirus, nob., it is an interesting addition to our catalogues, to which it is only most extraordinary that it has not sooner been admitted, being far from uncommon, and a well-known market-fish, deservedly held in the very highest estimation for the table.

Brama Raii, Cuv. & Val.—“Freira,” Cuv. & Val. vii. 281. t. 190.


Ray’s Bream, Yarr. 117.


Gen. Leirus, nob.

Corpus ellipticum, compressum, squamis deciduis, laevibus, parvis.


Pinna dorsalis et pinna analis squamosæ, postice latiores.

Cauda subfurcata.

Membrana branchiostega septemradiata.


Another new and very distinct genus, closely allied to Brama, and through it to the preceding genus Polymixia; whilst on the other hand it approaches the true Chaetodontidae in more points than even Brama does. Each of these three
genera, however, offers characters so much at variance with those of other constituted families, whilst they possess collectively so strong an air of family resemblance amongst themselves, that I have not hesitated to consider them as the nucleus of a new small family group, for which, in the Cambridge Transactions, I have proposed the name of *Bramidæ*.

**Fam. Scombride.**

*Scomber scomber*, *Linn.*—“*Cavalla.*” *Linn.* i. 492. No. 1.

S. *scombrus*, *Cuv. & Val.* viii. 6.

The Mackerel, *Yarr.* i. 121. Vulgatiss.


Scomber *Thynnus*, *Linn.* i. 693. No. 3.

The Tunny, *Yarr.* i. 134. Vulgatiss.

Three other species or varieties of *Tunny proper* are distinguished by the fishermen, under the names of “*Atum Patudo,*” “*Atum Albacora,*” and “*Atum Avoador.*”

*Thynnus pelamys*, *Cuv. & Val.*—“*Gaiado,*” *Cuv. & Val.* viii. 113. t. 214.

Scomber *Pelamis*, *Linn.* i. 492. No. 2.

The Bonito, *Yarr.* i. 140. Vulgatiss.

**Gen. Aplurus, nob.**

*Corpus* elongatum, compressum, capiteque cute coriaceo, retrorsum echinato-scabro asperrimum: abdomine carinato: postice utrinque planum, simplex s. ecarinatum.


*Pinna dorsales* duæ: prior angusta, spinis debilibus, brevibus, subequalibus: secunda triangulari, antice elevata, postice in pinnulas spurias subsecedente.

*Pinna analis* secundæ dorsali simillima.

*Cauda* furcata.

*Membrana* branchiostega septem-radiata.

*Ceca* plura. *Vesica* âcrea parva.


*A. tota* purpureo-fusca; 3 ad 4 v. 5 pedes longa; muriculato-squamulosâ; s. *squamulis* in spinellas subradiantes, adpressas, postice abeantibus, retrorsum scaber-rima, quasi fufuracea.
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D. 14 v. 15—II; A. 14—II; P. 14; V. 1 + 5; C. fere 20; Vert. 32. Rarior.

The flesh of this very singular species is said to be extremely rich, and the bones, it is affirmed, abound in an oil or marrow, which, when they are sucked incautiously, produces speedy diarrhoea. The fish is not uncommonly brought into the market, where its flesh is sold by the pound; but it is seldom seen except at the tables of the Portuguese. Its place in the system seems to be next Tyrsites, Cuv. & Val.

Prometheus atlanticus, nob.—"Coelho," v. "Peixe Coelho."

Gempylus Prometheus, Cuv. & Val. viii. p. 213. t. 222. (piscis junr.)

Solandri, Cuv. & Val. viii. p. 215. (piscis adult.)

(Scomber macrophthalmus, Soland.) Cuv. & Val. Vulgatiss.


Lepidopus or peite espada, of the Tagus, Bowd. Ex., p. 10. f. 1.


Gen. Alepisaurus, nob.

Corpus elongatum, attenuatum, capiteque omnino nudum, valde compressum; postice utrinque carinatum.


Membrana branchiostega septem-radiata.

(Cæca vesicaque aëris nulla).


Two more specimens have occurred in the spring of the present year; one about two feet, the other about three feet and a half long. The fin-formula was:

In the smaller specimen,

D. 46; A. 15; P. 14; V. 9; C. \( \frac{9}{9} + \frac{9}{9} + \frac{9}{9} \)

In the larger specimen the dorsal fin was injured at the hinder end, and had only thirty-nine rays left. The others were,

A. 16; P. 14; V. 9; C. \( \frac{9}{9} + \frac{9}{9} + \frac{9}{9} + \frac{9}{9} + \frac{9}{9} \)
In each the branchiostegous membrane was on both sides seven-rayed; and the joints of the spine, which was soft and flexible, or almost merely cartilaginous, and when dry fragile, thin, and light almost as tissue-paper, were in number fifty.

The visceræ are singularly simple. The stomach is a vast, oblong, simple, black sac, filling the whole abdominal cavity (when distended with food) from one end to the other. The intestine is perfectly straight and simple, originating remarkably forward, even from the very entrance into the stomach or esophagus, with no trace of æœna at the pylorus. The liver is small; and there is no air-bladder. This remarkable simplicity of internal organization reminds one strongly of the Blenny family (Gobidae); to which there are not wanting points also of external resemblance, such as the general smoothness, want of scales, feebleness of the fin-rays, &c. (Confer Anarrhichas.)

The stomach of these two individuals was found completely gorged with food. In that of the smaller I found specimens of three distinct species of Hyalea, of Carinaria mediterranea, a Limicina, Cranchia, Loligo; and various pelagic Isopodous Crustacea in great numbers. Of fishes, it contained two small specimens of Capros aper, Lac.; two of the young of some Shark (Squalidae), too much decomposed to be made out; and a single specimen of the fry of its own species! only two inches and a half long, but perfectly formed and entire, except the tail-fin, which was quite decomposed. The teeth, it is highly interesting to observe, had attained, even in this minute specimen, their full development, especially in size, being even proportionately larger than in the more full-grown specimens. In the lower jaw there is a pair of moderately-sized ones at the tip; and at some distance behind these there is another pair of vastly larger size, locking between two corresponding pairs, one behind the other, in the upper jaw. In the upper jaw there is a pair, a little backward from the tip, of large moveable teeth, placed close together, side by side, one upon each palatine bone, near its anterior symphysis; and at some distance behind these, so as to allow the long pair of the lower jaw to lock into the interval, a smaller pair further apart; each tooth of the pair being exactly opposite the other. The rest of the teeth are exactly as in the larger specimens.

The stomach of the larger of the two individuals above-mentioned contained three specimens of Capros aper, Lac.; two small ones of Sphyraena vulgaris, Cuv., four or five inches long; a pretty large Garoupa (Serranus cabrilla, Cuv. & Val.), five or six inches long; the beak of a Cuttle-fish; a Hyalea; and an Idotea.

I have had no opportunity of accurately examining the "Sword-fish" of Madiera, which is occasionally taken, but have no reason to doubt its being the true Xiphias gladius, L. It is called by the Portuguese "Peixe Ayulha;" though the fish more commonly known by that name is the Gar-fish (Belone vulgaris, Cuv.).
Gasteroistes ductor, Linn. i. 489. No. 2.
The Pilot-fish, Yarr. i. 149. Rarior.
Scomber Glaucus, Linn. i. 494. No. 5. Vulgatiss.
Caranx Cuvier, nob.—"Chicharro."
C. corpore graciliore; lineae lateralis angustae parte posteriore rectae, anteriori curvatâ aequali; scutellis 94 ad 99 armatae.
Cuv. & Val. ix. p. 18.
First properly indicated as a distinct species from the common Horse Mackerel of the British Channel (C. trachurus, L., Yarr. i. 154. Cuv. & Val. ix. 11. t. 246.), by MM. Cuvier and Valenciennes, as above cited.
Gasteroistes Saltatrix, Linn. i. 491. No. 7.
The only specimen I have seen was twenty-two inches and a quarter long.
The Dory, or Doree, Yarr. i. 162. Sat frequens.
Not inferior in flavour to the common European or English John Dory, from which it differs in no point whatever of external character.
Zeus aper, Linn. i. 455.
Zeus Childrenii, Bowd. Exc. in Mad. p. 124.
The Boar-fish, Yarr. i. 169. Vulgaris.
Lampris lautæ, nob.—"Peixe Cravo."
D. 1 + 54; A. 1 + 39; P. 1 + 25; V. 16; C. $6 + X \over 6 + IX^$. M. B. 6 utrinque; Vert. 49.
In another specimen the fin-formula was
D. 1 + 54; A. 1 + 41; P. 1 + 24; V. 17.
Rarior.
The general agreement of this fish with the descriptions of L. guttatus, Retz, is very close; and to that species, notwithstanding certain important differences, I had formerly referred it, known, as it long remained to me, only by the exa-
mination of a single specimen. MM. Cuvier and Valenciennes, however, state, in the 10th volume of their *Histoire*, the number of the vertebrae in that species to be only forty-three. I have also lately obtained the fin-formula of another specimen, and ascertained the smoothness of the tongue to be constant in several more of the Maderan fish. The strongest grounds for its specific distinction from the old-established species are, that the only specimen examined as to these two points had six vertebrae more, and one branchiostegous ray less, than *L. guttatus*, Retz, is described to possess. It may, however, possibly prove identical with *L. guttatus* of Nilsson and Faber, which had also only six branchiostegous rays.

**Fam. Mugilidæ.**


The Atherine, or Sandsmelt, *Yarr.* i. 214. Vulgatiss.

It is a curious fact that the Atherine of the Canaries is, according to MM. Cuvier and Valenciennes, a different species from that of Madera, viz. the true *A. hepsetus*, L.


The Thick-lipped Grey Mullet, *Yarr.* i. 207.

1st D. 4; 2nd 1 + 8; A. 3 + 9; P. 1 + 17; V. 1 + 5; C. \(3v.4 + \frac{1}{1+VI}\); M. B. 6; Vert. 24.

This fish is altogether more slender and shapely than the next species; but is at once distinguished by its perfectly smooth and even upper lip, which is also smaller and thinner than in *M. corrugatus*, and has the edge very distinctly ciliated. The suborbitaries are more slender, narrow, and strongly crenulated, but not notched, yet showing just the ends of the maxillaries when the mouth is closed. Several scales above the axil of the pectoral fins are more pointed than the rest, but not enlarged or elongated.

*Mugil corrugatus*, nob.—"Tainha."

*M. labro superiore lato, crassissimo, antice corrugato: intermaxillarium extremitatis, ore clauso, conspicuis: suborbitarii subemarginatis, minutissime crenulatis: foraminibus nasalis approximatis."

1st D. 4; 2nd 1 + 8; A. 3 + 9; P. 1 + 17; V. 1 + 5; C. \(4v.5 + \frac{1}{1+VI}\); M. B. 6; Vert. 24.

Vulgatiss.

There is no enlarged or pointed scale above the pectoral fin, or adipose veil at the fore and hinder edge of the orbit, in this species, which is the common "Tainha," simply so called, or Gray Mullet of the island. The ends of the
maxillaries appear altogether below the commissure or canthus of the closed mouth, as in _M. labeo_, Cuv. & Val., or _M. chelo._

**Fam. Gobiidæ.**

Blennius palmicornis, _Cuv. & Val._—" _Cabez,_" " _Frade,_" or " _Peixe frade,_" _Cuv. & Val._ xi. p. 214; haud Yarr.

B. pholis, _Risso_ iii. 232. No. 119.

D. 33; A. 21; P. 13; V. 2 + 1; C. \( \frac{5 + \text{VI}}{4 + \text{V}} \); M. B. 6.

Vulgaris; cum _Sal. atlantico, inter rupes ab estu relietas._ About six inches long.

My specimens certainly belong to this species.


A single specimen only, 2½ inches long, has occurred, which I had not an opportunity of examining, but which, judging from Miss Young's notes and drawing, must be referred to _B. inaequalis_ rather than to _B. trigloides_, _Cuv. & Val._ In this figure the upper tentacle is placed upon the vertex, behind rather than between the eyes; so that I am not entirely free from suspicion that it may prove an imperfectly observed _B. Montagui_, Flem.; and this rather than _B. Artedii_, _Cuv._ & _Val._, though the latter has been established from Maderan specimens.


Shanny, or Smooth Shan, _Yarr._ v. i. p. 230.


Always characterized by an orange-red patch in the middle of the pectoral, and on the upper and lower parts of the caudal fins.


D. 3—17—(2 + 10); A. 2 + 25; P. 16; V. 2; C. \( \frac{6 + \text{I} + \text{IV}}{6 + \text{I} + \text{III}} \); M. B. 6.

Longit. 2\(\frac{7}{8}\) unc. Rariss.


Black Goby, _Yarr._ v. i. p. 251.

**Fam. Labridæ.**


Crenilabrus caninus, nob.—"Peixe Cão."
C. ruber: pinnae analis trispinosae, albidae, immaculatae; dorsalis flavae, antice rubescente nigroque maculatae; pinnis pectoralibus carneis, basi flavis; caudae radiis exterioribus rubris; mediis flavis, interstitiis nigris.
D. 12 + 10 v. 11; A. 3 + 13. v. 14; P. 17; V. 1 + 5; C. 16; M. B. 6; Vert. 28. Vulgaris.
From twelve to sixteen inches long. Of a nearly uniform deep bright vermilion, with an obscure olivaceous band over the head, from the front corner of one eye to the other, and a black patch, extending some way up each side, from the origin of the anal fin. Traces of narrow, dusky, waved, vertical bands are also seen, low down along the sides or belly. The head and opercula are a little variegated with yellow. The large patch on the first three or four spines of the dorsal fin is dark violet, or black. The caudal fin has the rays red or yellow, with the interstices black; so that the tail appears in the middle longitudinally barred alternately with black and yellow. The flesh of this fish is as indifferent as its outer colouring is brilliant.
Crenilabrus pictus, nob.—"Trombetão."
C. capite nuchā guldque caeruleis, inter oculos fasciis flavis flexuosis: corpore rubescente, caeruleo variegato; maculā supra lineam lateralem caeruleam ad basin caudae fascō: pinnis pectoralibus citrinis, basi maculā caeruleo-nigrā; dorsali analique flavis aurantiiseve, plus minusve rubris, immaculatis, nigro-caeruleo marginatis; caudali basi aurantid, dimidio posteriori nigro-caeruleo.
D. 17 + 8. v. 9; A. 3 + 11. v. 12; P. 15; V. 1 + 5; C. 15. Rariss.
I propose this as a species not without diffidence, a single example only having yet occurred. In so intricate a genus as the present, it is better to err by over distinguishing than confounding; and, in the present state of ichthyological knowledge, to labour to supply those who may have hereafter means of judging the materials for coming to a sure decision, by separately registering every variation, which cannot at present be referred with certainty to its appropriate type. The evil of an useless name swelling the list of synonyms, every accurate naturalist will readily admit to be far less than the confused entanglement resulting from a describer mistaking affinity or similarity for identity. The present fish, in its general reddish tint of body and blue head, reminds one of C. Tinea, Yarr., but differs in the dusky spot above the lateral line at the base of the caudal fin, and the deep indigo spot at the base of the pectoral fins, which is bordered by a crescent-like mark or lunule of brilliant lemon yellow. In this
last point it approaches C. Boryanus, Risso; but in the number of fin-rays, and several other points, it seems nearer C. mediterraneus of the same author.

Crenilabrus trutta, nob.—“Truta do Alto.”

C. virescens, variegata et maculata; squamis medio fuscis; fuscis verticalibus fuscor- nigrescentibus: cauda utrinque basi fusco uni-maculata: pinnâ anali quinque-spino-

D. 17 + 8; A. 5 + 8; P. 14; V. 1 + 5; C. 13; M. B. 5.


β Var. unicolor; viridis, subimmaculata. Rariss.

Crenilabrus luscus, Yarr.—“Truta.”

The Scale-rayed Wrasse of Couch’s MS., Yarr. i. p. 300. Rariss.

The anal fin in the Maderan fish has only five spines. The dorsal fin has a large black patch at the end of the spiny portion, while the root of the tail has a dark patch at its lower or ventral, as well as at its upper or dorsal edge; neither of which characters are noticed by Mr. Couch in his description, quoted by my friend Mr. Yarrell. With these exceptions there is in general a strong agreement; and especially the peculiarity of the large scales extending up between the rays of the dorsal and anal fins, thus forming imbricated moveable processes, renders most probable the identity of the Maderan with the British species.


Coryphaena Novacula, Linn. i. 447. No. 4. Rariss.

Scarus mutabilis, nob.—“Bodiao.”

S. versicolor; olivaceo-fuscus, vel ruber, vel utroque colore pictus: cauda truncata.

D. 9 + 10; A. 3 + 9; P. 1 + 12; V. 1 + 5; C. 13; M. B. 5.

Vulgaris.

In the absence of materials for accurate comparison with other genuine Scari, the provisional formation of a new specific name and character, however imperfect the latter, seems less likely to produce confusion than a doubtful reference of the present fish to an old synonym. It possesses no pretensions, except in brilliancy of outer colouring, to the fame of the celebrated Scarus of the Romans, being one of the worst, if not the very worst, of the Fishes usually brought into the market in point of quality or flavour.

**Fam. Fistularide.**


Ord. MALACOPTERYGIANÆ ABDOMINALES.

Fam. CYPRINIDÆ.


The Gold Carp, Yarr. i. 315. Vulgaris.

Domesticated, or rather naturalized in all the tanks, &c. of the island, yet not found in the streams or torrents.

Fam. ESOCIÆ.


Esox Belone, Linn. i. 517. No. 6.

Gar-pike, or Sea-needle, Penn.

The Gar-fish, or Sea-pike, Yarr. i. 391. Haud rara.


Saury Pike-skipper, Yarr. i. 394.


Fam. SALMONIDÆ.


I do not feel by any means secure in the above reference. Besides other discrepancies, the following is the fin-formula of the Maderan fish:

1ma, D. 15; 2da, adiposa; A. 11. v. 12; V. 9; P. 13; C. 19; M. B. 16. v. 17; Vert. 51.

Saurus griseus, nob.—"Lagarto de rolo," or "L. da costa."


1ma, D. 12; 2da, adiposa; A. 11. v. 12; V. 8; P. 13; C. $^{8+1+VIII}$; M. B. 16; Vert. 60.

An Salmo Saurus, Linn. i. 511. No. 14? Rariss.

Very distinct from the preceding, whatever it may prove to be from others, when compared by those who have the means of judging. One of the only two specimens I have seen had sixteen branchiostegous rays on the right, and seventeen on the left side.
OF THE FISHES OF MADEIRA.

Fam. Clupeidæ.

Clupea maderensis, nob.—"Arenque."


D. 19; A. 19; V. 1+7; P. 17; C. 19; M. B. 6; Vert. 47.

Vulgatiss.

This, the common Herring of Madera, abounds in the spring and earlier summer months.

Clupea sardina, Cuv. ?—"Sardinha."


D. 17; A. 17; V. 1+7; P. 16; C. 19; M. B. 7; Vertebrae 50 v. 51.

La Sardine (Clupea sardina, N.), Cuv. R. An. ii. 319.?


Much less abundant; and scarcely taken, except in stormy weather during the winter months. This species never exceeds six inches in length. The "Arenque" averages eight or ten inches.

Ord. Malacopterygianæ Subbrachiales.

Fam. Gadidæ.


Gadus Merluccius, Linn. i. 439. No. 11.


Motella tricirrata (Nilss.), Yarr.—"Abrotea de Poça."

Three-bearded Cod, Penn. iii. 201. t. 33. No. 87.

The three-bearded Rockling, Yarr. ii. 186.

La Mustèle commune, Cuv. R. An. ii. 334. Rariss.

This species, having only three beards or cirri, can scarcely be properly referred, as it is by Cuvier, to the Gadus Mustela, L., which is described as having five.


Blennius Phycis, Linn. i. 442. No. 7.


VOL. II.—PART III. 2 c
A much-esteemed fish for the table when in season, and thought to resemble
the Whiting (Merlangus vulgaris, Cuv.) in flavour.

Phycis Yarrellii, nob.—"Abrotea do alto."

P. capite depresso: corpore graciilore, elongato, angusto, pallide cinereo-lilacino:
pinnis dorsalibus anali et caudali nigris, albo fimbriatis: prima dorsalis quinque-
radiatae radio primo producto, elongato, secundae dorsalis radios duplo excidente:
ventralibus capite subbrevioribus.

lma, D. 5; 2da, 59; A. 60; Ps. 23; V. 1; C. 20, fere; M. B. 7. Rariss.
The only specimen yet seen was between eight and nine inches long. By the
name, I wish not only to offer a public tribute to one of our ablest ichthyologists,
but my private acknowledgements to the friend who first drew my attention to
this very distinct and pretty species.

Lepidoleprus coelorchynus, Risso, iii. 244. No. 133. Rariss.
Of this most singular fish I have seen but three examples.

Fam. Pleuronectidae.

Rhombus maderensis, nob.—"Sola," or "Solha."

R. corpore ovali; latere sinistro scabriuscolo, etuberculato, olivaceo-fusco, ferrugi-
nascente, annellis punctorum albiderum ocellatim picto: pinnae dorsalis analisque
radiis inclusis, indivisis: dentibus minutis, uniseriatis: maxilll superiore ambitu-
que oculorum antice tuberculato-cornutis.

D. 91—95; A. 69—71; P. \{sin. 10 v. 11.\}; V. \{sin. 6.\} \{dext. 9 v. 10.\}; C. 15—17.
Rarior.
I have heard of another "Sole," but have not yet obtained a specimen.

Fam. Cycopteridae.

Lepadogaster?—"Chupa sangue."

L. Candollii, Risso, iii. 275. No. 169.? Rariss.
Of this very curious little fish I have only obtained a single specimen, which
agrees tolerably with the species above referred to, as far as the account there
given goes. Without better materials, however, both for description and com-
parison, I can by no means satisfy myself even as to the genus of the Maderan
fish. The ventral disk is truly double; or rather there are two, properly distinct
and separate ventral disks, as in a genuine Lepadogaster; but the ventral fins
spring from the sides of the first, or anterior disk, and are united by their hinder
margins with the pectoral fins, as in Liparis: thus they have no connexion what-
ever with the second, or hinder sucking-disk. A short fleshy conical cilia, close behind the vent in a groove, reminds one of Gobidae. In form this fish resembles a good deal Lep. bimaculatus, Yarr. ii. 268; but the muzzle before the eyes is considerably longer, broader, and more depressed; and the dorsal and anal fins are continued nearly to the caudal, though still not joined to it. The fin-formula is, D. 14; A. 10; P. 25; V. 4; C. 15.

**Fam. Echeneidæ.**

Echeneis ————?—"Pogador," or "Apogador." Rariss.

Of this I have also seen only a single specimen, which I cannot venture to identify positively with any published species; far less at present to characterize as really new. It approaches nearest to E. naucrates, L. in the truncate tail: while in its uniform dark slaty colour and scaliness it resembles the West Indian species, published in the fifth volume of the Zoological Journal (E. lunata, Bancr.). It differs, however, from both, and approaches E. Remora, L., in having only sixteen laminae to the sucker. The pectoral fins were very obtuse, or even truncate. The specimen was nearly eight inches long. The fin-formula as follows;

D. 28; A. 24; P. 26; V. 1+5; C. \(\frac{3}{3}v.4+7\); M. B. 8.

Echeneis Naucrates, L.?—"Peixe Pogador." Linn. i. 466. No. 2.? Rariss.

All I know of this fish is from a short note, furnished me by my friend and assistant Miss Young, of a single specimen, seen for a few minutes only, and partially examined by her. "It was about fifteen inches long, and the sucker had twenty-four pairs of laminae. It was round and thick at the shoulders, yet much attenuated at the tail, where the other species was broad and thick. The tips and edges of the dorsal and anal fins were white."

As to the colour and the shape of the tail, I can only say, that had they differed from the former species in any remarkable degree, Miss Young would no doubt have observed it.

**Ord. Malacopterygianæ Apodes.**

**Fam. Murenidæ.**

Anguilla latirostris, Yarr.—"Eiro."

The Broad-nosed Eel, Yarr. ii. 298.

Eels are the only indigenous fresh-water fish of the island. They abound in the torrents, up to the height of about 500 feet above the sea. There are more species or varieties; but I am not sufficiently acquainted with them at present to attempt their classification.

Muræna Conger, Linn. i. 426. No. 6.

The Muræna, Yarr. ii. 308. Vulgaris.

Muræna anatina, nob.—"Moreia Serpente," or "Serpente."
(The Duck’s-bill Muræna, or Sea-serpent).

M. corpore post caput contracto, dein crassiore, postice attenuato; purpureo-hepatico, flavo maculato; maculis longitudinaliter seriatis: capite incrassato, occipite elevato, gibbosum; rostro tenui, elongato, producto, depressum: dentibus acicularibus, rectis, elongatis, numerosis; in maxilla superiore tri-, in inferiore bi-seriatis: pinnae dorsalis radio primo super apertura branchialis.

Sat vulgaris.

Muræna guttata, Riss.?—"Moreia preta."

M. corpore utrinque attenuato, nigrescente, albo guttato 5, punctato: capite minimo, brevi, acuto: dentibus acicularibus, rectis, elongatis; in maxillâ superiore sub-biseriatis; in inferiore uniseriatis.

Risso, iii. 191. No. 77. Sat vulgaris.

Muræna unicolor (Lar.), Cuv.—"Morrião."

M. corpore postice attenuato, antice crassiore, hepatino, immaculato, lineis circularibus capillaris, flexuosis, confertissimis picto: capite incrassato; occipite gibbosum; rostro brevissimo, obtuso: dentibus brevibus, conicis; in maxilla superiore antice tri-, lateralibus bi-seriatis; in inferiore antice bi-, lateralibus uni-seriatis.

Cuv. R. An. ii. 352.

M. Cristini, Risso, iii. 191. No. 78. Sat vulgaris.

Ord. LOPHOBANCHIA.

Fam. SYNGNATHIDE.

The short-nosed Hippocampus, Yarr. ii. 342. Rariss.

Hippocampus ramulosus, Leach.—"Cavalo marinho." Leach’s Zool. Miscell. i. 105. t. 47. Rariss.

Dr. Leach’s figure, though generally good, is deficient in several points, especially in colour, being taken from a preserved specimen. I had an opportunity of delineating the form, and watching the movements of this most interesting little animal, while living, in a glass of sea-water, for nearly a whole day. No pencil can do justice to its elegance and beauty; and the gem-like brilliancy of its eye especially is quite inimitable by colours. The branched cilia are quite flexible, soft, and floating; not straight and rigid, as they appear in Leach’s
figure. Those on the head resemble a stag's antlers. With the tail curled round a stick placed in the water, it was frequently at intervals employed in making circular sweeps with the head and body round the glass, as if in search of food, or trying its extent, accompanying each sweep with a rapid vibratory flutter of the fin.

Ord. PLECTOGNATHI.

Fam. GYMNOdontIDE.


Ostracion subrotundus; aculeis undique brevibus triquetris raris. Artedi, Gen. 59.

Diodon Atinga, ß. reticulatus, Linn. ed. 12ma, l. 413.

Le Diodon orbe, Lacepede. Rarior. A foot long or more. From the synonyms, this would appear to be the Diodon rivulatus of Cuv. R. An. ii. 367, note.

Tetrodon Pennantii, Yarr.—"Sapo," Yarr. ii. 347.

T. laevigatus, Penn. ed. 1ma. iii. 132. t. 20.


Tetrodon marmoratus, nob.—"Sapo."

T. pusillus; corpore supra fusco, maculis majusculis diffusis nigris marmorato, levis-simo, sparsim ciliolato; lateribus colore in lineâ longitudinali rectâ seriato-maculâ abrupte desinente: infra lacteo, immaculato, aequi-ciliolato.

D. 7; A. 6; P. 14; C. 7. Rarior.

This pretty little Toad-fish seems nearest allied to T. Spengleri, which is also T. Plumieri, Lac. according to Cuvier, though it cannot safely be referred either to that, or any other species in Artedi, Linnaeus, or Lacepede. It scarcely exceeds six inches in length. The ciliate are compressed, very short and obscure, being concealed in little pits or pores; those on the belly are regularly disposed quincuncially. The dorsal and pectoral fins are pale: the caudal fin is dark brown, like the upper half of the body, with a pale vertical band near the base. The anal fin is white.

Fam. BALISTIDE.


B. cauda bifurca, pinnae dorsi maculosa, Art. Gen. 54. No. 3; Syn. 82. No. 3.

Le Baliste queue-fourchue, Lacep.

Balistes lunulatus, Risso, iii. 175. No. 57.² Rara.
Ord. CHONDROPTERYGIANÆ.

Fam. SQUALIDEÆ.


Long-tailed Shark, *Penn.* iii. 110. t. 14. No. 44.


The "Marraxo" of the fishermen is probably some species of this genus; though it may be also merely the following (*Lamna cornubica, Cuv.*) full-grown, or of large size. I have not seen a specimen.

The "Tubarão" is another large-sized Shark, which I have not seen. From the teeth being described as small, it may prove, perhaps, to be the Basking Shark (*Selache maxima, Cuv.)*

*Lamna cornubica, Cuv.—"Requim" or "Nequim," R. An.* ii. 389.


*Squalus Galeus, Linn.* i. 399. No. 7.

Tope, *Penn.* iii. 111.


"Le Squale Perlon, Lacep." *M. Young.*

"Squalus cinereus, Gm." *Cuv.* Rarior. I have not seen the specimen, but depend on Miss Young’s identification of one brought to her in May 1835, with "le Perlon, Lac.", during my absence from Madera. The head of this specimen is at present in the Society’s Museum.


A single female specimen only has occurred, measuring 3 feet 3 inches in length. It contained six young ones, from 3 to 3½ inches long; they were altogether white, except their fins and tail; the teeth unfortunately were not yet formed. Their dorsal spines were soft and flexible. The branchiae were completely external, being exserted through the branchial openings in the form of copious long filaments.


OF THE FISHES OF MADEIRA.

Squalus Zygaena, Linn. i. 399. No. 5. Rarior.

Fam. RAiIDE.

Torpedo marmorata, Risso.—"Dromideira," i.e. Dormideira, Risso, iii. 143. No. 28. f. 9.
Rarior.

Torpedo hebetans, nob.—"Tromentin."

T. subitus alba, nigro marginata: supra nigrescens, unicolor, punctulis minimis raris, ad marginem anteriorem crebroribus adpersa: spiraculis majusculis, simplicibus: cauda corporis fere longitudine, vix breviore, apice truncatâ.
Rariss.

I should scarcely have ventured to consider this distinct from T. Galvani, Risso, had not Cuvier fortunately supplied a most essential mark of difference, by describing that species "A sept dentelures charnues autour de ses évênts." This character belongs indeed to my T. marmorata, but not to the present species; which may, however, also possibly be only a plain immaculate variety of "La Torpille à taches ocellées," Cuv. ii. 397, T. narke, Risso, iii. 142.

Raia Maderensis, nob.—"Raia" or "Arraia."

R. corpore exacte rhombiformi: supra scabro, griseo-fusco, maculis pallidis, cinereis, ocellatis, in figuras fasciasve flexuosas, transversales, indistinctas dispositis guttato: rostro brevi haud producto, marginibusque pectoralium anterioribus hispido-scabris; dorso subinermi, medio tantum fere bi-aculeato: cauda aculeis triseriatis; lateralisbus subobsoletis; omnibus basi simplicibus, recurvis.
Haud rara.

The upper or dorsal surface of this fish, which is the common Skate of Madeira, is rough like a file, especially towards the anterior edges of the pectorals and snout; but otherwise unarmed, except generally two pretty conspicuous prickles about the middle of the back, one close behind the other, and a single prickles at the anterior, and another at the posterior canthus of each eye. All these, as well as those on the tail, which extend no further forward than its root, are recurved, and without the prominent tubercular base, resembling the head of a nail, so remarkable in the Thornback, R. clavata, L., to which this species comes in shape the nearest. The teeth are quite flat and pointless, like those of the "Caneja," Mustelus Lævis, Flem. No. 106, supra. The eye is furnished with a most curious and beautiful palmato-radiated nictitating membrane, of a greenish or brassy gold-colour, like their lids. I have seen only female specimens; none exceeding 20 inches long by 14 broad.

1 Lateribus scilicet omnibus æqualibus.
Raia Pastinaca, Linn. i. 396. No. 7.
The Sting Ray, Yarr. ii. 442. Rarior.
Raia Aquila, Linn. i. 396. No. 6.

The foregoing list has no pretensions for consideration as a full and perfect catalogue of the Maderan fishes. Having scarcely begun to feel much interest in ichthyology till a period when continual engagement in more serious duties precluded all regular or close attention to the subject, I have been obliged to rely altogether for the capture or collection of the species on the common fishermen, whose indolence a bribe will scarcely stimulate, and whose carelessness is only to be matched by their propensity to imposition and deceit. Thus many of the smaller and rarer kinds no doubt remain to be discovered by any one provided with the proper nets or apparatus, and commanding leisure, time, and personal industry for their collection.

But allowing for much imperfection from these various causes, sufficient data are, perhaps, here afforded for a tolerably correct approximation to the general character of Maderan ichthyology; for it is not probable that future discoveries will do more than slightly affect the coordinate value of several amongst the secondary groups (e.g. Triglidae, Gobiidae, Labridae, Clupeidae, Pleuronectidae, Murænidae, Cyclopteridae, &c.); raising these, perhaps, to a somewhat higher value in proportion to the rest, but not counterbalancing the general preponderance of others (e.g. Scombridae, Sparidae, &c.), or altering the more obvious and striking features of the whole. To exhibit these results, therefore, at once in a clear and convenient form, I have composed the following Table, relying solely on the admirable work of Mr. Yarrell for the British species; and for the Mediterranean principally upon Risso's Histoire Naturelle, &c., de l'Europe Meridionale, corrected, as far as to the middle of the Gobiidae, by the Histoire Naturelle des Poissons of MM. Cuvier and Valenciennes, and by the second edition of the Règne Animal of Cuvier for the remainder.
A Table of the comparative number and distribution of the British, Mediterranean, and Maderan Species of Fishes*.

<table>
<thead>
<tr>
<th>Families</th>
<th>Whole number of Species found in</th>
<th>Species peculiar † to</th>
<th>Species common to</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percide</td>
<td>8</td>
<td>20</td>
<td>13</td>
</tr>
<tr>
<td>Triglide</td>
<td>+2</td>
<td>+3</td>
<td></td>
</tr>
<tr>
<td>Sciaenidae</td>
<td>12</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>Sparidae</td>
<td>+7</td>
<td>+4</td>
<td>3</td>
</tr>
<tr>
<td>Meridae</td>
<td>2</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Brachidium</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Scorbiidae</td>
<td>12</td>
<td>43</td>
<td>18</td>
</tr>
<tr>
<td>Tetraoidea</td>
<td>3</td>
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</tr>
<tr>
<td>Mugilidae</td>
<td>4</td>
<td>14</td>
<td>3</td>
</tr>
<tr>
<td>Lophidae</td>
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<td>Gobiidae</td>
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<tr>
<td>Labridae</td>
<td>11</td>
<td>51</td>
<td>9</td>
</tr>
<tr>
<td>Fistularidae</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td>229</td>
<td>73</td>
</tr>
</tbody>
</table>

1. Acantopterygianæ  

2. Malacoptygianæ.  

Abdominales.  

2. Malacoptygianæ.  


4. Malaco. Apodes, i. e.  

4. Malaco. Apodes, i. e.  

Malacoptygū  

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* The freshwater fishes are added in smaller figures under the numbers of the marine species; and all families which have no British or Maderan representatives are omitted.

† By peculiar, is meant only not found in either of the other two localities here specified.

‡ No attempt is made to distribute geographically, or even in some cases to enumerate the freshwater Malacoptygianæ, or the Rajaæ, further than Great Britain and Madera are concerned, in the present absence of all accurate knowledge of the South European species of the former, and the inextricable confusion in the synonyms of Raja, Risso.
<table>
<thead>
<tr>
<th>Families</th>
<th>Whole number of Species found in</th>
<th>Species peculiar to</th>
<th>Species common to</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Lopholbranchiacea, i. e. Synagnathidaceae...</td>
<td>6</td>
<td>14</td>
<td>2</td>
</tr>
<tr>
<td>Gymnodontidaceae</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Balistidaceae</td>
<td>1</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>6. Plectognathi</td>
<td>4</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>7. Chondropt. Ord. I. i. e.</td>
<td>Sturionidaceae</td>
<td>2</td>
<td>3</td>
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<td>8. Chondropt. Ord. II.</td>
<td>Squalidaceae</td>
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<tr>
<td>i. e. Railliei</td>
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<td>5</td>
</tr>
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<td>Petromyzidaceae</td>
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<tr>
<td>Chondropterygi</td>
<td>31</td>
<td>+4</td>
<td>55</td>
</tr>
<tr>
<td>Total</td>
<td>173</td>
<td>392</td>
<td>116</td>
</tr>
</tbody>
</table>

It only remains briefly to indicate a few of the chief results above displayed in figures. The first of these is one, indeed, which might have almost safely been anticipated, in consideration of the physical condition of the country; the small extent of which, its abruptness of elevation above the level of the sea, and the extreme inequality of the surface, are causes combining to reduce its freshwater streams, however copious, to the mere character of rapid rivulets or mountain torrents, and to prevent the natural formation of any permanent lakes, pools, or ponds of stagnant water. Thus is excluded of necessity, with the exception of the Eel (Anguilla), the whole race of either permanent or temporary freshwater fishes.

Bearing in mind this great source of deficiency, and then considering another almost equally influential on the numerical abundance of the species, namely, the perfect uniformity of these shores in structure and materials, occasioning a corresponding uniformity of food and shelter, and encouraging tenants alone of one particular set of habits; it is only matter of surprise that the total number of Maderian fishes is not less than half the whole number inhabiting the rivers, lakes, and seas of England, Ireland, and Scotland. Excluding the freshwater species, as in the foregoing Table, for the purpose of a fair comparison, Great Britain possesses along all its well-searched, varied, and extended shores, only one-third more fishes than Madera. And in the Acanthopterygian or Spiny-finned division the numbers are very nearly equal.

But allowing for the absence of the fluvial species in Madera, by omitting them on
the side also of the Mediterranean and Great Britain, there still remains an essential
difference characteristic of the former; a difference, however, conformable to what there
seems some reason to suppose may prove a general law, namely, a variation in the ratio
between the marine Acanthopterygians and the Malacopterygians inversely proportion-
able to the latitude. In Britain the marine Acanthopterygians are to the marine Mala-
copterygians as low as one and a quarter to one, i.e. nearly in a ratio of equality; in
the Mediterranean they are as two and three-fifths to one; and in Madera the ratio has
increased to three and a half to one.

Another curious general feature deducible from the foregoing Table, is that Madera
has nearly as many species in common with Great Britain as it has in common with
the Mediterranean. For striking off one third part of the whole number of Maderan
fishes, which is the proportion peculiar to the island, it appears that one-half of the re-
mainning two-thirds belongs to the Mediterranean, while the other half is formed of
species also found in Britain. Indeed, in several respects, instead of occupying a place,
considered ichthologically, corresponding with its latitude, Madera seems rather to be
intermediate between Great Britain and the Mediterranean. It presents us with a very
small sprinkling of species (Priacanthus, Pristipoma, Glyphisodon, Heliastes, Diodon,
Tetrodon, Balistes) belonging to the tropical forms; while the numbers of the species,
in most of the families, either about equal those of the same families in Britain, or are
intermediate between them and the numbers for the Mediterranean. The families of
Triglidæ, Gobidæ, Clupeidæ, Cyclopteridæ, and Syngnathidæ are, it must be confessed,
at present seemingly exceptions to this rule, but exceptions which, I think, will pro-
bably not prove to be such ultimately. Gadusidæ, Pleuronectidæ, and Raiidæ are such
exceptions, which should rather go to prove the rule. In respect to these peculiarly
northern tribes of fishes, Madera takes the place, accordant with its latitude, as lowest
in the scale.

In one particular the foregoing Table fails to convey a faithful picture of the general
character and aspect of Maderan Ichthyology. It does not sufficiently express the de-
cided predominance of the Sparidal, Scombridal and Percidal forms above all others.
This arises from the profusion in which the individuals of certain species in these fa-
milies occur; while the species which compose the other families are in general poorer
considerably in this respect. The commonest edible fishes of the island are found in
the three families just named, as well as the more gregarious and prolific species.

Thus the European visitor on entering the markets, or examining the boats, is struck
at once with the almost total absence of the Flat-fishes, Salmonidæ, and Cod-fish tribe,
which more especially characterize our stalls in England, and with the unwonted forms
of the Sargus, Pagrus, Pagellus, Box, Oblada, Smaris, Thynnus, Prometheus, Lichia, &c.;
or with the brilliant hues of the Serranus, Beryx, Scarus, &c., or the grotesque deformed
Scorpaena and Sebastes.

This impression will be somewhat different at different seasons. The spring is cha-
characterized by the commoner appearance of the splendid-coloured Beryx in the streets; attracting notice no less by its form and hues of silver, scarlet, rose and purple, than by the extraordinary size, and opaline, or rather brassy lustre of its enormous eyes. With this, or even earlier, appears abundantly the common Herring of Madera (Clupea Maderensis); and as the season advances the Mackerel (Scomber scombrus, L.); the scarlet Peixe Cao, or Dog-fish of Madera (Crenilabrus caninus); Carneiro, or Mutton-fish (Scorpaena Serofa, L.), and Requienne (Sebastes Kuhlii); the Pike-like Bicuda, or Spet of the Mediterranean (Sphyrena vulgaris); the Sargo (Sargus Rondeletii, Cuv. & Val.), with teeth resembling the human; the elegantly golden-striped but worthless Saléma (Box Sulpa, Cuv.); and the plain-coloured Dobrada (Oblada melanura, Cuv.).

The Herring and the Alfonsin (Beryx splendens) attain the climax of their season about March or April; the Mackerel in May and June; but the whole, except the Herring, continue throughout most part of the summer and autumn. In May the magnificent Lampris lauta, the beauty of which in the water excites the admiration even of the fisherman, begins to make its occasional appearance in the market; and what is of far more importance in an economic point of view, the Tunny fishery begins. This last is at its greatest height in June or July; and to it succeeds the capture of the Gaiado (Thynus Pelamys, L.), which is pursued with such success, that I have sometimes watched a single boat, furnished with scarce half a dozen rods, pulling them in at the rate of three or four a minute. With the Gaiado appears in almost equal plenty the Coelho, or Rabbit-fish (Prometheus atlanticus); and these continue till the close of the summer by the equinoctial rains of October. The winter months of January and February are chiefly characterized by the presence, close along the shores, of the little Guelro (Atherina presbyter, Cuv.), or Sandsmelt of Madera, of the common Maderan Herring (Clupea Maderensis), and Sardinha (Clupea Sardina, Cuv.?); the two last being captured principally after violent gales and storms, when the swollen rivers or torrents carry down much mud into the sea.

The following species occur in great profusion, more or less, throughout the year, but still most plentifully in the spring and summer; viz. Garoupa (Serranus cabrilla, Cuv.); Cherne (Polyprion cernium, Cuv. & Val.); Goraz (Pagellus centrodontus, Cuv.); Bezugo (Pagellus acarne, Cuv.); Pargo (Pagrus vulgaris, Cuv.); Boga (Box vulgaris, Cuv.); Bocairão (Smaris Roperi, Bowd.); Ranhosa or Tronbeta (Lichia glaycos, Cuv.); Chicharro or Maderan Horse Mackerel (Caranx Cuvieri); Bodião (Scarus mutabilis); and Abrotea (Physis mediterraneus, Lar.). The well-known John Dory, or Peixe Gallo (Zeus Faber, L.), and delicate Red Mullet or Salmoneta (Mullus surmuletus, L.), are also taken at all seasons, but more sparingly. The Grey Mullet, or Tainha, is captured very plentifully throughout the year, but most abundantly perhaps in June.
XV. Observations on the Genus Galictis (Bell), with the Description of a new Species.
By Thomas Bell, Esq., V.P. Z.S., F.R.S., &c., Prof. Zool. in King's College.

Communicated April 25th, 1837.

In the year 1826, in offering to the Zoological Club of the Linnean Society¹ some remarks on a living female Grison which had been for some years in my possession, I was led to consider this species as constituting a new generic type, to which I gave the name of Galictis, but without then assigning its distinctive generic character.

The existence, in the museum of the Zoological Society, of a new species, nearly allied to the former and yet evidently distinct, has induced me now to enter more particularly into the subject, and to lay before the Society, in addition to a description of the new species, some observations on the characters and affinities of the genus.

Buffon, in the third volume of the supplement to his "Histoire Naturelle," gives two figures under the respective names of "Fonine de la Guyane" and "Grison," which have always been considered as belonging to one animal, the Viverra vittata of Schreber.

The animal which forms the subject of the first-named figure was brought from Guiana; the teeth were wanting, but the general form of the body led Buffon, with his usual ignorance of true distinctive character, to consider it as a variety merely of the former or Marten. His description as well as the figure is sufficiently clear to designate the animal as identical with that which has subsequently been known as the Viverra vittata, and could not have appertained to the species which I shall presently describe. The second figure above alluded to, accompanied by a description, was first published in the fifth volume of the Dutch edition of Buffon, by Allamand, who gave it the name of "Grison," quasi Belette grise. This animal was said to have been brought to M. Allamand from Surinam. The figure is certainly very different from the former, so as to prove that great fault exists in the stuffing of both specimens. The former has an extremely attenuated nose with a lengthened body; in the latter the muzzle is thick and obtuse and the body less slender. But the colours, if the engraver can be trusted, and the character of the hair, are sufficiently different to warrant considerable doubt whether this may not be a representation of the same species as that which is now introduced to the notice of the Society. It is also the "petit furet" of d'Azara's History of the Quadrupeds of Paraguay.

Schreber, in his History of Mammalia, placed the former animal amongst the Viverræ,

under the name of *Viverra vittata*, which was retained by Gmelin and others; but the semiplantigrade character of the foot seems to have led Thunberg to consider it as more nearly allied to the *Ursidae*, and he accordingly calls it *Ursus Brasiliensis*. By Desmarest it is arranged in the genus *Gulo*; and the name *Gulo vittatus*, given to it by this author, has been employed by the Cuviers and all other subsequent writers, with the exception of Dr. Traill, who, in the third volume of the Memoirs of the Wernerian Society, restores it to its proper family the *Mustelidae*, but under the erroneous name of *Lutra vittata*; for it has no nearer affinity to the otters, than that which is possessed by the whole of the species of the genus *Mustela*. M. Fred. Cuvier has given in his great work on the "Mammifères," an account of an individual which lived in confinement, whose habits almost exactly agreed with those of mine already alluded to; the figure which this naturalist has there given, although the best that has hitherto appeared, is so faulty that I have thought it necessary to offer another, taken from my own specimen when living. When the form, the structure, and the habits of this animal are considered, it appears strange that all the Zoologists subsequent to Buffon, who have hitherto examined it, should have failed to ascertain its real affinities. In the form of its body, and particularly in the structure of the teeth, it is absolutely similar to many of the genus *Mustela*, particularly to the ferret and the polecat. This similarity, at least in form, was detected both by D'Azara and by Buffon, as is proved by the names which they assign to it. Nor is there a single difference of any importance in the structure of the teeth, between this animal and the polecat, with the single exception, that the inner tubercle of the carnivorous tooth is, in a very slight degree, broader in the present species. The character which induced me to consider it as generically distinct from *Mustela*, for there cannot for a moment exist a doubt as to the necessity for its removal from *Gulo*, is the semiplantigrade nature of the feet; and this appeared to be a structural distinction of sufficient importance to warrant such a separation. This view has been confirmed in a very interesting manner by the occurrence of the new species about to be described, having exactly the same general character of coloration and markings, but with sufficient essential distinctive characters to point it out as specifically different.

The genus then belongs to the family of the *Mustelidae*, but exhibits in the form of the feet a slight indication of an approach to the *Ursidae*, in which group it is probably represented by the genus *Ratellus*, which, whilst it shows a similar degree of aberration from the type of its family, has an almost identical peculiarity of coloration. It is in such circumstances as these, where the animals really possess the more important analogies of form and of relation to their respective types, that the confirmatory though only subordinate analogies of colour are of real value; and it is surely unnecessary to point out the difference between relying upon colour and markings, on the one hand, as a primary analogical character, irrespective of other and more important relations; and, on the other, considering them as constituting only a collateral corroboration of
them. I wish however to be understood as offering this suggestion respecting the analogical relation between *Galictis* and *Rotellus* as still doubtful; for I cannot but feel it to be a far more difficult matter to decide upon these relations than some naturalists of the present day appear to consider it. That relations of analogy between the members of different groups do exist, there cannot perhaps be any reasonable doubt; that such analogies do in many instances, and would in all, were our information less limited, assist us in the determination of the affinities of correlative groups, may also possibly be true; but that these relations are to be perceived at a single glance, that they are to be picked up, as it were, by every careless passer-by, and forced with all the confidence of undisputed authority into the service of every fabricator of systems, is inconsistent with the modesty of true science, derogatory from its dignity, and calculated only to bring the study of zoology itself into contempt.

**Fam. Mustelidæ.**

**Genus Galictis.**

*Dentes molares spurii* 2·2
*Rostrum breve*
*Palæ atque plantæ nudæ subplantigradae*
*Ungues breviusculi, curvi, acuti*
*Corpus elongatum, depressum.*

1. **Galictis vittata.**

**Tab. XXXV.**

*Gal. vertice, collo, dorso, atque caudâ flavescenti-griseis; rostro, guldâ et pectore fuscescenti-nigris; fasciâ a fronte usque ad humeros flavescenti-albidd; pilis longis laxis.*


*Pouine de la Guyane.* Buffon, Suppl. iii. p. 161, t. xxiii.


The general form, attitudes, and movements of this animal resemble those of the common *Polecat*. The head is depressed; the muzzle moderately acute, but not attenuated, projecting beyond the lower jaw; the eyes are moderately large, the iris dark brown, or nearly black; the ears short, broad, and rounded; the teeth are almost exactly similar.
to those of true *Mustela*, particularly *M. putorius*. The body is elongate and much depressed, covered with rather long loose hair, the under hair soft and short; the tail more than half the length of the head and body; the hair of the tail very long and lax. The legs are rather short; the toes five on each foot, with short, strong, curved, rather acute claws; the upper part of the toes hairy; the soles of the feet naked. The fore-feet with a thick pad under each toe; the palm furnished with a broad tubercle consisting of three elevated portions, with a slight one internally, and a round simple one at the wrist, behind the little or outer toe. The hinder foot likewise furnished with a thick pad beneath each toe, and a broad trifid tubercle beneath the metatarsus: there is also a long tubercle beneath the heel at the outer side. The whole of these parts, that is to say, the soles of all the feet, are covered with a soft naked skin, and are evidently placed on the ground in progression.

The colours are very remarkable, and the markings distinct and decided. The whole of the upper part of the head, the neck, the back, the flank, and the tail are yellowish light or brownish gray, produced by the mixture of a dirty yellowish white, with brownish black, the hairs being brownish black for about two-thirds of their length, the tip dirty or yellowish white. The muzzle, the cheeks, the throat, the under part of the neck, the belly, the anterior legs, and the hinder feet are black, with a brownish tinge lighter towards the back part, and on the belly interspersed with a few whitish hairs. The gray of the upper, and the black of the under parts, are separated by a rather broad *fascia*, extending on each side from the centre of the forehead above the eye backwards as far as the shoulder, including the ears; this *fascia* is of a buff or yellowish white colour.

There is a large round follicle situated on each side the *anus*, covered with a muscle, and opening by a round duct within the anal orifice, secreting an unctuous matter, less feetid than that of the *Polecat*, but not possessing the rather agreeable odour of the *Marten*, or the powerful perfume of the *Viverra*. The stomach is very simple, the pyloric extremity long, cylindrical, and curved. There is no *cæcum*.

2. *Galictis Allamandi.*

Tab. XXXVII.

*Gal. vertice, collo, dorso, atque caudâ nigricanti-griseis; portibus inferioribus nigris; fasciâ a fronte usque ad collum utrinque albâ; corpore pilis brevibus adpressis.*

*Habitat?*

This species, although evidently distinct from the former, exhibits the same general character of colour and marking, with some remarkable differences, however, which, though not easily expressed in a specific phrase, are tangible and important. The whole of those parts, which in the former species are yellowish, are here perfectly white; and those which are blackish brown in the former, are in this pure black.
The basal portion of the hairs on the back, therefore, is black, and the apical quite white, forming a pure blackish gray, or black, with white points and lines; whilst all the under parts of the throat and part of the belly are black. The *fascia* extending from the forehead to the sides of the neck is also white. This *fascia* does not extend in the specimen described so far back as in the former species. The hairs of the whole body are very short in comparison, and much stiffer and more closely set. The animal is considerably larger, and the tail, as far as can be ascertained from a stuffed specimen, short in proportion.

The native habits of the *Grison* are, doubtless, those of the terrestrial *Mustelidae* generally. Pursuing the smaller *quadrupeds*, *birds*, and *reptiles* on the ground, and even into trees, its carnivorous instinct is, probably, judging from its dentition, equally strong with theirs. The beautiful female specimen, which I had living for more than three years, was as tame and affectionate as a *dog*. She followed me, if permitted, wherever I went about the house, was extremely frolicsome and playful, and was delighted at being caressed. She would throw herself on her back, and seize the hand that fondled her with all four of her paws and her mouth at the same moment, pressing it with her teeth, but never sufficiently hard to cause the slightest degree of pain. She was extremely fond of eggs, which she ate in a very singular manner. On one being given her, she first played with it for some time, running backwards, and at the same time pushing it under her belly with her fore-feet. At length she would fix one of her sharp canine teeth through the shell, and lick or suck as much of the contents as would flow through the orifice. Then again inserting her tooth, a piece of the shell was broken out so as to enable her to insert her tongue; and finally, the egg-shell was broken to pieces and each fragment carefully licked clean. For *frogs* she exhibited a decided fondness; and she attacked two small *alligators* which I had living; one of which she killed and partly ate, and the other she wounded. The wound in each case was inflicted under the *axilla*, as being the least protected part, and that at which the large blood-vessels being torn through, would speedily bleed the animal to death. She died of stricture of the *pylorus*, without any other disease.

This description of the genus appears to warrant the opinion which I have given of its affinities; namely, that it essentially belongs to the family of the *Mustelidae*, but deviating from that type by the plantigrade character of the feet, in which it exhibits an obvious approach to the *Ursidae*.

To *Viverra* its relation must be very remote; to *Ursus* and *Gulo* its approach has just been alluded to; to *Lutra*, in which genus we have seen it was placed by Dr. Traill, its affinity is more obvious, as it clearly belongs to the same family; but by the important character of the dentition, as well as its general form, it approximates so closely to *Mustela* (*Putorius* of Cuvier) the typical genus of the family, that but for the more plantigrade character of the feet, it must have been associated with it.
PLATE XXXV.

Galictis vittata.

PLATE XXXVI.

Fig. 1. Cranium of Galictis vittata, seen from beneath.
2. The same seen laterally, with the addition of the lower maxilla.
3. The odoriferous glands: the left one covered by its investing muscle, which has been removed from that on the right.
4. The stomach.
5. The right fore foot.
6. The right hind foot.

PLATE XXXVII.

Galictis Allamandi.
Salutia cellula
XVI. On a new Sub-genus of Fishes, allied to Ophidium. By William Thompson, Esq., Vice-President of the Natural History Society of Belfast. Communicated by the Secretary.

Read June 13th, 1837.

The species of fish which is the subject of the present communication ranks under the Malacopterygii Apodes, and in its genus most nearly approximates Ophidium. Although with Ophidium, as described in the "Règne Animal" (t. 2. p. 358. 2nd ed.), it possesses many characters in common, others are at the same time presented which have suggested the propriety of constituting it a sub-genus. Cuvier having given as a character of Ophidium, "l'anus assez en arrière," strictly considered prevents the admission of the present specimen. The genus is, again, in the Règne Animal subdivided into the true Ophidia and the Fierasfers; the former, "Portent sous la gorge deux paires de petits barbillons adhérents à la pointe de dos hyoïde," and the latter, "Manquent de barbillons, et leur dorsale est si mince, qu'elle ne semble qu'un léger repli de la peau."

In external characters—for the specimen being, so far as known to me, unique, I have been unwilling to injure its appearance by dissection,—it is excluded from the Ophidia proper in consequence of not having the barbules; and though agreeing with the Fierasfers in the negative character of wanting these appendages, yet, by having the dorsal fin strongly developed and elevated, it ranges not with them.

Its want of the very obvious character of the Ophidia, renders all comparison with them unnecessary; but of two species belonging to the Fierasfers, and which approach the present specimen most nearly, I may state, that it possesses many of the characters of the Oph. fierasfer of Risso, but differs from that species in the teeth, (both jaws are described as armed with three rows of sharp and hooked teeth,) number of fin-rays, and some minor characters; besides, there is nothing said of the remarkable teeth terminating both jaws, as exhibited in my specimen. In the Règne Animal we again find an Oph. dentatum described as having in each jaw "deux dents en crochets," but no further details are given. In this only character, however, the Oph. dentatum

1 It may, perhaps, be objected to this strict reading, that Cuvier has himself admitted into the genus the Oph. Vassuili, which is described by Risso as having "l'anus situé près de la gorge" (tome iii. p. 212. ed. 1826); but although the characters of this species are pretty fully detailed in the Règne Animal (t. ii. p. 359.), the one here quoted from Risso is not mentioned. The last-named author similarly describes the position of the vent in the Oph. fierasfer. On the contrary, both of the British Ophidia figured by Pennant (Brit. Zool. vol. iv. pl. 93. ed. 1777), and Montagu (Wern. Mem. vol. i. pl. 4.), accord with Cuvier's generic description in this character.
differs from my fish, which has four large hooked teeth in the upper, and two in the under jaw.

The specimen under consideration was found dead on the beach at Carnlough near Glenarm, in the county of Antrim, by my friend Dr. J. L. Drummond, when collecting Algae there in the month of June 1836, and, along with some other fishes, &c. obtained about the same time, was kindly handed over to me on his return to Belfast. Dr. Drummond informs me, that from its appearance when found, it had most probably been cast ashore by the tide of the preceding night when a strong easterly wind prevailed.

Genus Echidon.

Corpus valdè elongatum, complanatum et lanceolatum.

Caput ovale; rostrum mediocrît productum; os sub-obliquè fissum; maxilla dentibus armatae sicutossa palatina vomerque; dentes duo utrinque apud maxillae superioris apicem magni et prolongi; maxilla inferior utrinque dente unico cylindraceo terminata; apertura branchialis magna; operculum satis amplum.

Pinnae dorsales et anales valdè productæ.

Anus anteriora versus positus.

Echidon Drummondii.

Tab. XXXVIII.

Ech. corpus longe; maxillae ambae, vomer, ossaque palatina dentibus parvis obtusiusculis densè armatae; maxilla superior longior, cujus dentes externi ore clauso conspicui; vomer admodum prominens antrorsumque valdè productus; lingua brevissima; pinne dorsales analesque cum caudali contiusæ, et posticè corpore multo altiores; pinna analis ante dorsalem eoriens; radii pinnales nulli ramosi; membrana branchiostega septem radiata.

Total length 11 inches; greatest depth (at 1 inch 4 lines from the snout) 6 lines, thence posteriorly gradually narrowing; greatest breadth of body anteriorly 3 lines; at the middle of the entire length 1 line, and thence to the tail becoming gradually more compressed.

Head 1 inch 2 lines long, or rather more than one-ninth of the entire length; profile sloping forward equally on both sides to the snout, which is truncated, and projects 1 line beyond the lower jaw; narrow, increasing in breadth very gradually from the snout, its breadth as 1 to $3\frac{1}{2}$ of its length; height half its length, compressed at the sides, and rather flat above from the eyes backward; from the eyes forward a central bony ridge; snout viewed from above somewhat bifid in consequence of the forward position of the large teeth on each side. A few large punctures extend from the snout below the eye, and are continued just behind it; a series of small ones closely arranged extend from the upper portion of the eye in a curved form posteriorly to near the edge of the pre-opercle, and thence a double row extends downwards. Nostrils very large,
placed just in advance of, and before the centre of the eye, and in form a somewhat oval transverse aperture. Eye large, occupying the entire upper half of the depth of the head; its width greater than its height, in the length of the head, occupying the place of 1 in 4½; its distance from the snout 3 lines, or equal to its diameter, consequently 2½ of its diameters are contained between it and the edge of the operculum. Operculum rounded at the base, terminating above in a minute point directed backwards, strongly radiated, striæ distant; preoperculum ascending vertically; checks smooth and soft. Mouth rather obliquely cleft. Teeth, two large strong ones, placed close together, and curving inwards at each side the extremity of the upper jaw, the two inner ⅔th of an inch apart. In the lower jaw one slender rounded tooth, nearly 1 line long on each side, curving outwards at the base, and inwards at the point. Entire upper and under jaw and vomer densely studded with small bluntish teeth, somewhat uniform in size; vomer extending far forward, and very much developed, forming a cavity in the lower jaw, and in advance of the tongue when the mouth is closed; a series of rows of teeth similar to those last described on the palatine bones; all the teeth of the upper jaw exposed to view when the mouth is closed. Tongue short, not reaching within 2½ lines of the extremity of the lower jaw, and apparently toothless. On the dorsal ridge, 1 inch from the snout, or 2½ lines behind the cranium, is a short, stout, bony spine, not very conspicuous, and, excepting its extreme point, covered with skin: it is 6 lines in advance of the first ray of the dorsal fin. Scales none (?). Lateral line inconspicuous, being a slight depression extending in a straight line along the middle of the sides posteriorly, or throughout the greater portion of its length, but anteriorly nearer to the dorsal than the ventral profile. Vent 1 inch 3 lines from the extremity of the lower jaw. Branchiostegous membrane opens forward rather before the extremity of the gape. Dorsal fin commencing 1 inch 6 lines from the snout, low at its origin, but gradually increasing in height to near the caudal fin, which it joins, the two or three anterior rays, which are very short, flexible and simple (?), remainder articulated. Anal fin originates just behind the vent, or at 1 inch 3 lines from the point of the lower jaw, joins the caudal fin, near to which it increases in depth posteriorly from its origin, deeper than the dorsal fin throughout; about 1½ inch from the caudal fin the rays are in length four times greater than the depth of the body at the same place, the rays of the dorsal fin opposite being three times the depth of the body; the first and second anterior rays flexible and simple (?), remainder articulated. Pectoral fins originate 1 line behind the head, and are equal to half its length, central rays longest, all very flexible, placed below the middle of the sides. Caudal fin, central rays longest. Articulations very long on the rays of all the fins; no branched rays in any of them.


1 It must be observed, that had the specimen possessed scales of the same nature as those of the Cepola rubescens (Varr. Brit. Fish. vol. i. p. 197.), it may have been divested of them during its short exposure on the beach.

2 As in Cepola rubescens.
Although the numbers of these fin-rays be marked with doubt, they were reckoned with the greatest care; but without injury to the specimen they could not be ascertained with certainty to a single ray. Vertebrae, which distinctly seen through the skin can be reckoned with accuracy, 98. Colours, anterior half a dull flesh colour, similar to specimens of Cepola rubescens preserved in spirits, hence it is presumed to have been originally red; behind this portion, reddish-brown markings appear on the body at the base of the dorsal and anal fins, and suddenly increase in number, until from an inch behind the middle, the whole sides are closely marked and spotted over; the entire top and the sides of the head before the hinder line of the eye are similarly spotted; just behind the cranium a few spots also appear: the posterior rays of the dorsal and anal and the entire caudal fin blackish. Iris, operculum, and under surface, a short way beyond the vent, bright silver.

The two large teeth, resembling serpents' fangs, which terminate the upper jaw on each side, have suggested the generic appellation of Echidon (εχιδων, a viper, and ὀσκως, a tooth); and the specific name of Drummondii is proposed in honour of its discoverer.

Although when this fish first came into my possession, I saw that it might be classed under the Malacostracii Apodes, and be placed near Ophidium, I considered that in a natural arrangement it would best constitute a new genus of the family Tanioidea. In being apodal it was not excluded from this family, as two genera belonging to it are destitute of ventral fins. I did not hesitate to place it under the Acanthopterygii, as some genera which are included in this order are, like it, strictly Malacostracian, their natural connexion with genera having fins with spinous rays being considered—and in my opinion most philosophically—to outweigh this character: and further, I felt less reluctance in thus placing it, in consequence of Cepola rubescens, which it assimilates in

1 In Mr. Templeton's catalogue of "Irish Vertebrate Animals," published in the Magazine of Natural History (new series) for 1837, we find the following remarks in reference to Ophidium imberbe. "The only specimen I have observed was thrown on the shore of Belfast Lough, near the Whitehouse Point, on January 9, 1809. It was a large specimen, not less than a foot long, and agreed so exactly with the figure in the British Zoology, and differed so much from that of Mr. Montagu (Wern. Mem. p. 93. pl. 4.), that I am led to believe there are two distinct species, of which Pennant has described the one and Montagu the other." New series, vol. i. p. 412.

In endeavouring to gain further information on this subject from the late Mr. Templeton's papers, (all of which through the kindness and liberality of his family are accessible to me,) I have been only able to find the following note, which appears in his Journal, under date of January 10, 1809. " Went to the White House to look for Fuci: found a fish about 18 inches long, more taper than an Eel, at the thickest part about an inch and a half diameter. I think it was the Ophidium imberbe. Brit. Zool. iii. 398. t. 93, in vol. iv." It is much to be regretted that the information was not more precise, as it is not improbable that the species alluded to may have been identical with that which forms the subject of the present article. The White House Point and Carnlough Bay are in a direct line about twenty miles distant.
some respects, having but one spinous ray, and that in the ventral fin. At the suggestion of John Edward Gray, Esq. F.R.S., I have, however, reconsidered the subject, and have come to the conclusion above advanced. As a difference of opinion may still exist with regard to the position of this genus, I subjoin the observations originally made.

Like certain other genera which are comprehended under Acanthopterygii, the first order of the Osseous Fishes, its fins are altogether destitute of spinous rays, but like those alluded to, such as Zoarcus, &c., its other characters1 seem to point out the Tenioides as the family to which it belongs. Of the eight2 genera of Tenioides already known, viz. Lepidopus, Trichiurus, Gymnotus, Stylephorus, Cepola, Lophotes, Truchypterus, and Alepisaurus3, the specimen under consideration agrees with Trichiurus and Stylephorus in being apodal, or wanting ventral fins, but in this character only is there any generic accordance. Though considerably more elongated, from the head posteriorly it approaches most nearly to Cepola rubescens in the form of the body and in the forward commencement of the anal fin, which, with the dorsal, is prolonged until it joins the caudal; but it is only in the continuity of these fins until this junction is effected that the resemblance holds, as in my specimen the dorsal rays (of which the five foremost are very short) increase in length posteriorly, and near the caudal fin are about three times as long as the depth of the body beneath them; in the anal fin, which is throughout much higher than the dorsal, the rays likewise increase posteriorly, and near the caudal are in length four times greater than the depth of the body at the same place. The length of the posterior rays of these fins causes the dorsal, anal, and caudal to appear as one, whilst, though they do join in Cepola rubescens, the last ray of the dorsal and anal being much shorter than the outer rays of the caudal, may at the same time be said to mark distinctly the termination of each fin4. In my specimen the anal originates two lines in advance of the dorsal fin.

In the form of the head and in dentition, it differs so remarkably from all the other genera as to render a comparison with them unnecessary. Its absolute characters must suffice for distinction.

As Mr. Yarrell has in his valuable work on "British Fishes" (vol. i. p. 185.) suggested, that of the two specimens described as Trichiuri by Mr. Hoy in the Linnean Transactions (vol. xi. p. 210.), the first may be the type of a new genus, it should be observed, that this individual approximates the specimen under consideration in but one generic, and that a negative character, namely, the want of ventral fins.

1 I allude to external characters only, being unwilling to dissect a specimen as yet unique.
2 For the purpose of comparison, all the genera given by Cuvier in the “Règne Animal” and “Hist. de Poiss.” are here brought together.
3 Zool. Trans. vol. i. p. 123.
4 For illustration of this, see Cuv. and Val. Hist. de Poiss. pl. 300. Two species of Cepola from Japan, the C. limbata and C. marginata, are (as has been observed in this work, tome x. p. 403.) figured by Krusenstern with the caudal fin continuous with the dorsal and anal, as in the genus Anguilla.
PLATE XXXVIII.

Fig. 1. Echiodon Drummondii.
2. Anterior region of the head seen laterally, the jaws extended to show the dental system, enlarged.
3. Front view of the anterior terminal teeth, enlarged.
XVII. Description of a new Species of Antelope. By Capt. W. C. Harris, (Bombay Engineers,) in a Letter addressed to the Secretary.

Communicated January 9th, 1838.

Sir,

Cape Town, South Africa, Oct. 10, 1837.

I BEG the favour of your presenting to the Zoological Society the accompanying drawing and description of an entirely new and very interesting species of Antelope, which I discovered in the course of an expedition to the interior of Africa, from which I have lately returned. A perfect specimen that I brought down has been admirably set up by Monsieur Verreaux, the French naturalist at Cape Town, and will be sent to London in the course of a few days, to the care of Dr. Andrew Smith. It would appear to belong to the sub-genus Aigocerus, and in form, as well as in other respects, bears remote resemblance to the Aigocerus Equina, (Roan Antelope or Bastard Gemsbok,) with which it has been confounded by many persons imperfectly acquainted with the subject to whom it has been exhibited. A comparison of the two animals will, however, render the existing difference between them too obvious to demand any observation from me.

During nearly three months that I hunted over the country lying between the 24th and 26th parallels of south latitude, within 28° and 30° east longitude, I only once met with the Antelope in question. On the northern side of the Cashan range of mountains, about a degree and a half south of the tropic of Capricorn, I found a herd, consisting of nine does and two bucks, and followed them until I captured the specimen from which the enclosed drawing was made.

None of the natives of the country were familiar with the appearance of the animal when first interrogated on the subject, although after conferring amongst themselves, they agreed that it was Kōokāme, (Oryx Capensis,) the Gemsbok; and, of the many individuals to whom it has been shown, a trader named Robert Scoon is the only one by whom it has been recognized. He declares that he saw a herd of them some years ago near the very spot I have described, but could not succeed in killing one. It is, doubtless, very rare; and, judging from the formation of the foot, entirely confined to the mountains.

The females are somewhat smaller than the males, are provided with shorter and slighter, but similarly shaped horns, and are similarly marked; a deep chestnut brown, verging upon black, taking the place of the glossy black coat of the male. I did not
obtain a female specimen; but whilst riding down the buck, I had abundant opportunities of narrowly observing them within the distance of a few yards, and am, therefore, positive as to the correctness of the description here given.

I have for the present designated the new Antelope "Aigocerus niger;" but of course it will rest with the Zoological Society either to confirm that name, or to bestow one more appropriate or more scientific; and I shall be gratified by their doing so.

I have the honour to be, sir,
Your most obedient servant,
W. C. Harris.

Aigocerus niger. The Sable Antelope.

Adult male four feet six inches high at the shoulder; nearly nine feet in extreme length. Horns thirty-seven inches over the curve, placed immediately above the eyes, rather higher than occurs in the Aigocerus Equina; flat, slender, sub-erect, and then strongly bent back scimitar wise; at first gradually diverging, and then running parallel to each other; three-fourths annulated with about thirty strongly pronounced, incomplete rings, more rigid on the edges, but chiefly broken on the outside of the horn; the remaining one-fourth smooth, round, slender, and pointed. Head somewhat attenuated towards the muzzle, and compressed laterally. Carcase robust. Withers elevated. Neck broad and flat. Hoofs black, obtuse, and rather short. Hair close and smooth: general colour of the coat intense glossy black, with an occasional cast of deep chestnut. A dirty white streak commencing above each eye, continued by a pencil of long hairs covering the place of the sub-orbital pouch, (of which cavity no trace is to be found in this Antelope,) and then running down the side of the nose to the muzzle, which is entirely white; the same colour pervading one half of the cheek, the chin and the throat. Ears ten inches long, narrow, tapering and pointed; white within, lively chestnut without, with black pencilled tips. A broad half crescent of deep chestnut at the base of each ear, behind. A small, entire black muzzle. A copious standing black mane, five and a half inches high, somewhat inclined forwards, and extending from between the ears to the middle of the back. Hair of the throat and neck longer than that of the body. Belly, buttocks, and inside of thighs, pure white. A longitudinal dusky white stripe behind each arm. Fore-legs jet black inside and out, with a tinge of chestnut on and below the knees. Hind-legs black, with a lively chestnut patch on and below the hocks. Tail black; long hair skirting the posterior edge, and terminating in a tuft which extends below the hocks. Sheath tipped with black.

Female smaller than the male, with smaller but similarly shaped horns. Colour, deep chestnut brown verging upon black.

Very rare. Gregarious, in small families. Inhabits the great mountain range which threads the more eastern parts of Moselekatse's territory.
CAPT. W. C. HARRIS ON A NEW ANTELOPE.

**Dimensions.**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height at shoulder</td>
<td>54 inches.</td>
</tr>
<tr>
<td>Length of body</td>
<td>44</td>
</tr>
<tr>
<td>Length of neck</td>
<td>17</td>
</tr>
<tr>
<td>Length of head</td>
<td>19</td>
</tr>
<tr>
<td>Length of tail</td>
<td>25</td>
</tr>
<tr>
<td>Length of hind-quarter</td>
<td>19</td>
</tr>
<tr>
<td>Depth of chest</td>
<td>30</td>
</tr>
<tr>
<td>Length of fore-arm</td>
<td>16</td>
</tr>
<tr>
<td>Fore-knee to foot</td>
<td>15</td>
</tr>
<tr>
<td>Croup to hock</td>
<td>36</td>
</tr>
<tr>
<td>Hock to foot</td>
<td>18 $\frac{1}{2}$</td>
</tr>
<tr>
<td>Breadth of neck</td>
<td>16</td>
</tr>
<tr>
<td>Breadth of fore-arm</td>
<td>6</td>
</tr>
<tr>
<td>Breadth of thigh</td>
<td>6</td>
</tr>
<tr>
<td>Breadth of fore-leg</td>
<td>2 $\frac{1}{2}$</td>
</tr>
<tr>
<td>Breadth of hind-leg</td>
<td>3</td>
</tr>
<tr>
<td>Length of horns</td>
<td>37</td>
</tr>
<tr>
<td>Breadth asunder at base</td>
<td>1</td>
</tr>
<tr>
<td>Breadth asunder at tips</td>
<td>9 $\frac{1}{2}$</td>
</tr>
<tr>
<td>Length of ears</td>
<td>10</td>
</tr>
<tr>
<td>Breadth of head</td>
<td>9</td>
</tr>
</tbody>
</table>

**PLATE XXXIX.**

*Aigocerus niger*

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1 From a drawing taken on the spot by Captain Harris. The original specimen is in the collection of the British Museum.
vigocornus niger

Communicated January 23rd, 1838.

After the lapse of many centuries the civilized nations of Europe begin again to be familiar with living specimens of the rarer animals from the remote regions of the globe; and as a consequence naturally flowing from the great moral revolution which has been effected during that interval, they can plead higher and better motives for such collections than those which stimulated the citizens of ancient Rome to excel in the exhibitions of the circus. But the improvement in our tastes and wants, in reference to collections of living animals, has not hitherto produced a corresponding activity in their gratification: nor, indeed, does the service of modern zoological science require the extraordinary energies and pecuniary expenditure which enabled a Roman dictator or emperor to gratify the vitiated desires of an enslaved and cruel people with spectacles of the slaughter of lions, bears, elephants, dromedaries, and ostriches, by hundreds at a time. It is the variety and not the number of rare animals which we are now concerned in procuring; but even in this respect much remains to be done before we shall have rivalled the ancients as importers of rare species; and it is somewhat mortifying to reflect that the living hippopotamus and the two-horned rhinoceros have hitherto been witnessed in Europe, only in the degrading sports of a Roman amphitheatre, and that science has profited nothing by their exhibition.

No person who has perused the "Historia Animalium" of Aristotle but must feel convinced that, if the Grecian naturalist had enjoyed opportunities like those afforded to the Roman philosophers of observing the rare animals which were repeatedly exhibited alive, and slain in the public games in their times, he would have left to posterity the same accurate and philosophical record of their characteristic forms and qualities as of the animals whose descriptions are given in the wonderful treatise above mentioned. The hippopotamus was known to Aristotle only through the medium of a vague description by Herodotus; the two-horned rhinoceros and the giraffe he had neither seen nor heard of; yet at Rome, besides the hippopotamus and rhinoceros, the giraffe was more than once exhibited. The third Gordian showed ten living giraffes, which it is conjectured were afterwards slaughtered at the millenarian games. But our


knowledge of these facts is derived, less from the descriptions of the naturalist, than from the satire of the poet, the records and medals of political history, or the mosaic pavements and other ornaments of public buildings. We can scarcely perceive in the works of the Roman philosophers a trace of that love of natural knowledge which induced the preceptor of Alexander the Great to investigate and record the habits and structure of the animals which that monarch’s conquests and just appreciation of science placed at his disposal. A greater contrast cannot be found in the literature of natural history than is afforded between the description of the Elephant, in the Historia Animalium, and the crude and casual notice by Pliny of those rarer animals which more extended conquests brought within his reach and observation. The spectacles and slaughters of the amphitheatre, such as have been alluded to, were continued uninterruptedly for more than four hundred years, and must have afforded to the Roman philosophers, ample opportunities of making observations on the form and organization of foreign animals: yet it seems that these animals, once killed, were applied to no further use. Everything, in short, that such occasions could afford to debase the human mind and heart was extracted from them, but nothing to elevate or improve.

It is surely a just subject of congratulation, that in these later times worthier motives for bringing rare animals within the sphere of our observation have been associated with happier and better results. Our national menageries not only add to the innocent pleasures of the people, by gratifying ordinary curiosity, or ministering to the—perhaps somewhat spurious—enjoyment which arises from a consciousness of personal security while standing at arms’ length from the encaged monarch of beasts, or affording the amusements of witnessing the sagacious feats of the ponderous Elephant or the nimble antics of the Ape; but their chief object is to give to the scientific inquirer the means of determining the relations which subsist between habits and organization, and to trace the modifications of form and structure by which each species is adapted to its destined sphere in the wide and diversified field of nature. These establishments afford at once the opportunity of combining observation of the living animal with dissection of the dead. It is true, indeed, that the menagerie offers a very imperfect substitute for those opportunities and advantages which the intelligent traveller enjoys in witnessing the habits of a species in its free state and native wilds; but, on the other hand, the conveniences for prosecuting anatomical inquiries are much greater, and the neglect of the latter means of advancing zoological knowledge would now be much more reprehensible, than in the time of Pliny.

The scientific publications of the Zoological Society give ample proof that its members have not been indifferent to the opportunities which a choice menagerie affords of prosecuting anatomical researches into the structure of rare and interesting animals. In the present communication I propose to give the results of a dissection of the male Giraffe which died in the gardens at Regent’s Park, and of various parts of a male and a female Giraffe which died at the Surrey Zoological Gardens, and which were sent to me for examination by the kindness of Mr. Cross.
OF THE NUBIAN GIRAFFE.

The position of the Giraffe in the mammiferous series has hitherto been laid down from external characters alone, and one cannot wonder therefore that Zoologists should not be unanimous on this point. Cuvier assigns to the genus Camelopardalis a place between Cervus and Antilope. The horns of the Giraffe, in fact, are of a bony texture, covered with a periosteum and a hairy integument, like the growing antlers of the Deer; but the tegumentary defence of the vascular periosteum is not deciduous, and the horns are consequently persistent, as in the Antelopes, in which the vascular covering of the bony core is protected by a sheath of horny substance.

In regard to the existence of horns in the two sexes, we find a few examples among both Deer and Antelopes, which thus resemble the Giraffe. The horns of the Giraffe possess, however, certain characters which are peculiar to themselves; the basis of the horn, for example, is articulated by synchondrosis to the frontal and parietal bones, and thus constitutes an epiphysis rather than an apophysis of the cranium. A broad, obtuse, osseous eminence in the middle of the forehead has been described as a third horn, and has been stated to be similarly articulated to the frontal bone, at least in the male Nubian Giraffe, and to be the only instance of a horn developed in the mesial line of the cranium, and over a cranial suture in the Mammiferous class. Cuvier says, "Au milieu du chanfrein, est un tubercle ou une troisième corne plus large et beaucoup plus courte, mais également articulée par suture." J. B. Fischer describes the third articulated horn as peculiar to the male Giraffe.

The general form of the Giraffe is modified with a special reference to its exigencies and habits, which are dependent upon its geographical position and the nature of its food; the prolongation and extensibility of the hair-clad muzzle, and the peculiar length, slenderness, and flexibility of the tongue, are in exact harmony with the kind of food on which it is destined to subsist. The oblique and narrow apertures of the nostrils, defended by the hair which is continued to their margins, and surrounded by cutaneous muscular fibres by which the animal can close them entirely and at will, form a beautiful provision for the defence of the air-passage, and the irritable membrane lining the olfactory cavity, against the fine particles of sand which the storms of the desert occasionally raise in suffocating clouds, and which man, and the animals compelled through his necessities to become occasional inhabitants of the desert, find so much difficulty in excluding.

The position and peculiar prominence of the large, dark and lustrous eye of the

1 See the section of this protuberance in the figure of the cranium, pl. 40.
2 Règne Animal, 2nd ed. tom. i. p. 266. The figure of the skull which illustrates the account of the Nubian Giraffe in the "Atlas zu Rüppel's Reise im Nordlichen Afrika," pl. 9. p. 23., represents indeed this third tubercle as distinct and articulated by suture with the cranium; but in the original cranium, from which the figure is taken, and which I have examined in the Frankfort Museum, I could not perceive any evidence of the existence of such a suture; the mesial protuberance had not been detached from an epiphyseal articular surface, but had been sawn off in order to be preserved in the stuffed skin.
3 Synopsis Mammalium, p. 455.
Giraffe, together with most of the external peculiarities of the body, have already been ably detailed in Rüppel's Reise, above quoted. Observations taken from the living animal have also been recorded by Geoffroy in the Annales des Sciences, xi. p. 210.; by Salze in the Mémoires du Museum, xiv. p. 68.; and some remarks on the tongue and stomach are given, with figures, in the 5th and 6th volumes of the Comparative Anatomy of Sir Everard Home.

All the three Giraffes on which the present observations were made were young animals and had not shed the deciduous incisors and anterior molares; two of them (a male and female) were ascertained to be about three years old; the third (a male, of which the skeleton is now preserved in the Museum of the Royal College of Surgeons, London,) might, by its size, be about four years old.

The following admeasurements were taken from the female Giraffe, which died (December 10th, 1836) in the Surrey Gardens:

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Ft.</th>
<th>Ins.</th>
</tr>
</thead>
<tbody>
<tr>
<td>From the nose to the hind-hoof in a straight line</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>From the nose to the vent</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>The length of the head, following the curve of the forehead</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Breadth of the head across the eyes</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Circumference of neck immediately behind the head</td>
<td>1</td>
<td>9\frac{1}{2}</td>
</tr>
<tr>
<td>Do. near the trunk</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Greatest circumference of trunk</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Length of the fore-leg, from the axilla, or setting on, to the hoof</td>
<td>4</td>
<td>5\frac{1}{2}</td>
</tr>
<tr>
<td>Length of the hind-leg, from the setting on at the groin</td>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>

The apparent greater length of the fore-legs in the living animal while in the erect posture, arises from the remarkable depth of the chest, length of the anterior dorsal spines, and corresponding length and position of the scapula.

In the Horse, as is well known, there is a central point on each flank, whence the hair radiates in a somewhat spiral manner: the corresponding centre in the Giraffe is a little behind the middle of the abdomen, towards the lower part.

There are four nipples in the inguinal region, of which the two anterior are wider apart than the two posterior.

**Organs of Digestion.**

In the form of the mouth the Giraffe differs from every other Ruminant. In the non-division and extensibility of the hair-clad upper lip it resembles the Elk, but differs widely from that animal in the elegant tapering form of the muzzle. There is no trace of the bifid division of the upper lip which distinguishes the Camel.

The inner surface of the lips, especially where they join to form the angles of the mouth, is beset with numerous, close-set, strong, retroverted and pointed papillæ,
similar to those which are distributed over the interior of the gullet in the *Turtles (Chelonia)*. Other *Ruminants* have this structure, but less strongly developed than in the *Giraffe*. On the palate there are about sixteen irregular transverse ridges, some slightly incurved, others tending to the *chevron* form, but all presenting a free denticulated edge turned backwards; these are traversed by a median groove, and gradually subside posteriorly. At the anterior part of the palate there are transverse rows of large obtuse *papillae* in the interspaces of the ridges. This mechanical apparatus for detaining the food in the mouth and ensuring its deglutition, is required in the *Giraffe* more particularly on account of the small size of its head and jaws as compared with the body. The *bolus* which is regurgitated in rumination is generally so large as considerably to distend the cheek externally to the grinders; and all the callos processes which beset the interior of the mouth tend to direct the nutritive matter to the space between the grinding teeth.

It is in relation to the lengthened mastication which the alimentary substances undergo in the mouth of the *Ruminants*, that these peculiarities of the lips and palate exist. They have not escaped the notice of Cuvier; but their presence by that great anatomist is only connected with the corresponding existence of papillary productions from the lining membrane of the paunch; and he states it to be difficult to trace a final connexion between their development and the kind of food on which the animal lives. But in reasoning on this structure, I think we may legitimately ascend beyond the simple relation of coexistence to which Cuvier alludes. In the act of rumination the *bolus* is driven into the mouth with great force; and the use of these *papillae* as mechanical obstacles to its escape, and their tendency to confine the soft slimy comminuted vegetable substances to the molar region during the second mastication, appear to be offices of sufficient importance to found upon their presence an argument of special adaptation or design. Cuvier, in illustrating his opinion, cites the *Horse* as having no buccal *papille*, and as having, in like manner, no *papille* in the interior of the stomach; but the front part of the mouth of this Herbivorous animal is closed by teeth both above and below, and its food is never regurgitated for the purpose of undergoing a lengthened remastication. That they have no necessary relation of coexistence with *papille* in the stomach or any other parts of the alimentary canal is obvious from the simple structure of the lining membrane of the stomach in the *Turtle*, in which the *oesophagus* is remarkable for the numerous, callous, pointed *papille*, designed to facilitate and ensure the passage to the stomach of the slippery sea-weed and other substances which constitute its food.

Having frequently witnessed the great extensibility, flexibility, and extraordinary command and power which the *Giraffe* possesses over the movements of its tongue, and knowing the important share which this organ plays in the prehension of food in the

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wild animal, I was prepared to expect that it would offer some well-marked and perhaps anomalous modifications in its structure; but the modifications are in fact of a very simple nature. (Pl. XLI.) The muscles of the tongue are the same in number, position, and attachments as in other Ruminants; the principal difference obtains in the greater extent of the organ, anterior to the insertion of the genio-glossus; and as this free and active part consists entirely of a firm muscular tissue, invested by a thin, but dense and very closely adhering integument, there is a corresponding increase in the bulk of the linguales muscles as compared with those muscles of the tongue which have attachments to the bone; of these latter the stylo-glossi, (fig. 2. a. a.) which are the principal retractors of the free anterior part of the tongue, are relatively stronger than in other Ruminants; they arise by a thin but strong tendon from near the lower extremity of the styloid bone, and run forwards below the lateral margins of the tongue, to which they are braced by a thin sheet of fibres (fig. 2. f. f.) descending obliquely forwards from the sides of the linguales to the upper margin of the stylo-glossi. The lingualis inferior is a broad thin sheet of muscular fibres (fig. 2. c. c.), which comes off from the condensed cellular tissue at the under part of the root of the tongue, and runs forward parallel with the fibres of the stylo-glossi, with which it becomes blended anterior to the hyo-glossi (fig. 2. b. b.); these accessory fibres cross the inner surface of the hyo-glossus muscle, which is thus inclosed between the two layers of longitudinal retractors. Sir Everard Home, in his observations on the anatomy of the Giraffe which died in the menagerie of His Majesty King George IV., near Windsor, conceived that the extension and change of size of the tongue was effected chiefly by vascular action—by "its containing a reservoir, out of the course of the circulation, which can be filled with blood at the will of the animal, so as to give it rigidity, and enable it to extend itself for the performance of the different actions in which it is employed with the smallest possible degree of muscular exertion," and that the increase and diminution of size arose from the blood vessels being at one time loaded with blood and at another empty. The movements of the Cameleon's tongue have been explained on a similar theory of vascular or erectile action.

The arteries and veins of the tongue of one of the Giraffes dissected by me, were both successfully injected, and the non-existence of either a reservoir of blood or a vascular erectile tissue was clearly proved. The lingual artery (fig. 2. i.) at the base of the tongue, sends off a large branch which runs upwards on the outside of the posterior part of the genio-glossi muscles (fig. 2. d.), and is principally distributed to the large fessurate mucous papillea and glandular surface on the raised posterior margin of the tongue: the main artery is then continued forwards along the inner surface of the stylo-glossi muscles, giving off branches here and there to the muscular substance of the tongue, and the only modification which it offers worthy of note is the existence of numerous and large anastomotic communications with the lingual artery of the opposite side. The first of these intercommunicating branches, which was as large as a crow
quill (fig. 2. k.), occurred immediately anterior to the genia-glossus, and full six inches from the apex of the tongue. In the specimen here described there was a marked difference in the size of the two lingual arteries: the left was the larger, and, beyond the preceding anastomosis, formed the principal channel for the supply of the free prehensile part of the tongue with blood, which part thus displays more singleness and unity in its organic composition than in man and most other Mammalia, in which the arteries supplying the two lateral moieties of the tongue are equal in size, and have only a slight anastomosis near its apex. The lingual veins in the Giraffe are of large size and present a slight plexiform arrangement beneath the base of the tongue (fig. 2. h. h.). The vein, together with the lingual artery which it accompanies, along the inner side of the stylo-glossus muscle, is covered by a thin stratum of transverse fibres, which pass from the middle line of the under surface of the tongue over the stylo-glossi to the upper surface of the tongue, and when in action would serve to compress the vessels, and at the same time elongate the relaxed fibres of the stylo-glossi; but the space surrounding these vessels is quite inadequate to allow of their distention, so as in any degree to affect the size or motion of the tongue. The whole of the movements of the tongue, in fact, are due to muscular action: any physiologist who has felt the firm but regulated grasp of the tongue of the Giraffe, when twined round the finger, must have been convinced that the action was totally dissimilar to that sudden and fitful force arising from vascular or erectile action. The muscular fibres in the free and flexible part of the tongue present an arrangement adequate to all its movements. The stylo-glossi and inferior linguales expand into a layer of longitudinal fibres, about a line in thickness, covering the whole of the inferior surface of the free portion of the tongue, and becoming continuous at the sides, with a corresponding but thicker stratum of longitudinal fibres on the upper surface of the tongue; these longitudinal muscles inclose a mass of fibres, which run in the transverse direction. The action of these transverse fibres, combined with that of several short vertical fibres near the margins, and of those forming the thin circular stratum surrounding the stylo-glossi at the middle part of the tongue, serves to attenuate or diminish the transverse diameter of the tongue and increase its length; while thus rigidly extended, the apex of the tongue can be curved upwards or downwards by the superficial longitudinal fibres, which are less intermingled with the transverse fibres than in the tongues of most other Mammalia: the contraction of the longitudinal fibres taking place with the relaxation of the transverse ones, produces the retraction of the whole organ. The nerves of the tongue present the same disposition as those in ordinary Ruminants, but the ninth pair is relatively larger than the branch from the fifth pair: the nerve which runs along the inner or under surface of the stylo-glossi towards the free extremity of the tongue is remarkable for its beautifully wavy course (fig. 2. g.), by which it is accommodated to the variations which occur in the length of the organ in the living animal.

The epithelium is thickest at the apex of the tongue, on the upper surface of which it is developed into numerous minute retroverted spines, which occasion the rasp-like
roughness which is felt in the tongue of the living animal (Pl. XLI. fig. 3). A dark leaden-coloured pigment is developed beneath the epithelium, covering the anterior half of the tongue, in relation doubtless to its frequent exposure; the pigment assumes a black colour over the prominent round obtuse papillae which are somewhat sparingly scattered, like coarse grains of gunpowder, over the dark-coloured portion of the tongue: from fifteen to twenty larger fossulate papillae are arranged in an irregular longitudinal row on each side of the raised inter-molar part of the tongue. This surface of the tongue is otherwise smooth, and does not support any large pointed papillae, like those which characterize the corresponding part of the tongue in the Camel and Llama. There is a fold of lingual integument on each side of the posterior part of the tongue, which is covered with a thicker epithelium, and supports a longitudinal row of pointed papille, together with numerous orifices of a thick layer of mucous glands (Pl. XLI. fig. 1.).

On looking down the mouth into the faucæ the cavity appears to be as completely closed as in the Capibara; but instead of narrowing in an infundibular form to a small circular depression, it is terminated by a transverse slit, through which projects a soft, rounded, valvular ridge, formed by the broad superior margin of the epiglottis, which is folded down upon itself at that part. The surface of the faucæ is broken by large risings and depressions, or is coarsely corrugated. (Pl. XLII. fig. 3.) The velum palati, when viewed from behind, is seen to descend to the margins of the glottis in the interspace between the epiglottis and the large arytenoid cartilages; and on raising the soft palate, a small process, or rudimental uvula, appears, descending from the middle of its inferior margin into the open laryngeal fissure; but it fits only into the posterior part of this fissure, the anterior part being defended by two processes of the mucous membrane of the larynx which are continued from the sides of the base of the epiglottis. These processes are thick, of a triangular form, with their upices turned backwards and inwards, so as to cover and close the anterior part of the glottis: when the soft palate is raised to bring them into view, as in Pl. XLII. fig. 1, they seem like two accessory epiglottides; but they consist merely of a duplicature of mucous membrane. At the posterior part of the soft palate there is an oval glandular body about one inch in long diameter.

The tonsils are well-developed glands of a flattened oval form, two inches long, and one inch broad; having each a short duct communicating with the faucæ by a single wide opening, or fossa, and thus exhibiting a higher type of structure than they present in the human subject, where the mucous follicles terminate by several separate apertures.

*Esophagus.*

The aesophagus, like the other parts running along the neck, is chiefly remarkable for its great length. It presents a very regular and uniform diameter throughout (1½ inch).
It is surrounded by two strong layers of muscular fibres. The external muscular layer is the thickest, and its fibres are nearly transverse in their arrangement: those of the internal layer are oblique, but approach towards the longitudinal disposition. I subjected them to microscopical observation, and compared them with the muscular fibres of the four cavities of the stomach; they presented a structure which may be regarded as intermediate between that which characterizes the voluntary and involuntary muscular fibre. In the voluntary muscles the ultimate filaments are collected into what may be called ultimate fascicles, which present a uniform or definite size, and these are characterized, as is well known, by transverse striæ: in the involuntary muscles, as those of the stomach of the Giraffe, the ultimate filaments are not collected into fascicles, but are uniformly interwoven with each other in a wavy course, and there are consequently no striated fascicles. In the muscles of the œsophagus the ultimate filaments are aggregated into regular-sized ultimate fascicles, in which they present a parallel disposition: but the fascicles exhibit no trace of the transverse striæ which characterize the voluntary fascicles, but, on the contrary, are perfectly smooth and sub-transparent.

True involuntary fibres arranged round mucous membranes, as those of the intestine, or urinary bladder, may be thickened by increased action, but do not acquire a deeper red colour: the muscular fibres of the heart, which are developed in the vascular layer of the germinal membrane, and which present the striated character, are generally the reddest in the body, and present the red colour in those animals in which all the other muscular fibres are white. Now the muscles of the œsophagus, which resemble in their ultimate aggregation the true voluntary fibres, also assume a deeper red tint in the Giraffe and other Ruminants, in relation to the increased number and force of the contractions which they have daily to perform, as compared with the œsophageal fibres in the non-ruminating animals.

The mucous membrane of the œsophagus is thick and firm; it is lined by a well-developed smooth and polished epithelium, and is connected to the muscular coat by a very lax cellular membrane.

Abdominal viscera.

Before adverting to the rest of the alimentary canal, I may describe the position in which the abdominal viscera were seen in two dissections of the Giraffe.

In the female, which died at the Surrey Gardens, the paunch occupied the ventral aspect of the anterior two-thirds of the short abdominal cavity, resting immediately upon the abdominal muscles and their strong and elastic fasciae. The great omentum, which was studded with fat, as in the Deer and Ruminants generally, extended from the paunch to below the brim of the pelvis: on raising it, a fold of the colon appeared immediately below the paunch, towards the left side; below this were several convolutions of small intestines: the obtuse blind end of the cæcum made its appearance in the left hypogastric region, and below these was another portion of the colon.
In the male *Giraffe*, dissected at the Zoological Gardens, the abdominal *viscera* presented nearly the same appearances: the paunch here also, as in other *Ruminants*, was so placed that no *viscus* was interposed between its weighty and indigested contents and the inferior abdominal *parietes*.

On raising the paunch, the spiral coils of the *colon*, characteristic of the *Ruminants*, came into view, together with the rest of the *jejunum* and *ileum*. When these were removed, the third and fourth stomachs were exposed, together with the small liver which was wholly confined to the right of the mesial plane.

The spleen, as usual in *Ruminants*, had its concave surface applied to the left side of the first stomach or *rumen*.

The *pancreas* extends transversely behind the stomach within the posterior duplication of the *omentum*, from the spleen to the *duodenum*.

The kidneys occupy the usual position in the loins; the right one a little more advanced than the left: their figure is rounded and compact, as in the *Deer* and *Antelopes*; they are not externally lobulated, as in the *Ox*.

The stomach presents in every respect the structure which characterizes the horned *Ruminants*. The paunch or *rumen* has the usual enormous proportions, and is bifid at the lower extremity; the *papillae* (Pl. XLI. fig. 4) with which its inner surface is every where beset, are more regular and uniform in their size and shape than in the *Ox*, they are relatively thicker, narrower and longer; their margins are thickened but entire, instead of being irregularly notched; and they become expanded and rounded at their free extremity, instead of tapering to a point, as in many parts of the paunch of the *Ox*: they resemble more those of the *Reindeer*. There is more variety among the horned *Ruminants* in the form and depth of the cells of the *reticulum*; and these modifications have been supposed to relate to differences in the power of retaining fluids. The structure of the *Reindeer’s* stomach appears to be confirmatory of this view: the snow which must be swallowed with the *lichen* through a great part of the year would render any reservoir for water unnecessary, and the cells in the *reticulum* are, in fact, in this *Ruminant* remarkably shallow. The same structure also obtains in the *Giraffe*. The cells are not, however, as has been stated, entirely wanting; but their hexagonal boundaries appear as mere raised lines supporting a row of pyramidal *papillae* larger than those in the interspaces (Pl. XLI. fig. 5); for any imaginable use, they might have been arranged in any other even the most irregular forms; but that pattern is closely adhered to which grouping together a number of cells in the least possible space renders necessary in other *Ruminants*, and almost universal in nature. In the *psalterium*, between each two narrow folds, there is alternately one of great and one of moderate breadth, as in the *Ox*, &c.: these *lamellae* are beset with short pyriform *papillae*. In the fourth stomach, the *rugae* of the digestive membrane are slightly developed, and chiefly longitudinal; the *pylorus* is protected by a valvular protuberance, placed above it, just within the stomach; this protuberance is relatively smaller than in the *Llama*.
The duodenum is dilated at its commencement; it receives the biliary and pancreatic secretions about ten inches from the pylorus.

The small intestines are rather tightly bound to the spine in short coils by a narrow mesentery, which contained much fat. They were of the following length:

<table>
<thead>
<tr>
<th></th>
<th>Cross's Female</th>
<th>Cross's Male</th>
<th>Zool, Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Intestines</td>
<td>ft  in.</td>
<td>ft  in.</td>
<td>ft  in.</td>
</tr>
<tr>
<td></td>
<td>91 0</td>
<td>88 0</td>
<td>82 0</td>
</tr>
<tr>
<td>Large Intestines</td>
<td>43 2</td>
<td>43 0</td>
<td>40 0</td>
</tr>
<tr>
<td>Cecum</td>
<td>2 2</td>
<td>2 0</td>
<td>2 0</td>
</tr>
</tbody>
</table>

The small intestines present a pretty uniform size, measuring in circumference four inches. The ileum ceases to be convoluted towards its termination, but ascends in a straight course and enters the cecum near the root of the mesentery. The termination of the ileum forms a circular tumid lip within the cecum, and presents a less efficient mechanical obstacle to regurgitation than in the human subject.

The cecum is a simple cylindrical gut, as in other Ruminants; its circumference is six inches; it extends downwards from where the ileum enters, and its blind end appears on the left side above the pelvis; but this position might be accidental as its connexions are loose.

The disposition of the colon resembles that of the Deer. The extent of this intestine, before it begins to make the spiral or involuted turns, is about eight feet; it becomes narrower where it takes on this characteristic disposition, and the separation of the feces into pellets begins at the end of this part. The spiral coils are situated to the left of the root of the mesentery, which, with the small intestines, must be turned to the right in order to bring them into view: there are four complete gyrations in one direction, and four reverse coils in the interspaces of the preceding, the gut being bent back upon itself; the length of this part of the intestine, when unravelled, is about fourteen feet. The spiral coils are not on the same plane, but form a depressed and oblique cone, whose concavity is next the mesentery. The colon, emerging from its coils, passes to the right, behind the root of the mesentery, becomes connected with the duodenum and the first part of its own course, then winds round to the left of the mesentery, and finally recedes backwards and descends to form the rectum: I may observe, that in those Ruminants which have soft undivided feces as the Ox, the coils are less numerous and regular, and the colon shorter and wider than in the Giraffe and Deer tribe.

The Liver is a small viscus, as in most herbivorous Mammalia; it weighed but six pounds, eleven ounces, avoids upois; it is of a flattened form, consisting of one lobe, with a small posterior Spigelian process; its greatest breadth twelve inches; its antero-posterior diameter eight inches. The inferior cava passes through a notch at the posterior edge of the liver, and does not perforate it.

As the presence of a gall-bladder distinguishes the hollow-horned from the solid-
horned Ruminants, the investigation of this point in the anatomy of the Giraffe was attended with much interest; and the result of an examination of three individuals shows how necessary it is not to generalize on such a point from a single dissection.

In the first Giraffe, the female at the Surrey Gardens, I found a large gall-bladder, which presented an unusual structure, being bifid at its fundus. It was attached in the usual manner and situation to the under part of the liver, having a covering of peritoneum over three-fourths of its surface. It measured three inches in length, and two inches in diameter. On making a longitudinal incision down one side of this apparently single gall-bladder, it was seen to be divided throughout its length by a middle vertical septum. Further dissection of this septum showed that the gall-bladder in fact was double, and that the two reservoirs of equal size, were connected together, side by side, by means of a common investment of serous membrane. The lining membrane of each bladder was smooth; they communicated separately with the commencement of a single cystic duct, the terminal orifices admitting freely the blunt end of a common probe, and being protected by a valvular fold. The cystic duct receives the hepatic ducts in its course towards the duodenum. (Pl. XLII. fig. 4.)

In the two males afterwards examined there was not a vestige of a gall-bladder, but the bile was conveyed by a rather wide hepatic duct to the duodenum. I conclude, therefore, that the absence of a gall-bladder is the rule, or normal condition; and that the Giraffe in this respect, as in the structure of its horns, has a nearer affinity to the Deer than to the Antelopes.

The pancreas is broader, thinner, and of a more irregular form than in the Calf or human subject. It is attached on the left side to the diaphragm and posterior part of the stomach, and it extends transversely across the spine to the termination of the biliary duct.

I found in one Giraffe that the spleen was ten inches long and seven inches and a half broad; in another of the same stature, nine inches long and five inches broad. It is of a pretty regular oval form, but very thin, not exceeding one inch and two-thirds at the thickest part.

The kidneys present the usual disposition, the right being nearest the diaphragm. They are of a short or full oval figure, with a simple unbroken exterior, as in the Deer; about four inches and a half in length, four inches in breadth, and two inches and a half in thickness. The tubuli uriniferi converge towards a single ridge, which receives eight processes like abutments on each side, and occupies a narrow pelvis.

**Organs of Circulation.**

In the chest the viscera presented the usual disposition. The processes of the pleura supporting the lungs contain fat disposed between the layers, as in the mesentery.

The heart measured in the full length of the ventricles eight inches and a half, and
the same in the transverse diameter of the base. The auricles are small as compared with the ventricles, which form a rounded lengthened cone. The right ventricle terminates at two inches from the apex. The left flap of the tricuspid valve has its free margin attached by long chordae tendineae to the septum ventriculorum on one side, and to a columna carneae on the other; which columna also gives attachment to some of the chordae tendineae of the right flap of the tricuspid; the rest of the chordae of this flap, and all the chordae of the third or internal flap, are attached to a very short and thick columna which rises from the septum. Below the left flap of the tricuspid valve there is a fleshy column connecting the free wall of the right ventricle to the septum. In the right auricle the Eustachian valve is represented by a slight ridge circumscribing the left boundary of the lower cava. At the base of the heart, on one side of the origin of the aorta, and imbedded in the tendinous circle which gives attachment to the muscular fibres of the ventricle, there is a curved bone two-thirds of an inch in length.

The arch of the aorta, after distributing the vessels to the heart itself, gives off, first, a large innominata which subdivides into the right vertebral artery, the right brachial artery, and the common trunk of the two carotids; secondly, the left brachial artery; thirdly, the left vertebral artery. The common trunk of the two carotids is remarkable for its length. The cranial plexus of the internal carotid is much less developed than in the grazing Ruminants.

Nervous System.

The brain of the Giraffe resembles in its general form, as well as in the number, disposition, and depth of the convolutions, that of the Deer: it is more depressed than in the Antelope (Antilope pica) and relatively broader and deeper than in the Ox: the cerebrum lies wholly in front of the cerebellum. The anterior contour of the cerebral hemispheres is somewhat truncated, as may be seen in the figure (Pl. XLIII. & XLIV.), which supersedes the necessity of further description of the external form. The cerebral convolutions are divisible, as in other Ruminants, into primary and secondary; they average a breadth of three lines and are almost symmetrical in the two hemispheres. The two posterior convolutions next the median line, towards which they converge and meet in the form of a chevron, are relatively larger than in the Ox; the two larger primary convolutions, external to these, proceed in an undulating course from behind inwards and forwards, as in the Ruminants generally, but they are more complicated by secondary convolutions than in the Ox. There is little symmetry in the disposition of the primary convolutions of the cerebellum: the middle one on the upper surface representing the superior vermiform process, pursues a wavy course from side to side; but the

1 The epithet "subclavian" is so obviously inappropriate as applied to the Ruminants and other non-clavicleate Mammals, that no apology seems necessary for adopting Dr. Barclay's term for the trunk supplying the pectoral extremity.
inferior vermiform process is straight, narrower than the upper one, and very prominently developed: these, with the lateral convolutions of the cerebellum, are subdivided as usual into narrow transverse folds. On divaricating the cerebral hemispheres, the corpus callosum was seen to be situated from nine to ten lines below the superior surface of the brain. Large and prominent corpora striata, a small triangular septum lucidum, with the fornix and other usual structures, were observed in the dissection of the lateral ventricles. The pineal gland presented a depressed subrhomboidal figure, and a very firm solid texture; but no particles of earthy matter could be discerned in its substance with the naked eye. The bigeminal bodies have the usual proportions observable in other Ruminants; the superior pair being the largest masses; the inferior bodies, or testes, resemble a thick transversely arched commissure, with the concavity applied to the superior vermiform process of the cerebellum, and the two extremities enlarged and rounded.

The following admeasurements of the brain and its parts were taken.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Inches</th>
<th>Lines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitudinal diameter of the brain</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Vertical ditto</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Breadth of the cerebrum</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Length of the cerebellum</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Breadth of ditto</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Length of the pons Varolii</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Breadth of ditto</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Length of the corpus callosum</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Length of the pineal gland</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Breadth of ditto</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Breadth of the superior bigeminal bodies</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td>Depth of ditto</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Breadth of the inferior bigeminal bodies</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Weight of the entire brain, strip of its membranes, fourteen ounces avordupoise.

The olfactory nerves were very large, as in most Ruminantia, and terminated in expanded bulbs, in length one inch and a half, in breadth one inch; these were lodged in special compartments of the cranial cavity. The optic nerves and ninth pair were relatively larger than in the Deer or Ox, corresponding with the magnitude of the eye, and the length and mobility of the tongue in the Giraffe. The other cerebral nerves presented no peculiarity.

The spinal chord is closely invested by the dura mater, which is thinner on the dorsal than the ventral region of the chord. The posterior roots of the nerves perforate the dura mater and converge to form the ganglia on the outside of that membrane. The chord is chiefly remarkable for the extreme length of the cervical portion. In the male Giraffe dissected at the Zoological Gardens, and which measured eight feet from
the muzzle to the vent, the length of the spinal chord from the *corpora pyramidalia* to the commencement of the swelling, giving off the brachial plexus, was three feet three inches.

The origin of the cervical nerves from this part of the chord presented an uncommon appearance; for, the elongation of this part during fetal development, having proceeded by means of uniform interstitial deposition, the roots of the nerves had become equally separated from each other; and as the lowest filament of the root of one nerve was not further removed from the highest of the next below, than this from the succeeding filament of the same nerve, the filaments composing the root of a single cervical nerve extended over a considerable space: thus the third cervical nerve derived its filaments from a tract of the spinal chord measuring fully six inches. The inferior roots of nerves, on leaving the medulla ascend and the superior ones descend to the perforation in the *dura mater* at a very acute angle with the spinal chord, and they may be traced for a short distance in a direction corresponding with their course externally, the upper filaments upwards, or towards the brain, the lower ones downwards, within the substance of the spinal chord. In the posterior roots of the cervical nerves, one and sometimes two of the lowermost filaments of one nerve are continued uninterruptedly into the uppermost filaments of the succeeding nerve of the same side. These communicating chords are of conspicuous size, and lie rather loosely in the subarachnoid tissue, on the surface of the spinal chord: there appear to be in some places very minute nervous filaments passing from the substance of the chord to the anastomotic loop. In one place I traced a corresponding superficial connecting loop between the anterior or motor roots of contiguous nerves. (Pl. XLIII. fig. 2.)

The brachial plexus is formed principally by the first two dorsal nerves; from these to the large nerves forming the lumber plexus there intervene seventeen pairs of nerves; the four following nerves, or those of the eighteenth to the twenty-first pair inclusive, are principally enlarged to form the plexus supplying the hinder extremities.  

From the remarkable length of the neck of the *Giraffa* the condition of the recurrent nerves became naturally a subject of interest: these nerves are readily distinguishable at the superior third of the trachea, but when sought for at their origin it is not easy to detect them or to obtain satisfactory proof of their existence. Each nerve is not due, as in the short-necked *Mammalia*, to a single branch given off from the *nervus vagus*, which winds round the great vessels, and is continued of uniform diameter throughout their recurrent course, but it is formed by the reunion of several small filaments derived from the *nervus vagus* at different parts of its course. The following is the result of a

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1 In the male *Giraffa* which died at the Society's Gardens, the lameness and subsequent paralysis of the hinder extremities were caused by an *exostosis* from the inner surface of the superior arch of the last lumbar vertebra, which pressed upon the posterior enlargement of the spinal chord, and had occasioned inflammation and thickening of the *dura mater*. The *exostosis* was a consequence of a wound of the spine received when the animal was captured.
careful dissection of the left recurrent nerve. The nervus vagus as it passes down in front of the arch of the aorta sends off four small branches, which bend round the arch of the aorta on the left side of the ductus arteriosus; the two small branches on the left side pass to the asophagus and are lost in the œsophageal plexus; the remaining two branches continue their recurrent course, and ascend upon the side of the trachea, giving off filaments which communicate with branches from the neighbouring œsophageal nerves: these recurrent filaments also receive twigs from the œsophageal nerves, and thus increase in size, and ultimately coalesce into a single nerve of a flattened form, which enters the larynx above the cricoid cartilage and behind the margin of the thyroid cartilage. I may observe, that hitherto the Giraffes have not been heard to utter any vocalized sound, except once in the case of the male during the coitus.

The sympathetic nerve in the neck presents five ganglionic enlargements,—the two lowest are moderately large, the next above is smaller, the fourth, counting from below, still less, and the fifth is again large and elongated.

**Muscles.**

No peculiarity of importance was noticed in the dissection of the abdominal muscles; the aponeurosis of the external oblique was thick and elastic, as in many other Ruminants and Pachyderms, which, from the nature of their food, require support for large accumulations of it, and proportionately developed alimentary sacs.

The mylo-hyoides is a thick and strong muscle; it arises from the whole of the internal surface of the lower jaw, and is inserted principally into the raphe, or longitudinal commissure dividing it from its fellow of the opposite side. It adheres firmly to the genio-hyoides: this arises by a well-marked tendon from the posterior rugous surface of the symphysis menti, and has the usual insertion. The genio-glossus arises by a tendon close to the inner side of the tendon of the genio-hyoides; its fleshy belly has a considerable antero-posterior extent, and diminishes to a very thin edge at its anterior margin. The digastricus has the usual origin, and is inserted broad and thick into the under side of the lower jaw. The stylo-hyoides is external to the digastricus, and is remarkable for the slenderness and length of its carneous part. The disposition of its fibres and of those of the other muscles which combine to form the fleshy substance of the tongue, have already been described. The most interesting modifications in the muscles of the os hyoides were found in those which retract that bone. The muscle which, as in some other Ruminants, combines the offices of sterno-thyroides and sterno-hyoides, arises in the Giraffe by a single long and slender carneous portion from the anterior extremity of the sternum; this single fleshy origin is nine inches long, and terminates in a single round tendon, which is six inches long; the tendon then divides into two, and each division soon becomes fleshy, and so continues for about sixteen inches: then each division again becomes tendinous for the extent of two inches, and ultimately carneous again, when it is inserted into the side of the thyroid cartilage, and is thence
continued in the form of a fascia into the os hyoides. We have in this alternation of a contractile with a non-contractile tissue a striking example of the use of tendon in limiting the length of the carneous or contractile part of a muscle to the extent of motion required to be produced in the part to which the muscle is attached. Had the sterno-thyroides been continued fleshy as usual from its origin through the whole length of the neck to its insertion, it is obvious that a great proportion of the muscular fibres would have been useless; for as these have the power of shortening themselves by their contractility only one-third of their own length, if they had been continued from end to end in the sterno-thyroidei, they would have been able to draw down the larynx and os hyoides one-third of the way down the neck; such displacement, however, is neither required nor indeed compatible with the mechanical connexions of the parts; but by the intervention of long and slender tendons, the quantity of the contractile fibre is duly apportioned to the extent of motion required for the larynx and os hyoides.

The muscle analogous to the omo-hyoides of other animals is adjusted to its office by a different and more simple modification: instead of having a remote origin from the shoulder-blade, its fixed point of attachment is brought forward to the nearest bone (the third cervical vertebra) from which it could act upon the os hyoides with due power and extent of contraction. Its insertion is by a small round tendon.

The analogue of the sterno-mastoideus should be called sterno-maxillaris. The pair arises by a single origin which soon divides, and each division forms a flat muscle, preserving an uniform breadth of one inch and a half: it continues fleshy the whole way to within one foot of the angle of the jaw, where it terminates in a small round tendon, which expands to be inserted into the inner side of the angle of the jaw. From the freedom of the inflection of the neck, the head can be brought as near to the chest as the contraction of these long muscles is designed to effect; the necessity, therefore, for intervening tendons does not exist, and the sterno-maxillares continue fleshy to their terminal tendons of insertion.

The scaleni muscles are most powerfully developed; they consist of four distinct masses on each side, arising from the fourth, fifth, sixth, and seventh cervical vertebrae, and are inserted into the manubrium sterni and first rib.

The trapezius consists of two pretty distinct portions: one arises from the transverse processes of the fifth and sixth cervical vertebrae; its fleshy part is thick and strong, but expands as it passes downwards and backwards, and finally is lost in a strong fascia overspreading the large shoulder-joint. The second portion is thin and broad; it arises from the ligamentum nuchae, and is inserted into the fascia covering the scapula.

The levator scapulae arises from the fifth, sixth, and seventh cervical vertebrae; and these three bulky origins, of which the lowest is the thickest, converge, unite, and are inserted into the outer margin of the scapula near its superior angle.
The *rhomboideus* is single, and is chiefly remarkable for its shortness; like the *serratus major*, it is inserted into the broad elastic cartilage, which is continued upwards from the base of the *scapula*. With reference to these scapular cartilages I may observe, that as the fore part of the trunk is, as it were, slung upon the two great *serrati* muscles which principally support the weight of the remarkably deep chest of the *Giraffe*, the interposition of the elastic cartilages between the upper attachments of the muscles and the capitals of the bony columns of the two fore-legs, must be attended with the same advantage as is obtained by slinging the body of a coach upon elastic springs.

The *pectoralis major* arises from the whole length of the *sternum*, and is composed of two portions, one superficial, the other deep-seated; the former is inserted into the *fascia* covering the extensor muscles of the fore-leg; the latter into the *fascia* covering the flexors.

The other muscles and tendons acting upon the distal joints of the extremities did not materially differ, otherwise than in their greater length from the corresponding parts in other bisulate Mammals.

The development of elastic ligament is truly extraordinary in the *Giraffe*, as exemplified in the *pax-wax* or *ligamentum nuchae*. This mechanical stay and support of the long neck and of the head commences from the sacral *vertebrae*, and receives fresh accessions from each lumbar and dorsal *vertebra* as it advances forwards; the spines of the anterior dorsal *vertebrae* become greatly elongated to afford additional surface for the attachment of new portions of the ligament, which appears to be inserted, on a superficial dissection, in one continuous sheet into the longitudinally extended but not elevated spinous processes of the cervical *vertebrae*, as far as the *axis*: the *atlas*, as usual, is left free for the rotatory movements of the head; the termination of the ligament passes over that *vertebra* to terminate by an expanded insertion into the occipital crest. It consists throughout of two bilateral moieties.

**Osseous System.**

The osteology of the *Giraffe* has been illustrated and briefly noticed in the *fasciculus* relating to the Osteology of the *Ruminants* (Die Skelete der Wiederkäfer, fol. 1823) in the beautiful work of Pander and D’Alton. Some observations on the *cranium* of the Nubian *Giraffe*, with figures of the skull of the male and female, are contained in the "Atlas zu der Reise in Nördlichen Afrika, von Rüppell, pl. 9. The skeleton of the *Giraffe* has been described with more detail in the second edition of Cuvier’s "Leçons d’Anatomic Comparée," and especially as regards the *cranium*, which is considered with reference to its general form (p. 234.), its external depressions (p. 278.), its internal depressions (p. 303.), the connexions of the component bones (pp. 365 and 439.), and the *foramina* and fissures (p. 494.).

After a comparison of these excellent descriptions with the skulls of the adult male
and female Cape Giraffe, and of the skeletons and skulls of a male and female Nubian Giraffe, rather more than half-grown, I have only a few additional observations to offer, chiefly in relation to the alleged existence of a third distinct bony nucleus, forming the anterior mesial protuberance or horn.

The part of the skull to which the elastic ligament is attached, is raised considerably above the roof of the cranial cavity by the extension backwards of large sinuses, or air-cells as far as the occiput. The sinuses commence above the middle of the nasal cavity, and increase in depth and width to beneath the base of the horns, where their vertical extent equals that of the cerebral cavity itself. The exterior table of the skull, thus widely separated from the vitreous table, is supported by stout bony partitions, extended chiefly in the transverse direction, and with an oblique and wavy course. Two of the most remarkable of these bony walls are placed at the front and back part of the base of the horns, intercepting a large sinus immediately over the middle of the cranial cavity, and dividing it from a smaller sinus which covers the anterior part of the cranial cavity, and from a third and larger one behind. The sphenoidal sinuses are of a large size. (Pl. XL.)

The nasal cavity occupies the two anterior thirds of the skull, and the ossa spongiosa are proportionally developed. The condyles of the occiput are remarkable for their extent in the vertical direction; it is this structure which enables the Giraffe to raise the head into a line with the neck, and even to bend it a little way back upon the neck. This action I have often witnessed in the living animal.

In the adult male Cape Giraffe the only appearance of the distinctness of the anterior protuberance is due to some irregular vascular grooves at the circumference of its base; but similar grooves are also visible in the skull of the female; and a section of the skull, taken through the middle of the frontal protuberance in the male, shows that it is formed by the thickening and elevation of the anterior extremities of the frontal and the contiguous extremities of the nasal bones.

In the male Nubian Giraffes, which had attained nearly two-thirds of their full stature, the posterior horns, like other bony epiphyses, were less firmly attached to the skull than they were in the full-grown Cape Giraffes, and they became detached from the frontal and parietal bones after a short maceration. Now if the anterior protuberance had been formed by a similar separate ossification, this would undoubtedly have been demonstrated in a similar manner; it, however, consisted only of a partial elevation of the frontal and nasal bones, as in the adult Cape Giraffe.

The two posterior or true horns are not supported exclusively by an enlarged frontal bone, but rest each upon the coronal suture which traverses precisely the middle of the expanded base of the horn-shaped epiphyses. I have noticed the same position of the horns in the skull of an adult female Cape Giraffe, in which the two frontals are distinct, and joined by a well-marked suture continued along the posterior two-thirds of the frontal protuberance, or as far as the nasal bones. The sagittal suture is also
persistent on both sides, external to the horns, and on the left side extends from beneath the middle of the base of the horn to the posterior extremity of the interfrontal suture.

There is a well-marked sexual difference in the horns of the Cape Giraffe. In the male they are nearly double the size of those of the female, and their expanded bases meet in the middle line of the skull, so that they would entirely conceal the coronal suture, even if it were not early obliterated in this sex. In the female, the bases of the horns are at least two inches apart, and in one instance the remains of the coronal suture on the left side are visible in the adult. The Nubian Giraffe exhibits the same sexual difference in regard to the proportional development of the horns.

The parietal bone is single, and is anchylosed with the occipital and interparietal bones. The persistence of the sutures in the temporal fossa shows that the sphenoid ala articulates with the angle of both the parietal and frontal. The zygomatic process of the temporal bone unites with the malar by a rectangular suture.

In all the crania of the Giraffe that I have examined there is a vacant space left in the side of the face, between the lachrymal, frontal, nasal, and superior maxillary bone: but this in some individuals is less conspicuous from the outward protrusion of the superior spongy bone. The figures of the cranium of the Giraffe by Pander and D'Alton show the same structure. In those of the Nubian Giraffe by Rüppel, the vacant space is relatively smaller than in skulls of the Cape Giraffe.

With respect to the extent of the malar bone upon the face, I find it proportionally less in the Giraffe than in the Sheep. The remarkable development of the lachrymal bone within the orbit, described in detail by Cuvier, seems to have relation to the peculiarly large size of the eye.

The nasal bone is bifurcate at its anterior extremity, as in the Deer, not simply pointed, as in most of the Antelopes.

The cervical vertebrae of the Giraffe are not only remarkable for their great length, but also, as Prof. De Blainville has recently shown, for the ball and socket form of the articulations of their bodies; the convexity being on the anterior extremity and the concavity posterior: in this respect they resemble the vertebrae of the Camel, but in both these species the vertebrae are united by the concentric layers of intervertebral ligament, and not by synovial capsules as in most of the Reptilia.

The superior ring of the atlas is perforated by the vertebral artery, near its anterior extremity.

The vertebra dentata is characterized by the absence of transverse processes; but a thick ridge on each side of the posterior part of the body represents the superior transverse process. The perforation for the vertebral artery is near the anterior extremity of the superior arch, and leads obliquely into the spinal canal. There are no anterior oblique processes, the axis being joined to the atlas by the anterior extremity of its body and by the processus dentatus, which latter are blended together into one common articulation, and inclosed in one capsular ligament. The spinous process of the axis is deve-

In the cervical vertebra of the Camel and Llama the transverse processes are more developed than in the Giraffe, but, as in that animal, are not situated in the same perpendicular plane on the sides of the vertebrae, and do not intercept a space, as in most other Mammalia, for the protection of the vertebral arteries. These important vessels, however, instead of perforating the sides of the body of the vertebrae, as in the Giraffe, pass through canals in the superior laminae, of which the orifices are entirely concealed from external view. From the seventh or sixth to the second cervical vertebrae inclusive, both in the Auchenia and Camel, the vertebral arteries enter the vertebral canal itself along with the spinal chord at the posterior aperture in each vertebra; they run forwards on the outside of the dura mater of the chord, between it and the vertebral arch, and when they have thus traversed about two-thirds of the spinal canal, they perforate separately the base of the superior vertebral laminae, and emerge directly beneath the anterior oblique or articulating processes, whence they are continued along with the spinal chord into the vertebral canal of the succeeding vertebra, perforating the sides of the anterior part of the superior arch in like manner, and so on through all the cervical vertebrae till they reach the atlas. In a very remarkable extinct Pachydermatous animal, (Macrauchenia), whose fossil remains were discovered by Mr. Darwin at Port St. Julian, Patagonia, and which had cervical vertebrae as long as those of the Giraffe, I found the same peculiar disposition of the canals for the vertebral arteries as in the Aucheniae and Camelidae.

In viewing the vertebral column of the Giraffe from above, we perceive that the cervical vertebrae present the broadest as well as the longest bodies; of these the third and fourth are the narrowest and longest, the rest gradually increase in breadth and diminish.
in length to the seventh: the dorsal *vertebrae* thence grow narrower to the ninth, after which the *vertebrae* increase in breadth chiefly by the progressive development of the transverse processes. The fourth dorsal spine is the longest; the second is the strongest. Their great development relates to the length of the neck, the head and its appendages being, in consequence of that length, rendered remarkably light. The spines of the dorsal and lumbar *vertebrae* all slightly incline backwards.

The *sacrum* consists of four *vertebrae* ankylosed together, but of these only the first is articulated with the *ileum*. I counted twenty *vertebrae* in the tail of the Nubian Giraffe. The vertebral *formula* in this species is therefore as follows: Cervical 7, Dorsal 14, Lumbar 5, Sacral 4, Caudal 20. In the greater development of the tail the Giraffe presents a marked deviation from the Deer, agreeing in this respect with the other Ruminants which have small and persistent horns.

There are fourteen pairs of ribs, seven true and seven false. The first pair is straight, the rest become gradually more and more curved to the last. They increase in length to the eighth, and thence gradually become shorter: they increase in breadth to the fifth, and thence gradually become narrower.

The *sternum* consists of a single series of six bones and an ensiform cartilage; it is chiefly remarkable for its great curvature. The first sternal bone is the narrowest and longest; the succeeding ones progressively diminish in length and increase in thickness.

Little remains to be said of the bones of the extremities after the illustrations which have been given by Pander and D'Alton. The Giraffe presents, perhaps, the relatively longest and narrowest *scapula* of all *Mammalia*. The apparent superiority in the length of the anterior extremities depends upon the nearly vertical position of this bone upon the anterior part of the side of the deep and narrow chest.

In the *humerus* the medullary artery enters the bone at its inner side, about the junction of the upper and middle third (in the skeleton of the Giraffe in the Museum of Comparative Anatomy at Paris the artery enters at the junction of the middle and lower third in the left *humerus*); the course of the canal is obliquely towards the distal extremity, as in almost all *Mammalia*.

The bones of the fore-arm, though ankylosed together, are well defined. The *ulna* forms the *olecranon* and the posterior third of the *trochlea* for the *humerus*; it then sends down the posterior and outer side of the *radius* a slender splint-like process, which becomes confluent with the *radius* at its lower end, and disappears about two-thirds of the way down the bone. Three inches below this extremity the *ulna* again reappears, and swells out into a process which presents an articular surface which glides upon the concavity of the cuboidean bone. In the Parisian skeleton the *ulna* is continued without interruption from end to end. The medullary canal commences at the posterior side

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1 The only exception I have as yet found is in the *Tamarindus*, where the medullary canal of the *humerus* runs rather proximad.
of the radius, one-sixth of the length from the head of the bone, and its course is obliquely distad, both in the skeleton of the Nubian Giraffe in the College of Surgeons, and in the skeleton of the Giraffe in the Parisian Museum.

The first row of carpal bones includes the scaphoides, lunare, cuneiforme, and pisiforme; the last is of large size, and represents the os calcis. The second row consists of three bones. The metacarpal bone is remarkable for its great length: a pair of sesamoid bones are articulated to the posterior part of each of its distal articular surfaces. A large sesamoid bone is also placed between the second and third phalanges.

The femur of the Giraffe may be distinguished from that of any other mammiferous animal by the large proportional size of its distal extremity. In the situation and course of its medullary artery it differs from Man and the ungulate Mammalia, and resembles the horned Ruminants generally: the artery, for example, enters the femur at its anterior surface, about one-fifth from the proximal extremity, and runs obliquely downwards or distad, and backwards: in the Camel, however, as in the Horse and Tapir, the medullary artery penetrates the femur at its posterior surface near the middle of the bone and runs distad. The tibia has the same disposition of the medullary canal as in other Mammalia. In the tarsus the two cuneiform bones which are separate in the Camel, and in most true Ruminants, are anchylosed in the Giraffe: but the rudimentary bones of the two posterior pendent or spurious digits, which are present in many of the Deer and Antelope tribe, are entirely wanting in the Giraffe, as in the Camel.

**Generative System.**

**Male Organs.**

The testes are situated in a short scrotum in the situation usual in the Ruminant tribe; on each side of the base of the scrotum are the rudiments of two mammae.

The testes themselves are elongate, oval: the tunica vaginalis, as usual, communicates with the peritoneal cavity. It is reflected from the tunica albuginea upon the outer side of the epididymis, covers that body, and is then continued from a longitudinal line traversing the middle of the concavity of the epididymis, which is applied to the testis, upon and over that gland. The globus major forms a rounded protuberance projecting below the testis. The corpus highmorianum, or line of condensed cellular tissue from which the tubuli testis diverge, is situated nearly in the longitudinal axis of the testis. This position is most favourable for the periodical enlargement of the testis, which takes place in the Giraffe, as in the Deer and Antelopes; for the development proceeding from this central line, as a fixed point, the tubuli testis can expand and become extended in every direction.

The vasa deferentia pursue the same course as in the Deer; they become slightly enlarged at the terminal two inches of their course, and the secreting surface of their lining membrane is augmented by various irregular folds and sinuses.

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1 This is the case in the Buffalo, the Aurochs, the Goat, the Sheep, and the Stag.
The *prostate* consists, as in other true *Ruminants*, of two separate, elongated, glandular bodies, placed on the outside of the *vasa deferentia*, and sending each a single duct to terminate with the *vas deferens* of the same side in one of the two deep lateral *fossae* which are seen upon the *verumontanum*. In the *Camel* the prostate forms one transversely elongated body, placed entirely behind the beginning of the *urethra*, and presenting in a slight degree only, the bilobed character. The *Giraffe* in this part of its structure agrees with the typical *Ruminants*: but in these the divided *prostate* offers several modifications of form. In the *Bull*, e.g., each lobe is an elongated body, disposed in a wavy figure, with irregular rounded projections from its sides. In the *Goat* the same part is simply elongated, and tapers somewhat towards the distal or free extremity. In the *Giraffe* the prostate corresponds rather with the modifications which this gland presents in the Deer-tribe; the distal extremity of each separate lobe forms a large round bulbous body, and the rest of the lobe diminishes towards the *urethra*. In the young males which I dissected these accessory generative glands were very small, the *parenchyma* dense, and the central cavity hardly perceptible. The lower extremities of these glands and the terminations of the *vasa deferentia* were included with the *urethra* in the commencement of the strong transverse muscle which surrounds the membranous part of the *urethra*. The length of this part was four inches, the thickness of the muscular stratum one-third of an inch.

At the base of the bulb of the *urethra* are situated two Cowperian glands, each as large as a nutmeg, and surrounded by a special and dense capsule of muscular fibres. The *parenchyma* of these glands is less compact than in the prostate glands; they have not a single cavity in the centre, but three or four *sinuses* convey the secretion to the duct, which terminates in the bulbous part of the *urethra*. A well-developed semilunar fold of membrane separates the dilated canal of the *urethra* occupying the bulb from the preceding membranous part. The length of the *compressores* or *acceleratores* muscles surrounding the bulb, is three inches and a half: anterior to the large and normal *acceleratores* there is a smaller *accelerator* half an inch in length. The *erectores* muscles present the usual structure. The *penis*, when retracted, is bent, as in other *Ruminants*, into a sigmoid form, and the two *retractores* muscles associated with and producing this sigmoid retraction offer the ordinary position and attachments; they expand to be inserted upon the sides of the *corpora cavernosa* near the base of the *glans*.

The cavernous texture of the *penis* is not divided by a middle *septum*. The *glans* begins by a somewhat sudden expansion, and continues to enlarge to its distal extremity, which is smooth and rounded. The prepuce is reflected upon this extremity, and not upon the root of the *glans*, so that only a small portion of the *glans* is exposed by laying open the prepuce. The urethral canal does not open upon the extremity of the *glans*, but is continued forwards for an inch and a half attached to the inside of the prepuce, its *parietes* being merely membranous, and its extremity projecting freely like a membranous bilabiate tube, about a line beyond the inner surface of the *prepuce*.
Female Organs.

The Ovaria are irregularly oval subcompressed bodies, one inch and a half in length, by one inch in breadth, and a third of an inch in thickness.

I give these dimensions, because they show that the ovaria, when in an unexcited state, are larger than those of the Camel in a similar condition, in which animal the ovaria are relatively smaller than in the horned Ruminants. But a more striking difference obtains between the Camel and the horned Ruminants in the relations of the ovarium to the pavilion and the broad ligaments. In the Camel the greater part of the capsula ovarii is formed by the expanded fimbriated aperture of the oviduct itself, which is of very large size; and which incloses the ovarium; in Deer, Antelopes, and Cows, the ovarium is lodged in a depression or sacculus of the broad ligament which is more or less deep, and has its apertures more or less contracted in different species. In the Giraffe the peritoneal sacculus of the ovary, formed by an expansion of the broad ligament of the uterus, is wide and deep and encloses almost the whole of the ovary. The fimbriated extremity of each oviduct, or fallopian tube, is expanded upon the outer margin of the ovarian capsule; the inner surface of the pavilion is beset with very numerous and fine oblique striæ, and is further increased by narrow folds of laminae converging towards the contracted opening duct. The oviduct forms three or four wavy folds, and is then continued along the walls of the wide ovarian capsule to the extremity of the uterine horn, which makes an abrupt curve to meet it. The ovaria presented a smooth exterior, slightly broken by a few linear impressions; the ovisacs were of a subspherical form, and varied in diameter from half a line to three lines; they were imbedded in and closely adhered to a very dense stroma. The ovum was of a spherical figure, 1/65th of a line in diameter, immediately inclosed by a transparent gelatinous chorion,—the zona pellucida of Baer,—and imbedded in a mass of elliptic granules of the same size as in the ovisac of the Cow.

The external orifice of the common vagina resembles that of the Deer, and the other horned Ruminants, in coming to a point below, within which is the clitoris. In the Camel, on the contrary, the apex of the clitoris and its preputium form together a conical projection externally to the margin of the common vaginal, or urethro-sexual canal. From this orifice to the communication of the urethra with the vagina the length in the Giraffe is five inches: the proper vagina is about six inches long. It is lined with a smooth and polished membrane, which is disposed in numerous fine and small longitudinal rugæ. The os tinae is a large transversely oval prominence, having the orifice of the uterus in the centre, and marked by numerous fine rugæ, which radiate from this orifice.

The length of the common uterus is two inches. The cervix is occupied by two circular series of close-set, short, longitudinal lamellar processes, about two lines in breadth, which project from the parietes of the uterus, and have their free margins converging to
the centre of the canal. Above these the inner membrane of the uterus sends off several thicker processes similarly arranged.

Each cornu of the uterus is about eight inches in length, and became bent in a spiral form when distended with fluid: four longitudinal rows of short flattened processes projected from the inner surface, showing that the fetus is developed in the Giraffe by means of a cotyledonous subdivided placenta, as in other Horned Ruminants, and not, as in the Camel, by a uniform vascular villosity of the chorion.

Concluding Remarks.

The nature and zoological affinities of the Giraffe, so far as they are illustrated by its internal structure, may be expressed by terming it simply "a modified Deer". It is in fact a Deer in all the essential parts of its organization: but the structure by which so large a Ruminant is enabled to subsist in the tropical regions of Africa, by browsing on the tops of trees, disqualifies it for wielding antlers of sufficient strength and size to serve as weapons of offence; and were it not that some species of Cervus, as C. rufus, have at all periods of life short and simple horns, it might be allowable to speculate on the influence which was due to the mechanical obstacles to the flow of blood up the singularly long and slender carotids in retarding in the Giraffe the development of the antlers beyond the point at which they characterize the pricket age of the Deer. This at least is certain, that the Elk, which amongst the Ruminants with hair-clad antlers presents the opposite extreme to the Giraffe in the magnitude of those appendages, has also the shortest neck. Why the diminutive antlers of the Giraffe should never lose their hairy and vascular integument, and why they are not shed, like those of the Deer-tribe, simultaneously with the shedding of the hair from the rest of the body, which takes place annually in the Giraffe as in the Deer, is not so obvious. We well know, however, the remarkable change of disposition which accompanies the full development of his formidable antlers in the full-grown Buck; and some physiologists have conjectured that both the disposition and power to injure the feebler individuals of his own race are intentionally suppressed by the annual shedding of the horns at a period when the young would be most liable to be injured by them. Now as the horns of the Giraffe never acquire the requisite development to serve as weapons of deadly attack, his disposition undergoes no change, and their temporary removal is not needed on that account. The integument originally developed with the horns is similar in structure to the ordinary skin, like that which invests the frontal processes or peduncles of the horns of the muntjak (Cervus Muntjak), and differs from the temporary integument or velvet of deciduous antlers.

Zoologists, guided by external characters only, have differed in their views of the natural position of the Giraffe in the Ruminant series. Illiger places it in the Cameline group, and Mr. Swainson between the Musk Deer and the Camels. The long neck, linear nostrils, and the absence of spurious hoofs are however the only outward indications of
this supposed affinity of the Giraffe; for the callosities on the sternum and knees which have been ascribed to the Giraffe have no existence in nature. Now, as to the neck, the value of its longitude as a mark of affinity to the Camel disappears when we come to investigate its structure. The long and singularly inflected neck of the Camel offers a peculiar and remarkable modification in its vertebral column, and the long-necked extinct quadruped (Macrauchenia,) which has been discovered to participate in that structure, thus manifests a real affinity to the Camelidae; but we find no such correspondence in the structure of the jointed pillar of the neck of the Giraffe; it is in all respects a mere adaptive modification of the vertebral structure of the neck of the Deer. There remains, then, only the want of spurious hoofs as an indication of the affinity of the Giraffe with the Camel. But in how many important particulars of internal organization might we not have expected to have met with evidences of this relationship if it had truly existed in nature: the pharyngeal sacculus,—the congeries of water-cells in the rumen,—the depth and complication of those of the reticulum,—the suppression of the psalterium as a third distinct cavity of the stomach,—the marked difference in the structure and disposition of the lining membrane of the cardiac and pyloric portions of the abomasus,—the subdivision of the under surface of the lobes of the liver, observed by Hunter and Meckel in the Camel,—and lastly, the modifications of the generative apparatus, as the undivided prostate, in the male, the conformation of the ovarian capsule and the absence of cotyledonal processes in the uterus of the female;—all these are peculiarities in the organization of the Camelidae among the Ruminants, to which some slight approximation should have been presented in the corresponding parts of the Giraffe, if its natural position were really between the Camelidae and any of the groups of the true Ruminantia. But the truth is, that many of the true Ruminants approximate more nearly to the Camel in their internal structure than does the Giraffe; the Ox, for example, in the depth of the cells of its reticulum, and the smaller Musk-deer, as will be shown in another communication, in a more important and more characteristic modification of the stomach. The Reindeer and some other species of Cervus deviate in the structure of the stomach perhaps the widest from the Cameline organization, and the Giraffe participates with them in this deviation. With regard to the affinity of the Giraffe to the different groups of horned Ruminants, the length of the tail and the persistency of the horns point out a resemblance to the Antelopes; their existence in the two sexes, on the other hand, is a rare condition, which the Giraffe possesses in common with the Reindeer. Perhaps the occasional presence of a gall-bladder, as observed in the first Giraffe dissected by me, is the best evidence of the affinity of the Giraffe to the Antelope tribe.
ADDENDUM.

In the year 1836 there were seven living Giraffes in England; three in the Surrey Zoological Gardens and four in the Zoological Gardens in the Regent’s Park. The latter were similar in age and size—one was a female, the other three were males. Three of these Giraffes were captured in the spring of the year 1835, in the deserts of Kordofan, at which time they were probably not more than one year old. I witnessed their arrival at the Gardens early on the morning of the 25th of May, 1836. They had to walk a distance of some miles from the place of their disembarkation to the Gardens; two keepers, each with a long rein attached to the head of the Giraffe, led it between them. They walked along at a rapid pace, generally in advance of their conductors. At first sight they seem to move forward simultaneously the two legs of the same side, and these are undoubtedly both off the ground at the same time through the greater part of the step, but upon a close inspection the hind-leg is always seen to be first lifted from the ground, and after a very brief interval the fore-leg of the same side. When they entered the Park and first caught sight of the green trees, they became excited, and hauled upon the reins, waving the head and neck from side to side, with an occasional caracole and kick-out with the hind-legs. M. Thibaud, their captor and chief conductor, contrived, however, to coax them along with pieces of sugar, of which they are very fond. In the sanded paddock appropriated to them at their present abode they enjoy ample space for exercise, and in the warm days of summer they often exhibit all their various and singular paces. In the simple walk, the neck, which is then stretched out in a line with the back, gives them a stiff and awkward appearance; but this is entirely lost when they commence their graceful, undulating canter: to judge by the movement of the legs, this pace appears not so rapid as it actually proves to be when the extent of ground is observed over which it has carried them in a given time. The motions of the legs are now very peculiar and uncommon: the hind-pair are lifted alternately with the fore, and are carried outside of, and beyond them by a kind of swinging movement: when excited to a swifter pace they often kick out their hind-legs during the course, and their nostrils are then actively and unwontedly dilated.

I have observed all the movements of the tongue which have been described by previous authors. The Giraffe being endowed with an organ so exquisitely formed for prehension, instinctively puts it to use in a variety of ways while in a state of confinement: the female in the Garden of Plants at Paris, for example, may frequently be observed to amuse itself by stretching upwards its neck and head, and with the slender tongue pulling out the straws which are platted into the partition separating it from the contiguous compartment of its inclosure. In our own menagerie many a fair lady has been robbed of the artificial flower which adorned her bonnet by the nimble, filching tongue of the object of her admiration. The Giraffe seems, indeed, to be guided more by the eye than the nose in the selection of objects of food; and if we may judge of the apparent
satisfaction with which the mock leaves and flowers so obtained are masticated, the
tongue would seem by no means to enjoy the sensitive in the same degree as the motive
powers: the difference in the size of the nerves of sense and motion of that organ
already mentioned accords with these habits of the living animal. The Giraffes have a
habit, in captivity at least, of plucking the hairs out of each other's manes and tails,
and swallowing them. I know not whether we must attribute to a fondness for epider-
nic productions, or to the tempting green colour of the parts, the following ludicrous
circumstance which happened to a fine peacock which was kept in the Giraffe's paddock.
As the bird was spreading his tail in the sunbeams and curveting in presence of his
mate, one of the Giraffes stooped his long neck, and entwining his flexible tongue round
a bunch of the gaudy plumes, suddenly lifted the bird into the air, then giving him a
shake, disengaged five or six of the tail-feathers, when down fluttered the astonished
peacock and scuffed off with the remains of his train dragging humbly after him.

When the Giraffe ruminates, he masticates the bolus for about fifty seconds, applying
to it from forty to fifty rotatory movements of the lower jaw, and then swallows it:
after an interval of three or four seconds a second bolus is regurgitated; the rapid
passage of this mass through the long cervical part of the esophagus is readily visible;
and the physiologist cannot fail to be struck with this instance of the surprising swift-
ness with which the contractions of the muscular fibres of the gullet succeed each other.
By attentively watching, we may perceive a slight contraction of the abdominal parietes
accompanying the action of the stomach by which the regurgitation is commenced.
This action of the abdominal parietes in ruminatio is much stronger in the Camel.
It is a singular fact, and one which has not hitherto been noticed, that the Cameline
Ruminants differ from the true Ruminants in the mode in which the cud is chewed: in
the Camels it is ground alternately in opposite directions from side to side: in the
Oxen, Sheep, Antelopes, and Deer, the lower jaw is ground against the upper in the
same direction by a rotatory motion: the movements may be successively from right
to left, or from left to right, but they are never regularly alternate throughout the mas-
ticatory process, as in the Camels: and here, again, in the rotatory motion of the jaws
of the Giraffe while masticating the cud, we have evidence of its affinity to the horned
Ruminants.

Each of the Giraffes eats daily eighteen pounds of clover-hay, and eighteen pounds
of a mixed vegetable diet, consisting of carrots, mangle-wurzel, barley, split beans and
onions; and drinks about four gallons of water.

When the Giraffes arrived at the Zoological Gardens, I perceived, by comparing
the incisors and anterior molars with those in the skull of an adult animal, that they
belonged to the deciduous series. The two middle incisors were shed in the month of
March, 1838, when the animals were little more than three years old; the two adjoin-
ing incisors were shed in the month of July; the first deciduous molares in October,
and the second deciduous molares in November and December of the same year. At
the present time, December 1838, the two middle permanent incisors are far advanced beyond the rest, and the two adjoining ones are risen into place.

The following table shows the rate of growth of the Giraffe, and the relative sizes of a male and female of the same age, which in May, 1836, was about one year and a half.

<table>
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<th>Guib-allah (male).</th>
<th>Height as far as reach.</th>
<th>Withers.</th>
<th>Rump.</th>
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<th>Zaida (female).</th>
<th>Height as far as reach.</th>
<th>Withers.</th>
<th>Rump.</th>
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</tbody>
</table>

Notwithstanding, however, the evidences of immaturity afforded by stature and dentition, copulation took place seven times in the course of March, 1838, the first occasion being on the 18th of that month: the manner and peculiar rapidity of the act were precisely as in the Deer. At the present time, December, 1838, there is evidence of the pregnancy of the female in the expansion of the abdomen, the swelling of the superficial abdominal veins, and the enlargement of the external parts of generation: and I have been able to discern the motions of the fetus through the abdominal parietes. This female is in excellent health; and it may be confidently expected that the period of gestation and the condition of the new-born animal,—facts which are of essential importance in the natural history of every species,—may soon be recorded in the Proceedings of the Zoological Society, in addition to those particulars with which the spirited and successful endeavours to import the Giraffe into this country have already afforded the means of enriching its scientific history.
OF THE NUBIAN GIRAFFE.

PLATE XL.

Section of the skull of the Cape Giraffe, showing the great size and extent of the cranial sinuses or air-cells. One-third of the natural size.

PLATE XLI.

Fig. 1. The upper surface of the tongue of the Nubian Giraffe, with a portion of the integument removed, to show the superficial longitudinal and deep-seated transverse muscular fibres of the anterior prehensile part of the tongue; the perpendicular fibres are principally situated at the sides.

2. The under surface of the same tongue dissected and injected, to show: a. The stylo-glossi muscles. b. The hyo-glossi. c. The lingualis inferior. d. The genio-glossi. e. The transverse fibres of the muscular tissue. f. f. The thin layer of transverse muscular fibres reflected from the stylo-glossus muscle, the lingual vessels and nerve, which it embraces. g. The nerve. h h. The venous plexus. i. The lingual artery. k. The principal anastomosis, with the artery of the opposite side. l. The continuation of the left lingual artery, which alone supplies the muscular and prehensile anterior part of the tongue. This figure was drawn on the stone without the use of the mirror.

3. The anterior extremity of the same tongue, showing the retroverted, pointed, horny papillae on its dorsum, and the spherical gustatory papillae at the sides. Natural size.

4. A portion of the rumen or first cavity of the stomach of the Nubian Giraffe, showing the size and form of the papillae. Natural size.

5. A portion of the reticulum, or second cavity of the same stomach, showing the small size of the divisions of the cells. Natural size.

PLATE XLII.

Fig. 1. A posterior view of the fauces of the Nubian Giraffe: with the velum palati d raised to bring into view a, the base of the epiglottis, and b b, its two lateral deflected processes. The letters c c are placed upon the apices of the arytenoid cartilages: e, levator palati; f, tensor palati; g g, the tonsils. Natural size.

2. The glottis and epiglottis of the Nubian Giraffe. Natural size. The letters indicate the same parts as in fig. 1.

3. An anterior view of the fauces of the Nubian Giraffe; a, the free margin of the epiglottis projecting into the mouth below the velum palati, d: g g, outline of the tonsils: h h, their excretory outlets.
Fig. 4. The double gall-bladder of a Nubian Giraffe. A probe is represented as passing through the communication of the right compartment with the common cystic duct.

PLATE XLIII.

Fig. 1. Upper surface of the brain of the Nubian Giraffe. Natural size.
2. A portion of the spinal chord including the origins of the third cervical nerve. 
   a a. The filaments of the posterior fasciculus or root which are continued into corresponding filaments of the adjoining nerves. Natural size.

PLATE XLIV.

Fig. 1. Lateral view of the brain of the Nubian Giraffe. Natural size.
2. Basal view of the same.

PLATE XLV.

Fig. 1. The female organs of generation of the Nubian Giraffe. Natural size. The corpus uteri and one of the cornua are laid open to show the cotyledonal processes.
2. The cervix uteri laid open to show the lamellar processes of that part.
XIX. On a new Genus of Insectivorous Mammalia. By W. C. L. Martin, Esq., F.L.S.

Communicated February 13th, 1838.

The intrinsic value which attaches to the discovery of new modifications of form depends much on the extent and abruptness of the vacuum which such modifications will tend to fill, and on the degree to which their absence has been previously felt. The present addition therefore to that particular group of the Insectivora, of which Erinaceus may be regarded as the typical genus—a group restricted to the older portions of the globe, and more numerously distributed throughout the warmer than the colder latitudes—cannot I think but be received by naturalists with a certain share of interest.

On a survey of the Insectivorous section of Mammalia (whether we regard that section as an order per se, or as only part of an order), the genera of which it consists mostly appear as if isolated from each other, or as so many disjuncta membra, the connecting parts between which, and necessary to its harmonious perfection as a whole, having either been lost, or having yet to be discovered.

Between the genus Erinaceus, for example, and that of Centetes, Illig., there has hitherto existed an unfilled interval: this interval, however, has in some measure been recently supplied by two genera, both peculiar to Madagascar, of which one has been lately characterized by M. Isidore Geoffroy St. Hilaire, under the title Ericulus; for the other I now propose that of Echinops.

The genus Ericulus includes, as far as hitherto determined, only one species, Ericulus nigrescens, Is. Geoff., and which is regarded by M. Blainville as the Tendrac of Buffon.

The skull and original spécimens, from which M. Isidore St. Hilaire took his description, were carefully examined by me during my recent visit to Paris (the autumn of 1838).

With respect to the skull, as in Centetes, and also Echinops (but not Erinaceus), the zygomatic arch is incomplete; its general contour is narrow and elongated, the muzzle being produced, almost as much as in Centetes. The dentition of Ericulus is as follows:

- Incisors above 4, disposed laterally in pairs.
- Molars above, on each side 7, of which the two first are false; the true molars, 5 in number, being transversely elongated.
- Incisors of the lower jaw 4, disposed laterally in pairs.
- Molars, as in the upper jaw, 7; 2 false and 5 true.

M. Isidore St. Hilaire considers the first false molar on each side, in either jaw in
the light of a canine; but this tooth differs so little from the acknowledged false molar succeeding it, that its claim to the title of canine only rests in its situation. The dental formula then of Eriacus stands thus:

\[
\begin{align*}
\text{Incisors} & \ldots \frac{2+2}{2+2} \\
\text{False Molars} & \ldots \frac{2+2}{2+2} \\
\text{Canines} & \ldots \frac{1+1}{1+1} \\
\text{False Molars} & \ldots \frac{1+1}{1+1} \\
\text{True Molars} & \ldots \frac{5+5}{5+5}
\end{align*}
\]

Total 36.

The general form of the body, the character of the spiny covering, and the feet, are as in Erinaceus; the ears are naked; the muzzle as in Centetes.

I am the more particular in making these observations, inasmuch as the genus Eriacus, Is. Geoff., closely approximates in its characters to that for which I have proposed the name of Echinops; but from which, nevertheless, it is sufficiently distinct.

In the Zoological Proceedings for 1833, p. 81, reference is made to a letter of Mr. Telfair’s, accompanying a very young insectivorous animal, known to the natives of the interior of Madagascar by the name “Sokinah,” and which Mr. Telfair was disposed to refer to the genus Centetes.

The specimen in question (preserved in the Museum Zool. Soc. Lond.) was compared with young specimens of the common hedgehog (Erinaceus Europaeus, Linn.), and the half-spiny tenrec (Centetes semispinosus, Ill.), but being only seventeen days old, its characters could not be satisfactorily determined; the form, however, of the muzzle and of the body, together with the array of short close spines, with which it was invested above, like a young hedgehog, raised some doubt, at least in my own mind, as to its belonging to the genus Centetes. While engaged in examining a collection of specimens from Madagascar and Mauritius, presented some time since to the museum of the Zoological Society by the same gentleman (the late William Telfair, Esq.), from whom the “Sokinah” had been received, I discovered a specimen of an insectivorous animal, the general form and aspect of which strongly led me to regard it as the adult of the same species. An investigation of its dentition confirmed the views I had entertained respecting the “Sokinah,” and I at once recognised it as the type of a new genus.

Echinops.

Corpus supernè spinis densis obtectum.
Rostrum breviusculum.
Rhinarium, aures, caudaque ut in Erinaceo.
Dentes primores \( \frac{1}{3} \), superiorum duobus intermediis longissimis, discretis, cylindraceis,
A NEW GENUS OF INSECTIVOROUS MAMMALIA.

Canini \(\frac{1-1}{1-1}\).

Molares \(\frac{5-5}{5-5}\); utrinsecus antico primo suprà, necnon primo infrà, spuriis; reliquis, ultimo suprà excepto, tricuspidatis, angustis, transversim elongatis; ultimo suprà angustissimo; molaribus infrà inter se æqualibus, ultimo minore.

Dentium numerus integer 32.

Pedes 5-dactyli, ambulatorii; pollice breviore; unguibus parvulis, compressis; plantis denudatis.

Dentium formula:

<table>
<thead>
<tr>
<th>Incisores</th>
<th>Canini</th>
<th>Molares spuri.</th>
<th>Molares</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\frac{2-2}{2-2})</td>
<td>(\frac{1-1}{1-1})</td>
<td>(\frac{1-1}{1-1})</td>
<td>(\frac{4-4}{4-4})</td>
</tr>
</tbody>
</table>

Echinosps Telfairi.

Tab. XLVI.

Ech. auribus mediocribus, subrotundatis, intùs atque extùs pilis parvulis albidis obsitis; capite supernè pilis fuscis; buccis, mystacibus, corpore que subtìs sordidè albis; spinis fuscuscenti-albis ad basin, apicibus castaneis; caudà vix apparente.

<table>
<thead>
<tr>
<th>Longitudo corporis totius</th>
<th>Unc.</th>
<th>Lin.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ab apice rostri ad auris basin</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>tarsi cum digitis</td>
<td>0</td>
<td>10(\frac{1}{2})</td>
</tr>
<tr>
<td>auris</td>
<td>0</td>
<td>5</td>
</tr>
</tbody>
</table>

Habitat Madagascar?

"Sokinah," apud indigenas Madagascarienses?

As respects the identity of the Sokinah with the Echinosps Telfairi, the presumption is founded upon a comparison of the form of the muzzle, and of the feet and the ears, which present in both specimens the same comparative proportions. In the young specimen the teeth have not made their appearance, and I am therefore deprived of the aid which would be afforded, even by a partial development of the dental system, towards the attainment of a positive opinion. It may be objected, that this young individual, only seventeen days old, promises to have become, when adult, larger than the Echinosps Telfairi, and that its spines are darker. The growth, however, of animals belonging to the group of which Erinaceus is the type, as in the case of the Armadilloes, is very rapid; and in the young Sokinah in question, the spines have already acquired considerable development and hardness. Their darker colour will arise from the apical half only being divulged, the basal portion having as yet to be protruded. Perhaps
they may also become paler with age. It will be observed, however, I only urge it as a probability that the two animals are specifically identical. With regard to the affinities of Echinops, I shall endeavour to illustrate them by a comparison of the characters of the genus with those of Centetes, Erinaceus, and Ericulus.

In the form of the true molars there is a close agreement between Centetes and Echinops, as well as in the number of these teeth; still other characters of the dental system clearly separate between these two genera, independently of such as are purely external. In Centetes (at least in the species Centetes setosus) the incisors above are four, small and pointed; below six, minute; in each jaw, separated by an interval from the rest, are two long compressed pointed canines; after a considerable interval follow on each side, above and below, two false molars, the second the largest; to these succeed four true molars, with triangular crowns. Still more distinct is the dental system of Echinops from that of Erinaceus, close as is the alliance between them in all external characters. In Echinops, for example, as in Erinaceus, the feet have five toes; the inner toe of the fore-feet is small and seated on the wrist, the other toes are small, and armed with feeble, compressed, hooked claws, the last toe the smallest: the toes of the hind-feet resemble those of the fore-feet, and the inner and outer are the smallest. The snout, ears, tail, and spiny covering of the upper surface of the body, are also alike in both. In Erinaceus, however, the upper incisors are six; there are no canines, but three false molars on each side, and four true molars, of which the last is small and narrow; the others square, with two outer and two inner tubercles; while in the lower jaw, the incisors, two in number, are very large, followed on each side by three false molars and four true molars.

In Echinops the teeth are thirty-two in number. In the upper jaw the incisors are four in number, and apart; the two middle are large, sub-cylindrical, elongated, and placed at the apex of the jaw; the two others are small, and seated behind the former. Separated from these by a small space, succeeds on each side a tooth, which, from its situation and magnitude, I am inclined to regard as a canine; it is similar in character to the incisors, but is stouter, and has a slight posterior notch. The molars are five on each side: of these the first is false and simple; the three next are transversely elongated, with two external tubercles in contact, and one internal; hence their crowns assume the form of an elongated triangle, the apex being internal; the fifth molar is a slender lamina, placed transversely, but not advancing so far laterally as the molar preceding it. The under jaw presents four incisors, the two middle being very small, somewhat apart from each other, and directed obliquely forwards: immediately behind the incisors below, on each side, without any interval, there follow in succession two larger and conical teeth, of which the first, from its situation, may be regarded as a canine; the second is the largest, and constitutes a false molar. The outermost incisor on each side (below) the canine, and the false molar agree with each other in form, and are set together without any interval, all leaning obliquely forwards. Separated from
the last of these by a small space, succeed four true molars on each side, vertical and smaller than those above, with two tubercles internally and one externally, so that the worn surface is triangular, with the apex outwards; the last is the smallest: the surfaces of all are apart, but their bases are in contact.

In all respects, however, the agreement between Echinops and Ericulus, Isid. Geoff., is more intimate than between Echinops and either the genus Centetes or Erinaceus. Here, however, we still trace important modifications, both in the form of the skull and in the dental system. In Ericulus the skull is very elongate, and especially the muzzle, which bears a close resemblance to that of Centetes; while in Echinops the muzzle is even proportionately shorter than in the Hedgehog.

Moreover, in Ericulus not only do the teeth exceed in number by two in each jaw those in Echinops, but they also differ somewhat in arrangement. In the upper jaw of Ericulus the incisors are four, followed on each side by two spurious teeth, the first of which M. Isidore Geoffroy regards as a canine; to these succeed five true molars. Now in Echinops there are four incisors, and on each side a large canine tooth, a false molar, and four true molars.

The lower jaw in Ericulus has four incisors, disposed laterally in pairs, followed on each side by two spurious teeth, the first of which, as on the upper jaw, M. Isidore considers to be a canine. To these succeed five true molars.

In Echinops there are also four incisor teeth below, succeeded without interval on each side by a tooth corresponding in situation to a canine, which is followed by one false and four true molars, as above.

Of the habits and manners of Echinops Telfairi I have no information: it cannot, however, be doubted that they resemble those of the Hedgehog; and the arrangement of the spines, and the strong muscular panniculus beneath the skin sufficiently attest the power of rolling up itself into the form of a ball, after the manner of that animal; a power with which the species of the genus Centetes are endowed in a far less degree. With respect to the internal anatomy of this animal, its decomposed condition prevented me from doing more than ascertaining the character of the alimentary canal. The individual proved to be a female. The liver consisted of two right lobes, the innermost of which had a furrow on its surface, near the edge, approximating to the first left lobe; and from this furrow arose the ligamentum latum. The left lobes were two in number, but smaller than those on the right. The gall-bladder large, oval and empty, occupied a situation on the under surface of the innermost of the right lobes; and its duct, after a course of 4ths of an inch, received a large hepatic duct: the common duct thus formed was accompanied by a distinct hepatic tube, and both entered the duodenum together, a little distance below the pylorus. A large epiploon spread from the stomach, over the intestines; and beneath the stomach, and attached to it, was the spleen, a long, slender, flattened mass, measuring one inch 4ths, and about 4ths in breadth. The decomposed state of the pancreas rendered this gland indefinite. The stomach was large, and almost
globular; but the cardiac portion being full of holes, its inflation was impossible. The duodenum began dilated, and almost like a succulus, and continued dilated for three quarters of an inch, when it gradually narrowed, merging into a simple intestinal tube, destitute of a cæcum, and measuring from the pylorus to the anus nine inches, being in fact not even twice the length of the animal. The bladder was small and contracted, the ureters entering as usual; and both these and the ovarian tubes were imbedded in a large fatty mass, occupying the lumbar region, and covering the kidneys, which latter were small, but so soft and disorganized that I could not examine them.

The skull of Echinops Telfairi, compared with that of the European Hedgehog, though resembling it in general form, differs from it in many important details. Among these the most remarkable is the total absence of the zygomatic arch. In the Hedgehog the zygomatic arch is bold, and of considerable strength; it consists of a process of the superior maxillary, and temporal bones, with an intermediate narrow malar, forming the centre of the arch. The distance from one zygoma to the opposite is 1/4ths inch.

In the Mole the zygomatic arch is reduced to an almost rectilinear bony thread, and the skull being peculiarly voluminous posterior to its temporal origin, it appears as if brought forwards, as well as sunk and compressed; hence the measurement from one temporal bone to the other far exceeds that from one zygoma to its fellow. In Centetes (the skull from which I describe being that of Centetes setosus, Desm.) the zygomatic arch is incomplete; a process, however, of the superior maxillary forms the lower boundary of the orbit, and advances as far as the edge of the coronary process of the lower jaw, turning, with a gentle curve, outwardly. The zygomatic process of the temporal bone is a mere point, and the distance between it and the zygomatic process of the maxillary bone is 4ths of an inch and a half, the total length of the skull being 2 1/2 inches.

In Echinops the lower edge of the orbit (open of course behind, to the temporal fossa) is formed by an elevated ridge of the superior maxillary, which ridge runs out into a small zygomatic process, forming the outer wall of the alveolus of the two last molars. The zygomatic process of the temporal bone is a little more distinct than in Centetes, and the vacant interspace between this and the process of the maxillary bone is nearly half an inch, the total length of the skull being an inch and a half. The long, slender, conical snout of Centetes (Centetes setosus), notwithstanding the absence of zygomatic arches, renders the aspect of its skull more remote from that of Echinops than is that of the skull of Erinaceus. In Echinops the muzzle is even shorter in proportion than in Erinaceus; there is not, however, as in the latter, any elevation between the orbits, but the skull is altogether flatter, and more level above, and proportionately narrower, with the cranial cavity more contracted. At the same time the transverse-occipital ridge is more elevated. The palate is proportionately narrower than in Erinaceus, and its posterior foramina, which in the Hedgehog are long open fissures, are reduced to minute orifices, which is also the case in Centetes. If, however, the palate itself be narrow,
the position and transverse elongation of the molar teeth give a greater proportionate breadth to the skull of *Echinops* (looking on the palate) than of the *Hedgehog*; and this is rendered the more remarkable by the great and sudden compression of the osseous sides of the posterior *nares*, the fossa thus formed being a deep but very narrow canal.

The lower jaw is very similar to that of the *Hedgehog*; the coronary process, however, instead of being externally concave, is flat and smooth; the condyloid process is neither so elongated in proportion, nor so oblique; nor is the process at the posterior angle so much developed. The admeasurements of the skull of *Echinops Telfairi* are as follow:

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length from apex to occipital condyles</td>
<td>1\frac{1}{2}</td>
</tr>
<tr>
<td>Interorbital space</td>
<td>0\frac{4}{1}</td>
</tr>
<tr>
<td>Length of osseous palate</td>
<td>0\frac{4}{1}</td>
</tr>
<tr>
<td>Breadth of ditto between last molars</td>
<td>0\frac{1}{1}</td>
</tr>
<tr>
<td>From outside of the third upper true molar to outside of opposite</td>
<td>0\frac{4}{1}</td>
</tr>
<tr>
<td>From apex of zygomatic process of maxillary bone to apex of the opposite</td>
<td>0\frac{4}{1}</td>
</tr>
<tr>
<td>Breadth of cranium from petrous portion of one temporal bone to the opposite</td>
<td>0\frac{4}{1} and a half.</td>
</tr>
<tr>
<td>Zygomatic vacancy</td>
<td>nearly 0\frac{4}{1}</td>
</tr>
</tbody>
</table>

With respect to other parts of the osseous system of *Echinops*, it may be stated that the pelvis was very narrow, and the pubic bones separate in front.

The vertebral *formula* is as follows:

<table>
<thead>
<tr>
<th>Vertebral Region</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervical</td>
<td>7</td>
</tr>
<tr>
<td>Dorsal</td>
<td>15</td>
</tr>
<tr>
<td>Lumbar</td>
<td>7</td>
</tr>
<tr>
<td>Sacral</td>
<td>2</td>
</tr>
<tr>
<td>Coccygeal</td>
<td>8?</td>
</tr>
</tbody>
</table>

The ribs consist on each side of eight true and seven false.
PLATE XLVI.

Echinops Telfairi.

Fig. 1. The skull, seen from above.
2. Side view of the same.
3. The same, seen from beneath.
4. The lower jaw.
5. Side view of the same.
6 & 7. Teeth of the upper jaw, magnified.
Echinops Teljaeri

By Professor Owen.

Communicated April 10, 1838.

If the Apteryx of New Zealand were to become extinct and all that remained of it after the lapse of one or two centuries for the scrutiny of the Naturalist were a foot in one Museum and a head in another, with a few conflicting figures of its external form,—one representing it in the attitude of a terrestrial Bird, another, like that in Dr. Shaw's Miscellany¹, portraying it erect, like a Penguin²,—the real nature and affinities of this most remarkable species would be involved in as much obscurity, and would doubtless become the subject of as many conflicting opinions among the Ornithologists of that period, as are those of the Dodo at the present day.

That the opportunities of acquiring a knowledge of the organization of the extinct Bird once inhabiting the island of Mauritius should be now irrevocably past, is, I need not say, a subject of the deepest regret to every one interested in the advancement of zoological science: whether he be engaged as a systematic naturalist in unravelling the intricacies of the natural system; or as a physiologist, in determining the relations which subsist between structure and habits; or as a philosophical anatomist, in investigating the principles which regulate the deviations from a typical standard of organization, and which always receive their most striking illustrations from the aberrant forms at the confines of a great natural group.

To prevent the recurrence of similar regrets in reference to the Apteryx australis, by securing a record of its organization, adequate to the several applications above-mentioned, is the object of the following pages.

In the year 1833 the only part of the Apteryx which existed in Europe was the stuffed skin in the Museum of the Earl of Derby; this was the original specimen on which the genus was founded by Dr. Shaw⁴; but many years having elapsed without any additional evidence of the bird having reached Europe, the very existence of the species, as in the case of the Dodo, began to be called in question. At this time the original and unique specimen of the Apteryx was transmitted to the Zoological Society and submitted to the free inspection of the Members by their Noble President, and the results of a minute and accurate examination of this precious evidence of the rarest and most sin-

¹ Naturalist's Miscellany, pl. 1037, 1058, vol. xxiv. 1813.
² Whence the name of Apterous Penguin applied to the Apteryx by Dr. Latham, General History of Birds, vol. x. p. 394.
³ Loc. cit.
gular of Birds are recorded by one of our ablest Ornithologists in the first volume of the Society's Transactions.1

Mr. Yarrell at the conclusion of his excellent description expresses "a hope, that the zeal and liberality of the numerous friends and corresponding members of the Society in that part of the globe inhabited by the Apteryx directed to the attainment of this object will yet be successful, and enable us at some future period, perhaps not far distant, to supply the deficiencies which at present exist in our knowledge of the natural history of the Apteryx." This hope has been fulfilled, and the appeal made by our esteemed fellow-member has been satisfactorily responded to.

The same Noble Cultivator and Patron of zoological science, to whom Ornithologists are indebted for the means by which the true external characteristics of the *Apteryx australis* have been established, has, in the present instance, liberally contributed the materials on which have been founded the chief part of the present account of its internal anatomy.

The trunk of a male *Apteryx* containing the *viscera*, and extremely well preserved for anatomical investigation, was transmitted by the Earl of Derby for that purpose to the Zoological Society in March 1838. Some months afterwards the abdominal *viscera*, with the bones and tendons of the feet of a female *Apteryx*, were liberally presented to me by Dr. Logan, R.N., through the friendly intercession of Sir Wm. Hooker. Subsequently I received the entire body of a male *Apteryx*, preserved in spirits, from my esteemed friend Mr. Geo. Bennett of Sydney, N. S. Wales, a zealous and valuable Corresponding Member of the Zoological Society. These are the materials from which the following descriptions have been taken.

The *Apteryx* presents such a singular and seemingly anomalous compound of characters belonging to different orders of Birds, as may well make the naturalist pause before he ventures to pronounce against the possibility of a like coexistence of incongruities in the historical *Dodo*. It seems, as it were, to have borrowed its head from the *Longirostral Grallae*, its legs from the *Gallinae*, and its wings from the *Struthious* order. It is clothed with a plumage having the characteristic looseness of that of the terrestrial birds deprived of the power of flight; its feathers resemble those of the Emeu in the general uniformity of their size, structure, and colour, but they are more simple than in any of the tridactyle *Struthionidae*, as they want the accessory plumelet. The skin of the *Apteryx* is remarkably thick and strong as compared with that of most other birds; it is fully a line in thickness along the back, and gradually diminishes to half a line along the under part of the neck and trunk. A great quantity of fat, of the

2 *Loc. cit.* p. 75.
3 Pl. XLVII. fig. 5.
soft oily kind usually found in Birds, is accumulated beneath the skin along each side of the spine, about the rump, beneath the abdomen, and more especially in front of the sternum, where it fills up the depression below the root of the neck, which is occupied by the crop in the Gallinaceous Birds. These prepectoral masses of fat are supported by a muscle arising from the sternum and expanding over the sternal aspect of the neck; there is no fat deposited beneath the skin covering the rest of the neck; this thinner integument adheres through the medium of a close cellular tissue to a cutaneous muscle with transverse fibres, which surrounds the whole of the neck, and will be subsequently described.

When the trunk is stript of its plumage, the body of the Apteryx presents the form of an elongated cone gradually tapering forwards, from the broad base formed by the haunches, to the extremity of the attenuated beak. The wings appear as two small crooked appendages projecting about an inch and a half from the sides of the thorax, and terminated by a curved, obtuse, horny claw, three lines long: the antibrachium is retained in a state of permanent flexion by the surrounding integument of the wing; and it cannot be brought by forcible extension beyond an angle of 45° with the humerus. Nine quasi-quill-plumes, not exceeding in length the ordinary body-feathers, but with somewhat thicker shafts, are arranged in a linear series along the ulnar margin of the antibrachium; the terminal ones are the largest, and in one specimen they presented a structure differing from that of the ordinary plumes, consisting of a shaft, from which radiated a series of flattened horny filaments of nearly equal length.

The podotheeca commences just above the ankle-joint (suffrago) by the development in the cuticle of small scales (squamae); these are smallest at the bend of the joint, where they are arranged in transverse rows; they increase in size as they descend, and at the eighth, ninth, or tenth row the two middle scales begin to enlarge and assume the character of scutula: a row of these scutula extends down the fore part of the tarsus; most of them are bipartite, but a few are entire: a double row of smaller scutula extends down the middle of the back part of the tarsus, as far as the base of the innermost toe: the rest of the podotheeca is formed by a reticulation of scales, somewhat larger on the inner than on the outer side. There is a large convex plantar cushion just behind the divergence of the three anterior toes: these differ from the toes of the typical Gallinae in not being connected at their base by an intervening membrane; they are on the contrary quite free, as in the tridactyle Struthionidae; a row of entire scutula extends along the upper surface of each toe; the sides and under part are covered with small rounded scales, which diminish in size to the ends of the toes. The length of the tarsus and of the toes in the largest male specimen of the Apteryx, transmitted to me in spirits, corresponds with that of the specimen described by Mr. Yarrell; the tarsus being 3 inches in length, the middle toe 2 inches 4 lines, the lateral ones each 1 inch and 5 lines.

1 Pl. XLVII. fig. 4.

2 M 2
The head of the Apteryx is broad, slightly depressed, and very regularly convex above. The opening of the eyelids is situated immediately behind the vertical line touching the angle of the gape, and about three lines above that angle; it is 4 lines in length; the lower lid is most developed, as in other birds; the upper one is fringed with a row of pretty stiff black cilia. The external auditory aperture is situated half an inch behind the eye, and is also a horizontal elliptical fissure, 4 lines in length, formed by a tumid fold of integument, and defended by short and strong ciliiform plumules.

The weight of the male Apteryx transmitted to me by Mr. Bennett, and which had all the appearances of a mature bird, was, without its plumage, 3 lbs. 6 oz. 12 dr. averdupoise; its total length, from the extremity of the beak to that of the outstretched leg, was 28 inches and 8 lines; from the extremity of the beak to that of the coccyx, 19 inches; the length of the trunk was 7 inches; the length of the neck, head and beak included, was 12 inches; that of the beak, from the gape to the point, 4 inches and 8 lines; the breadth of the beak at the gape, 1 inch; its depth or vertical diameter at the same part, 7 lines. The different proportions of these latter dimensions to the length of the beak, as compared with those in the specimen described by Dr. Shaw and Mr. Yarrell, are considerable; the length of the beak in that specimen, from the gape to the point, being 6 inches and three quarters. This difference has led me to compare together very minutely the different specimens of the Apteryx at present in the Museum of the Zoological Society and in that of Mr. Gould, particularly with reference to the condition of the beak. Of these specimens, which are five in number, two present proportions of the beak, corresponding nearly with those of the originally described specimen⁶; the other three have the shorter and weaker beak of the male Apteryx here described⁸. The following are the admeasurements taken from these specimens:

<table>
<thead>
<tr>
<th></th>
<th>Dr. Shaw's</th>
<th>Mr. Gould's</th>
<th>Zool. Soc. No. 1</th>
<th>Mr. Bennett's Male</th>
<th>Zool. Soc. No. 2</th>
<th>Zool. Soc. No. 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inches. Lines.</td>
<td>6</td>
<td>8</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Inches Lines.</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>8</td>
<td>6</td>
<td>6</td>
</tr>
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Thus we have a series of three longer-billed and three shorter-billed specimens of the Apteryx; dissection has shown one of the latter to be of the male sex; it remains to be proved whether the longer bill is peculiar to the female. At present it may be questionable whether this difference be dependent on a difference of age, of sex, or of species. But I would observe that on the first hypothesis it might be expected that the bill would have been smaller in all its dimensions, and that there would have been a want of correspondence in the size of other parts, as of the feet⁹. This, however, is not the case, but on the contrary, the very close correspondence between the short- and long-billed specimens in all other particulars indicates the difference in the length of the beak to be not a specific one. If, therefore, it should actually be found to be a sexual character, it will form another anomaly in the organization of the Apteryx; for

¹ Pl. XLVII. Fig. 1. ⁶ Pl. XLVII. Fig. 2.
² The general dimensions of Dr. Shaw's specimen being taken from a dried and stuffed skin are liable to inaccuracy; Dr. Shaw assigns to it, from the tip of the bill to the extremity of the body, about 30 inches.
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I am not aware that in any other species of bird there is the same difference in the relative length of the bill, as compared with its breadth, in the two sexes!

The soft integument of the head is continued over the base of the bill, and extended along each side, in the form of a narrow angular process, as in the larger Struthious birds. The lateral and a greater portion of the upper part of this integument are covered with short stiff plumes, directed forwards, with long slender black bristles intermixed, and projecting in various directions. The naked part of this integument or *cere* presents a peculiar form, being deeply emarginate both before and behind: the middle portion measures $\frac{1}{2}$ line in the longitudinal diameter; that of each lateral portion is 9 lines: the transverse diameter of the *cere* is 4 lines; from the gape to the *apex* of the lateral process of plumed integument is 1 inch 8 lines. From this *apex* two narrow grooves extend along the side of the upper mandible, nearly parallel with the *tomia*; the upper groove is continued into a subcircular furrow sculptured on the deflected truncate tip of the mandible; the lower groove leads into the external *nostril*, which forms the dilated termination of this groove; the nostrils, as is well known, are most singularly situated, within one-eighth of an inch of the extremity of the slender elongated mandible.

An angular process of plumed and bristled integument, narrower than that above, extends forwards upon each side of the lower mandible to the distance of 8 lines from the gape. A groove is continued forwards from the *apex* of this process, and expands into a shallow depression as it proceeds. The lower mandible becomes gradually narrower and flatter to its *apex*; its entire length in the male was 5 inches 3 lines; each *ramus* is articulated by two trochlear cavities to two corresponding convexities on the *os quadratum*; from the posterior extremity to the point of confluence of the two *rami* measures 3 inches; from this point two linear impressions extend forwards, slightly diverging from each other, until about half a line from the tomial margin, nearly parallel with which they are continued to the end of the mandible. This part is obtusely rounded, and is opposed to the posterior concavity of the deflected and expanded tip of the upper mandible. Thus when the Apteryx rests its head upon its beak, the extremity of which then presses upon the ground,—a not unusual posture, as I am informed,—the superincumbent weight is transferred by both mandibles to their proximal extremities: when, also, the beak is thrust into the ground in quest of food, the force of both jaws is concentrated upon the smooth and dense wedge-shaped extremity of the upper mandible, and the earth is less liable to be forced between the mandibles than it would have been if the anterior opening had not been defended by the deflected tip of the upper one.

1 In other classes we meet with examples of a considerable difference in the development of the jaws as a sexual character; thus, in Mammalia the jaws of the male Cachalot have more than twice the length, both relative and absolute, of those of the female. In Insects the *Lucani* are familiar examples of a still more disproportionate development of the mandibles in the male; in the Apteryx the difference in the development of the jaws, if sexual, is the reverse, the excess being in the female, and this would correspond with the sexual superiority in size and strength in the females of the Raptorial Birds.

2 Pl. XLVII. a. Fig. 2.

3 Pl. XLVII. a. Fig. 1.
If the beak of the *Apteryx* be compared with that of the *Ibis* and *Rhea*, it will be found that its plan of construction is precisely that of the Struthious Bird, and that the resemblance to the grallatorial beak is confined to the elongated form and slenderness of its produced anterior part. In the *Ibis*, for example, the beak is compressed from its very commencement; in the *Apteryx* it is depressed at its base, as in the *Rhea*. There is no production of integument, either plumed or naked, upon the base of the bill of the *Ibis*, while in the *Rhea* we find precisely the same structure, but on a magnified scale, as that above described in the *Apteryx*; the naked cere is deeply emarginate, both before and behind; the plumed integument has many black *setae*, but shorter and finer than in the *Apteryx*, mingled with the short and stiff feathers. In the *Ibis* the external nostrils are pierced in the very base of the beak; a groove is continued from each nostril to the end of the mandible; the same grooves are seen in the *Rhea*, but here the nostrils open at the anterior angle of the lateral processes of plumed integument, which are extended along the sides of the base of the bill, as in the *Apteryx*. In another Struthious genus, the *Cassowary*, the nostrils are situated still more forwards, and are pierced, as in the *Apteryx*, in the horny sheath of the bill itself; there is no other Bird which approaches nearer to the *Apteryx* in the anterior position of the nostrils than does the *Cassowary*; the peculiar modification of the base of the beak in this Bird obscures, as it were, the resemblance which we might otherwise have been able to trace in that part. The *Emeu* and *Ostrich* correspond with the *Rhea* and *Apteryx* in the modifications above noticed, in the base of the upper mandible. If we examine the lower mandible of the larger *Struthionidae*, we perceive a modification of its inferior surface, which distinguishes it from that of any Gallinaceous or Grallatorial Bird; in the *Ostrich* the tip is formed by a raised quadrate portion, separated by two lateral parallel grooves from the rest of the *gnathotheca*; in the *Rhea* the corresponding raised median piece is longer and narrower than in the *Ostrich*, and the lateral boundary-lines converge backwards to the angle where the *symphysis menti* commences. In the *Apteryx*, notwithstanding the modification by which the bill is transformed from a granivorous to an insectivorous instrument, we find a middle piece marked out, as in the *Rhea*, by two grooves diverging forwards from the angle of confluence of the *rami* of the jaw. The lower mandible of the *Ibis* offers no trace of this character, but is traversed longitudinally by a single mesial groove.

In the *Apteryx* a narrow membranous fold or ridge is continued from each angle of the gape obliquely forwards and inwards upon the slightly convex under or palatal surface of the upper mandible, and these ridges are gradually lost about 8 lines in front of the posterior apertures of the nostrils; these apertures present the form of two linear slits, 4 lines in length, situated close together, parallel with the axis of the beak, and 4½ inches from its extremity, in the male: the common opening of the Eustachian tubes is situated two lines behind the posterior *naris*. From the anterior part of these aper-

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1 Pl. XLVII. Fig. 3.  
2 Pl. LIII. Fig. 7.  
3 Pl. XLVIII. a. Fig. 1.  
4 Pl. XLVIII. b. Fig. 1.
tures a narrow ridge is continued forwards along the middle line of the palatal surface of the beak to its deflected extremity: a mesial groove, corresponding with the above ridge, runs along the flattened upper surface of the elongated myxa of the lower mandible.

There is the same structure on the inner surface of the upper and lower mandible in the Ostrich and Rhea. In these, however, the palatal surface of the upper mandible is slightly concave; but in the Apteryx the opposed surfaces of the upper and lower mandibles produce, when pressed together, uniform and entire contact, and, as Mr. Yarrell has observed, are well adapted for compressing or crushing such substances as may be selected for food: the coadapted ridge and groove above described must add somewhat to the power of retaining such substances. To judge from the feeble development of the muscles of the jaw, and their disadvantageous place of insertion, the force of the nip of the mandibles, however, cannot be very great; and with this knowledge of the structure of the bill, I was the less surprised to find large soft-bodied Lepidopterous larvae entire in the stomach of Mr. Bennett’s male Apteryx.

There are two small temporal muscles, one superficial, the other deep-seated, which cross each other obliquely: the superficial and posterior muscle is 4 lines broad and 1 inch long: it is inserted by a round tendon into the coronoid edge, and by fleshy fibres into the external depression beneath that edge, extending as far forwards only as two-thirds of an inch from the joint of the jaw. The deep-seated temporal muscle sends its fibres to be inserted more vertically into the coronoid margin. A masseter, which is connected with a remarkably strong orbicularis palpebrarum, is inserted still nearer the joint, below the fossa for the insertion of the temporal muscle, and external to it. There is a fourth muscle employed in closing the bill, having a similar direction of its fibres to those of the masseter, but situated on the inside of the temporal muscles: it extends from the pterygoid bone downwards, to be inserted fleshy into the inside of the coronoid margin of the lower jaw. This bone admits of slight protraction and retraction, the muscles performing which are the external and internal pterygoid, on each side. The external pterygoid arises by a broad and flat tendon from the pterygoid plate, external to the posterior nares, and expands as it proceeds backwards and outwards, to be inserted into the inflected posterior angle of the lower jaw. The internal pterygoid arises from the body of the sphenoid, behind the posterior nares, and contracts as it proceeds more directly outwards to be inserted into the angle of the lower jaw, above the preceding. The bill is opened by the analogue of the biventer maxilla, which is here a stout, short, square-shaped fleshy muscle, deriving its origin from the ex-occipital process, and descending vertically, to be attached to the broad posterior angle of the lower jaw: from its close situation to the centre of motion this muscle can divericate the tips of the mandibles about two inches. The movements of the jaw are regulated, and its joints strengthened, by several ligaments: one of these ligaments is interarticular, and passes directly between the jaw and os quadratum, in the interspace of the double condyle: another is external, and passes from the upper and outer angle
of the *os quadratum* obliquely forwards to the lower and posterior margin of the external coronoid depression: a strong posterior ligament descends from the ex-occipital process to the posterior angle of the jaw. These strong ligaments are an essential part of the mechanism of a beak which is destined to be forcibly thrust into the ground, and used in a variety of ways, to overcome considerable resistance.

The posterior expanded surface of the palate is quite smooth in the Apteryx, as in the larger *Struthionidae*, in which the ridges and *papillae*, commonly present in other birds, are altogether absent.

The tongue, as was conjectured by Mr. Yarrell, is short, much shorter indeed than the interspace of the united *rami* of the lower jaw; it nevertheless presents a greater relative development than in other Struthious birds. It presents a compressed, narrow, elongated, triangular form, with the *apex* truncate and slightly notched; the lateral and posterior margins entire: it is 8 lines in length, 4 lines broad at the base, 1 line across the *apex*. The anterior half consists of a simple plate of a white, elastic, semitransparent, horny substance, gently concave above; behind this part, the exterior covering, which is lost in, or blended with, the horny plate, gradually becomes distinct, and assumes the character of a mucous membrane, and is pitted with several very minute glandular *foramina*: this membrane is reflected over the posterior margin of the tongue, forming a crescentic fold, with the concavity towards the *glottis*; but here, as well as on every other part of the tongue, it is devoid of spines or *papillae*. This fold can be brought back by the retractors of the *os hyoides*, so as to cover the *glottis*; in which movement the *uro-hyal* process plays in a cellular sheath beneath the larynx, and its office seems to be to give steadiness to the protrac tile and retractile movements of the tongue. The superficial and principal protractor of the tongue represents the *genio-hyoideus*, its two lateral halves being separated and removed from the *symphysis* to within an inch of the angle of the jaw, whence its fibres pass almost directly backwards, and converge, to be inserted into the extremity of the bony *cornu* of the *os hyoides*. The *mylo-hyoideus* arises from the inner side of the lower jaw, commencing posteriorly about an inch from the angle, and extending forwards to within the same distance of the *symphysis*; the fibres become gradually fewer as they are placed more forwards; they meet to be inserted at a middle tendinous line posteriorly, and are separated anteriorly by a tendon about a line in breadth: these tendons are attached to the body of the *os hyoides*, and retract it: a few tendinous threads connect also the posterior margin of the muscle with the anterior part of the upper *larynx*. On the removal of this muscle two deeper-seated protractors of the tongue are brought into view; they arise by a very thin aponeurosis from near the angle of the jaw, and pass directly backwards, to be inserted into the base of the *cornua*. These muscles adhere closely to the membrane, filling up the interspace of the *rami* of the lower jaw. The cartilaginous extremities of the *cornua* of the *os hyoides* curve upwards, and terminate about a line behind the angles of the jaw.

1 Pl. XLVIII. Figg. 1 & 2.
The lining membrane of the pharynx, behind the glottis, forms two elongate, square-shaped, smooth, thick, and apparently glandular folds or processes, the obtuse free margins of which project backwards, like lappels, into the pharynx; beyond which the lining membrane is produced into close-set, narrow, somewhat wavy, longitudinal folds.

The esophagus is continued down the right side of the neck, behind and a little to the right of the trachea, through the thorax and diaphragm to the proventriculus, without forming any partial dilatation or crop.

The upper extremity of the esophagus is rather wider than the rest of the tube, measuring from half an inch to an inch in diameter, according to its state of contraction: it gradually diminishes to a diameter which I found in one specimen to be 3, in another 6 lines, and continues, without variation of size, to the proventriculus. The esophagus is connected somewhat closely to the trachea, and by a looser cellular tissue to the surrounding parts. The muscular coat of the esophagus is about half a line in thickness; its external fibres are arranged circularly; its internal ones form a longitudinal stratum. The ultimate muscular fibres are smooth, slightly wavy, and reticulately intermixed, but with a definite course. The internal membrane in the contracted esophagus is disposed in narrow and slightly wavy longitudinal rugae, which become more close-set and strongly marked at the lower part of the canal: when viewed with a magnifying power the whole internal surface presents a delicate reticular structure. The length of the gullet is 9 inches.

The proventriculus is a narrow elongated cylindrical cavity in the axis of the esophagus, of which it is an immediate continuation. In one specimen it measured 1 inch 2 lines in length and half an inch in diameter, in another it was 1½ inch in length and 1 inch wide. The gastric glands are developed around its whole circumference, and are closely packed together; they are narrow elongated follicles, from 1½ to 2 lines long, mostly bilobed, but sometimes more subdivided at their caecal or outer extremities. The glandular parietes of each follicle consists of minute tubuli placed at nearly right angles with the central cavity. The muscular coat covering the glands is somewhat thicker than in the membranous part of the gullet, which is chiefly caused by the increase of the outer circular stratum of fibres, by the action of which the secretion of the glands is squeezed out into the cavity of the proventriculus. The longitudinal rugae of the lining membrane gradually subside at the entry of the proventriculus, where they run into each other, and so form a general reticulate surface, in the meshes of which the orifices of the gastric glands are situated.

The epithelium lining the glandular part of the stomach is gradually condensed towards its lower part into a cuticle, which, as it passes into the muscular compartment, assumes a brown colour and a callous hardness, and forms a stratum about one-third of a line in thickness. In the Cassowary and Emeu the proventriculus is marked off.

1 Pl. XLVIII. c. Fig. 1.  2 Pl. L. & LI. a.  3 Pl. LI. fig. 2 & 3.
from the stomach by a circular strip of *epithelium*, whiter and thinner than the rest, from one to two lines in width: the structure is well shown in Plates LI. and LII. of the 'Comparative Anatomy' of Sir Everard Home. The *Apteryx*, though resembling these large Struthious birds in the arrangement of its gastric glands, does not participate with them in this structure. The muscular stomach does not present the characteristic sub-compressed shape of a gizzard, but resembles, in its regular oval-rounded form, the membranous stomach of carnivorous birds. In its contracted state it appears small for the size of the bird, not exceeding 1 inch 10 lines in length, and 1 inch 3 lines in its greatest diameter; but in the specimen in which I found the stomach distended with food it measured 2½ inches in length, and 2 inches across at the widest part. The muscular fibres are not arranged in the well-defined masses called *digastrici* and *laterales* in the true gizzard, but radiate from two tendinous centres of an oval form, measuring about two-thirds of an inch in the longest diameter. The muscular coat when contracted is thickest at the upper part of the cavity, where its depth is about 3 lines: in the bulging part at the upper end of the gizzard from which the *duodenum* is continued, the muscular coat is about 1 line thick. The inner surface of the contracted stomach (*b*, Pl. LI.) presented two protuberances at its posterior part, one near the lower and the other near the upper end: the latter is so situated with respect to the cardiac and pyloric openings that it would tend more or less completely to close those openings when the circular fibres at the upper part of the gizzard were forcibly contracted. There was no appearance of these internal projections in the dilated stomach of the second *Apteryx* dissected by me.

A narrow pyloric passage, of about 3 lines in length, leads from the left side of the upper extremity of the muscular stomach into the *duodenum*. The *pylorus* is defended by a transverse crescentic ridge of the lining membrane; there is no distinct *sphincter*. The cuticle is continued into the *duodenum* about 3 lines beyond the *pylorus*, but there is no dilatation of this part constituting a pyloric pouch as in the *Emeu* and *Ostrich*.

Before proceeding with the special description of the intestinal canal, the general disposition of the abdominal *viscera* may be mentioned, as they appear upon removing the abdominal muscles.

The *peritoneum* consists of an external strong fibrous and an internal serous layer.

The abdominal cavity is divided by peritoneal partitions into three compartments, which contain, besides the ordinary *viscera*, only a little fluid; and when the thoracic cells were inflated from the *trachea* no air passed into the abdominal cells or their interspaces. The two upper compartments contain the right and left lobes of the liver, which are separated from each other by a strong mediastinal process of *peritoneum*: the *ligamentum latum* in *Mammalia* seems to be the representative of this broad process. Each hepatic cell communicates with the single large inferior compartment of the *abdomen* by a round aperture situated close to the ribs; this lower compartment was

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1 Pl. L. & LI. *b.*
2 Pl. L. & LI. *c.*
3 Pl. XLIX.
partly divided into two lateral ones by the stomach, and the omental process continued from it to the lower or posterior margin of the hepatic septum.

A great quantity of adipose matter was accumulated, in one specimen, beneath the peritoneum. The two lobes of the liver occupied as usual the anterior part of the abdominal cavity, extending from above the notches of the sternum to midway between the sternum and the cloaca. The stomach was entirely concealed by the large omental adipose process above-mentioned, by dividing which and separating the divided portions (as in Plate XLVIII. fig. 3, a, a,) as much of the stomach was exposed as projects between and beyond the lobes of the liver. The space between the stomach and cloaca was occupied by long and simple loops of intestine, extending obliquely, and nearly parallel with each other, from the upper and right to the lower and left side of the abdomen. In one specimen these loops were concealed, like the stomach, by omental processes, thickly charged with fat (b, b,); each loop also included between the layers of its narrow mesentery one or two thick processes of fat (c, c), except the duodenal loop, the interspace of which was occupied as usual by the two lobes of a narrow elongated pancreas, the pointed extremity of the anterior lobe of which extended freely beyond the bend of the duodenum, as represented in the figure (Pl. XLVIII. fig. 3, d.). In one specimen the duodenum formed the longest and most superficial loop (e, Pl. XLIX.). Below or posterior to it lay the first loop of the jejunum, (f, Pl. XLIX.) and immediately below this appeared the dilated end of the rectum (g, Pl. XLIX.). In a second Apteryx I found that four loops of intestine, including the duodenum, were immediately exposed by dissecting away the omental processes: on raising these loops the rectum was seen extending forwards about 2 inches along the mesial line, and then receiving the ileum and the extremities of the two cæca. Only the anterior half of the rectum has an entire investment of peritoneum; at its posterior or lower half that membrane leaves the abdominal parietes on each side of the rectum, and gradually advances upon the anterior part of the gut.

The lobes of the liver require to be divaricated and raised, and the stomach and its omental processes to be drawn aside, in order to trace the disposition of the whole intestinal canal. The duodenal loop, which in one specimen was about 4 inches, in another 5 inches in length, extends in a curved direction from the stomach to the right side of the abdomen, curves obliquely across the lower surface of the abdomen to the posterior and left side, and returns upon itself: the anterior half of this loop is closely attached to the other coils of the intestine; the rest of the duodenum is suspended freely in the abdomen. The intestine, after having formed the duodenal loop, bends abruptly upon itself backwards and to the right, and then forms a second loop, 3½ inches long, which continues straight down the right side of the abdomen; its extremity is seen at Pl. XLVIII. fig. 3, f. Three similar but somewhat shorter loops are then formed to the left of the preceding, after which the intestine returns to near the commencement of the duodenum, behind the stomach and close to the root.
of the mesentery, whence it descends to form a fifth long loop, situated at the left side of the abdomen, behind the others, and then becoming looser, after a short convolution, terminates in the rectum. The ceca in one specimen measured each five, in another six inches in length; they are attached to the last folds of the ileum: their tunic is thinner than those of the rest of the alimentary canal. The adipose processes developed beneath the peritoneum investing the ileum and ceca, are smaller and more detached than those connected with the preceding intestinal loops, and assume the appearance of "appendices epiploica".

In one Apteryx I found a very short cæcum,—the remnant of the ductus vitello-intestinalis,—attached to about the middle of the small intestine⁸; and in the viscera of the small female Apteryx transmitted to me by Dr. Logan, there extended from the same relative position of the intestinal tube an obliterated duct three lines in length, which expanded into a still persistent vitelline sac of a subglobular form, about an inch in diameter, but collapsed and with wrinkled parietes. These presented a moderate degree of thickness in the moiety of the sac next the duct, but became gradually thinner to the opposite side. The interior of the sac was lined with a stratum of a yellowish substance resembling adipocere, and contained many small wavy filamentary vessels, converging to the commencement of the duct, and evidently remains of the vasa lutea. A small branch from the mesenteric artery, the remnant of the omphalo-mesenteric, and a minute corresponding vein, accompanied the pedicle of the sac (Pl. LI. fig. 1, s, t.).

In the large male Apteryx the intestinal canal measured four feet, independently of the cæca, which were each six inches in length: the rectum was four inches long.

The general diameter of the small intestines in the specimen first dissected was three lines; in the male Apteryx with the full stomach their diameter was five lines: they slightly diminish in size as they approach the rectum. In the duodenum the mucous membrane is beset with extremely fine villi, about one line in length; towards the end of the duodenum these villi are converted into thin zigzag longitudinal

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¹ These processes and the return of the small intestine, in the latter part of its course, to the duodenum and root of the mesentery, give to the part continued thence to the rectum the characters of the colon in Mammalia. The learned Editor of the excellent edition of Cuvier's Lesçons d'Anatomiie Comparée, now in course of publication, is disposed to consider all that part of the small intestine which intervenes between the single vitelline cæcum (in those birds which have it) and the double ordinary cæca, as representing the colon: and the analogy of the colon of the Iguana, which is similarly bounded at its commencement by a single cæcum, and at its termination by a double one, is undoubtedly very close. If, however, we are guided by the analogies afforded by the other oviparous classes, with which birds present so close a conformity of general structure, and in which the colon is always short, wide, generally straight, and in some, as Python, Testudo, Iguana, marked off, or commencing by a single cæcum, as in Mammalia, there can be no question in that case but that the part of the intestinal canal in Birds corresponding to the colon of Reptiles, is that which succeeds the entry of the two cæca, and which, from its shortness and straightness, is usually called the rectum. In the Ostrich, however, it is long and convoluted, and is provided with transverse valvula conniventes. A similar structure in a less degree is present in the colon of the Iguana.

² Pl. L. d.
folds, which are continued, but with gradually diminished breadth, to the end of the ileum. The ceca, at their commencement, are wider than the ileum, and go on slightly increasing in capacity to near their blind extremities, where they suddenly taper to an obtuse point. The diameter of each cecum, at its widest part, was five lines in the first, and six lines in the second dissected Apteryx. To the naked eye the lining membrane of the ceca presents a smooth surface; viewed with a lens, it is disposed in very fine longitudinal zigzag lines, which are replaced towards the extremities by very minute points. The lining membrane of the rectum is beset with minute short villi or points, together with glandulae solitariae, which become numerous and large at the terminal half of the rectum: the lining membrane of this intestine, when it is contracted, is thrown into longitudinal folds; but there is no trace of the transverse or spiral valvulae comminentes which so peculiarly characterize the ceca and rectum of the Ostrich and Rhea: in this respect the Apteryx resembles the Cassowary and Emu. The rectum communicates with the uro-genital dilatation by a small semilunar aperture, which, when contracted, appears as an oblique fissure, and from the produced valvular margin of which several short ruge radiate. The urinary compartment of the cloaca is not expanded into a large receptacle as in the Ostrich, but offers the same proportional size as in the Emu, and Cassowary: it measures about two-thirds of an inch in length and the same in diameter. The ureters terminate by oblique valvular apertures immediately beyond the above-mentioned membranous fold, at the back part of the cavity, and about two lines apart. The cæsa deferentia terminate, as in other Struthious birds, by two elongated papilla nearer the anterior part of the uro-genital cavity. This cavity is separated from the external compartment of the cloaca by a broader and stronger fold than that which divides it from the rectum, and the angles of this fold are lost upon the sides of the penis, which projects into the external compartment of the cloaca. This compartment is continued behind the uro-genital passage in the form of a large and wide bursa Fabricii, which, in the larger Apteryx dissected by me, was partly divided by a crescentic vertical fold, extending forwards from its upper and back part.

The stomach, in Lord Derby’s Apteryx, contained only a greenish-yellow pulpy substance, and numerous filamentary bodies, amongst which were some legs of insects and a few pebbles. The small intestines were contracted and contained only a little pulpy material like that in the gizzard, but of a darker colour. The ceca were distended with a greater quantity of a similar but more fluid matter, in which parts of the legs of insects, apparently orthopterous, were again discernible. In the male Apteryx transmitted by Mr. Bennett, the stomach was distended with insects of various orders, which seemed to have been recently swallowed. There were four larvæ, between two and three inches in length, belonging to some species of the Lepidopterous order, probably of subterraneous habits; five larvæ of some of the Scarabeidae, perfect; some mature Coleoptera; parts of

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1 Pl. L. e, e.  
2 Pl. L. f.  
3 Pl. L. g.  
4 Pl. L. h.  
5 Pl. L. i.  
6 Pl. L. k.
small species of the Locust tribe; one Elater; and one Spider, quite perfect; with a few hard seeds and small pebbles. There was also some muddy fluid loaded with the black particles of the earth probably swallowed along with some of the insects. The small intestines contained portions of insects floating in a larger quantity of the black fluid; the cæca were distended exclusively with a thin blackish-brown pulpy fluid, in which only extremely minute portions of the legs of insects could be detected.

The liver, in the larger male Apteryx, weighed 7 drachms, 35 grains, avoidupoise; it consisted, as usual, of two large lobes, connected by a narrow isthmus, with their thin anterior edges advancing forwards on each side of the proventriculus, and meeting in front and a little to the left of the middle line. The right lobe is the longer, of a sub-triangular figure; the left is of a subquadrat form. The two lobes are even and smooth on their posterior and outer surfaces, but present irregular furrows and projections on their inner surface. They are traversed here transversely by a broad portal fissure occupied by the vessels and ducts. In two of the specimens there was a gall-bladder, as in the Emeu and Cassowary; in the third it was wanting, as is usually the case with the Rhea and Ostrich. In the large male the gall-bladder adhered by its whole length to the omental process covering the stomach; in the other Apteryx it was free, and depended by its cervix from the inner margin of the right lobe of the liver; in this specimen it was an inch and a half in length, and received two short cyst-hepatic ducts at its cervix, each nearly a line in diameter; these ducts, with the serous membrane reflected upon them, and the nutrient vessels of the gall-bladder, formed the only medium of connexion between the gall-bladder and the liver. A cystic duct was continued, in length rather more than two inches, to half-way between the lower bend and the termination of the duodenum. The hepatic duct is formed by two branches, one from each principal lobe, which unite together to the left of the cystic duct; it runs parallel with, and terminates a few lines below the cystic: both ducts are longer than usual. The lining membrane of the gall-bladder presents chiefly longitudinal rugae, with smaller transverse lines in the interspaces. In the Apteryx without a gall-bladder there were two long ducts terminating in the same part of the duodenum; of which the one corresponding to the cystic (Pl. LI. o, fig. 1.) was very slightly dilated at its origin, where it was formed by the confluence of two ducts.

The pancreas (Pl. L. & LI. q, fig. 1.) consisted, as usual, of two elongated subtriangular lobes, lodged chiefly in the anterior part of the duodenal interspace. One of the lobes extended upwards and to the right as far as the spleen. The secretion was carried by two short and thick ducts, which terminated, close to the hepatic and cystic, and alternating with them upon a small longitudinal ridge of the duodenal lining membrane.

The spleen in one Apteryx was about the size and form of a hazel-nut (Pl. L. r); in the large male with the full stomach it was smaller and flatter: it was round, and an

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1 I am indebted to Mr. Waterhouse for the determination of the above insects.
2 Pl. L. l.
3 Pl. L. m.
4 Pl. L. n.
inch in diameter in the specimen without the gall-bladder. In the larger Struthionidae the organ generally presents a longer and more compressed figure.

In considering the physiological relations of the structures which have just been described, we shall be able to trace the same interesting correlation between their different modifications and the nature of the organic substances which it is their office to assimilate, as is illustrated in other known and more striking peculiarities in the digestive organs of birds. Animals which are destined to subsist exclusively on insects usually present the chief prehensile and preparatory parts of the digestive system, whether it be the beak, as in the Ibis, or the tongue, as in the Ant-eaters and Woodpecker, of a long and slender shape; in the present species we find a pair of Struthious mandibles lengthened out and made slender for this purpose. The beak, thus organized to seize and transmit to the gullet objects of small size, is succeeded by a muscular canal of moderate and uniform width; and the food being of an animal nature and swallowed in small quantities, with successive intervals, as it is caught, the **oesophagus** is not required to be modified to serve as a reservoir, either by a general width or partial dilatation. The **proventriculus** of the **Apteryx** is of a small relative size as compared with that of the **Ostrich**; its glands are also more simple in their structure, and are not aggregated into a circumscribed mass as in the **Rhea**. The stomach has its muscular coat more equally but less strongly developed than in any of the vegetable-feeding Struthionidae; and the small size of the cavity, as well as the moderate strength of its **papilae**, bespeaks a structure adapted for the bruising and chymification of animal substances presenting, as do worms and the larvae of insects, a moderate resistance.

The length of the intestines and the size of the **ceca**, both of which somewhat exceed those in the slender-billed Insectivorous Waders, indicate that the **Apteryx**—which, by being denied the power of flight, is confined to a more restricted range in quest of food—is designed to possess every needful and practicable advantage in extracting from its low-organized animal diet all the nutriment that it can yield.

The **lacteal** absorbents in the **Apteryx** in which the digestive system before death had been actively engaged in the assimilation of a full meal of insects, were plainly visible, and in many parts of the mesentery presented an opake white colour.

There was an absorbent gland, about the size of a hazel-nut, in the mass of fat below the root of the neck.

**Circulatory and Respiratory Systems.**

The heart is surrounded by a wide and thin **pericardium**, which is attached to the concave side of the **sternum** and to the margins of the anterior wide fissure of the **diaphragm**, through which the ventricular portion of the heart protrudes into the **abdomen**, in the posterior concave interspace of the two great lobes of the liver. (Pl. LII., fig. 1, a.) It requires only that a central **aponeurosis** should have been continued from the anterior
margins of the *diaphragm* between the heart and liver, to have completely separated from the *thorax* the proper abdominal *viscera*, as in the *Mammalia*; for, as will be presently described, the respiratory organs are confined entirely to the *thorax*.

The heart presents the usual ornithic form of a somewhat elongated cone, terminated by an obtuse rounded apex, produced beyond the projection formed by the right ventricle. The *pericardium*, after being reflected upon the origins of the great vessels, passes directly from the peripheral surface of the auricles upon the ventricles, so that there are no freely projecting auricular appendages. In one *Apteryx* I found much fat developed in the angle between the auricles and ventricles, beneath the *pericardium*. The right auricle appeared, when distended, of an uncommon size. The three veins terminated in it in the usual manner, but the inferior cava has a much greater relative capacity than either of the superior cavae, in consequence of these having to return to the heart little more than the proportion of venous blood brought back by the jugular and internal thoracic veins in other birds.

The auricles of the heart do not present any peculiarity of structure which is not met with in other birds; the resemblance to the *Eme* in the disposition of the valves of the right auricle is very close. The great inferior cava, (Pl. LII. b, fig. 3,) the trunk of which is extremely short, opens into the *sinus venosus* close to the termination of the left superior cava (c, fig. 3.); the intervening membrane is slightly produced in a valvular form: the coronary vein of the heart terminates in the left superior cava, just before it opens into the auricle. The right superior cava (d, fig. 3.) opens as usual into the upper part of the *sinus*. The tunics of the superior cavae are remarkably strong. The *sinus* is divided, as in other birds, from the proper auricle by two semilunar valves, one large and anterior, the other smaller and posterior (e and f, fig. 3.). The lower horn of each valve is fixed to the floor of the auricle, the upper or anterior horn of the anterior valve is attached to a strong muscular column, which traverses the upper and anterior wall of the auricle; the extremity of the posterior valve is in like manner continued into a muscular band from the back part of the auricle. From these attachments it is obvious that the valves, during the action of the muscular *parietes* of the auricle, will be drawn together, and their power to resist regurgitation into the *sinus* will be increased, as the action of the muscles to overcome the resistance of the contents of the auricle is greater.

The posterior valve which forms part of the boundary of the *foramen ovale* seems to be represented in *Mammalia* by the muscular ridge called the *annulus ovatis*; the anterior valve is obviously the analogue of that called *Eustachian* in *Man* and *Mammalia*.

The principal deviation from the ornithic type of the structure of the heart is presented in the valve at the entry into the right ventricle (Pl. LII. g, fig. 3.). This is characterized in birds by its muscularity and its free semilunar margin. In the *Apteryx* it is relatively thinner, and in some parts semitransparent and nearly membranous: a process moreover extends from the middle of its free margin, which process is attached
by two or three short chordae tendineae to the angle between the free and fixed parietes of the ventricle. We perceive in this mode of connection an approach in the present bird to the mammalian type of structure analogous to that which the Ornithorhynchus, among Mammalia, offers, in the structure of the same part, to the class of birds; for the right auricular ventricular valve in the Ornithorhynchus is partly fleshy and partly membranous. The dilatable or free parietes of the right ventricle were about $\frac{1}{4}$th of an inch in thickness, those of the left were $\frac{1}{8}$th of an inch thick.

There was nothing worthy of note in the left auricle (fig. 2 and 3 h,) or in the valves interposed between it and the left ventricle: the two membranous flaps presented the usual inequality of size characteristic of the mitral valve in birds.

The aorta divides as usual, immediately after its origin, into the ascending and descending aorta: the ascending aorta as quickly branches into the arteriae innominateae (i i, fig. 2.), which diverge as they ascend and give off the subclavians in the form of very small branches; they are then continued, very little diminished in size, as the carotids; each carotid divides or gives off a large vertebral artery before passing out of the thorax; they then mount upon the neck, converge and enter the inferior vascular canal of the thirteenth cervical vertebra, and are continued in the interspace of the haemapophyses to the fourth cervical vertebra: here they emerge from the subvertebral canal, and passing through the interspace of the recti capitis antici, they again diverge, and when opposite the angle of the jaw, give off occipital, internal carotid, large palatine, and other branches, as in the Emeu. The principal difference observed in the Apteryx was the equality of size in the carotids: in the Emeu I found the right carotid larger than the left.

The descending or third primary division of the aorta (k, fig. 2.) presents in the Apteryx, as in the Emeu and other Struthionidae, more of the character of the continuation of the main-trunk than in the rest of the class, in consequence of its greater size and thicker tunics, which relate of course to the diminished supply of blood transmitted to the rudimental anterior extremities; and the increased quantity required to be sent to the powerfully developed legs. The aorta arches over the right bronchus as usual, and is continued down the thorax to the interspace of the crura of the diaphragm, through which it passes into the abdomen in a manner remarkably analogous to that which characterizes the course of the aorta in the Mammalia (Pl. LII. n, fig. 1). The Apteryx, in fact, seems to be the only bird in which the limits of thoracic and abdominal aorta can be accurately defined. But, in thus establishing this distinction, we observe a remarkable difference from the mammalian arterial system, in the fact, that some large and important branches, which in the latter are given off from the abdominal aorta, arise in the present bird above the diaphragm, through which they pass by distinct and proper apertures to the abdominal viscera which they are destined to supply. These branches are the celiae axis (Pl. I.II. l, fig. 1.), and the great or superior mesenteric artery (m, fig. 1.). Besides these branches, the thoracic aorta
gives off the bronchial and intercostal arteries above the diaphragm. The latter are three or four in number, which divide and form the usual plexiform anastomoses round the heads of the ribs, with branches of the vertebral arteries; from which plexuses the proper intercostal branches are continued. The celiac axis, having perforated the diaphragm, divides and supplies the stomach, liver, and spleen in the usual manner. The mesenteric artery offers nothing unusual in its mode of distribution. The diaphragm is itself supplied by branches from the intercostal plexuses, and there are no proper phrenic arteries.

The first branch which the aorta sends off, after having entered the abdomen, is the spermatic artery (Pl. LII. o, fig. 1.) this was of moderate size in the large male Apteryx, and soon divided into two branches, which were distributed respectively to the corresponding testis and supra-renal gland.

The aorta having reached the first lumbar or sacral vertebra, sends off the femoral arteries (p, p, fig. 1.), which are of equal size with the ischiadic arteries afterwards given off. The femoral is continued outwards on each side at right angles with the aorta, sends a small branch to the upper lobe of the kidney and passes out of the pelvis, not through a notch or foramen, as in most other birds, but simply over the margin of the iliac bone. It is continued upon the thigh, covered by the wide and strong sartorius, where it divides into two principal branches, of which one is distributed to the sartorius, gracilis, vasti, and other muscles at the anterior and upper part of the thigh; and the second branch is continued to the knee-joint, where it ends by forming anastomoses with the ischiadic. The aorta next sends off a pair of renal arteries (q, q, fig. 1.) of moderate size, beyond which it may be said to resolve itself into the ischiadic (r, r,) and sacro-median arteries (s, fig. 1.). The ischiadic branches are not here, as in most other birds, the main arteries of the hinder extremities; they do not exceed the femorals in size, and are principally expended upon the muscles of the leg: they escape from the pelvis as usual by the ischiadic foramina, and are continued down the back part of the thigh external to the adductor magnus, covered at first by the broad biceps cruris, and afterwards continued between the biceps and the vastus externus to the outer side of the poplitel space: here the artery accompanies the ischiadic nerve and the strong tendon of the biceps between the two heads of the gastrocnemius externus, and through the tendinous trochlear loop connected with that muscle, where it divides, and is finally distributed as in other birds.

The sacro-median artery, after sending off a small branch to the rectum, divides into the genital or hypogastric and the coccygeal arteries.

I did not observe any modification of that condition of the venous system which usually characterizes the class of birds.

The inferior cava does not perforate the diaphragm, but enters the posterior part of the pericardium just above the anterior fissure of the diaphragm: it receives, close to its termination, the two large hepatic veins. There exists the same disposition of the
renal veins which regulates the quantity of blood transmitted to the lungs or to the liver respectively, as in other birds. This disposition has been erroneously supposed to indicate that the urine was secreted from the venous blood in birds, as in reptiles and fishes; but the end attained by the venous anastomoses in question bears a much closer relation to the peculiar necessities and habit of life of the bird, and, so far as I know, has not hitherto been explained. There is no class of animals in which there may be, at any two brief and consecutive periods of existence, a greater difference in the degree of energy and rapidity with which the respiratory functions are performed, than in birds. When the bird of prey, for example, stimulated by a hungry and an empty stomach, soars aloft and sweeps the air in quest of food, the muscular energies are then strained to the utmost, the heart beats with the most forcible and rapid contractions to propel the current of blood along the systemic arteries, and the pulmonary vessels require the greatest possible supply of blood to serve the heart with the due quantity of arterialized fluid: the digestive system, on the other hand, is in a state of repose, and we may conceive the portal circulation to be at its lowest ebb.

Suppose the Eagle to be glutted with his quarry and reduced to a state of stupor; the animal functions are now at rest, but the organic powers concerned in the assimilation of the food are in full play, and the portal or hepatic circulation is as active as was the pulmonary a short time before.

The venous system of the kidneys is so arranged in birds that it can be distributed either to the portal system by the mesenteric vein, or to the pulmonary system by the vena cava and right side of the heart, according to the degree of rapidity with which the pulmonary or portal systems of veins are respectively emptied, or in other words, according to the activity with which the circulation in each of these systems may be going on at two different periods. The arrangement is as follows: the venous blood of the kidneys is collected from all parts of the gland into a venous reservoir or trunk extending longitudinally through the substance of the kidney, and more or less subdivided at the anterior or thick part of the gland in most birds; here it communicates by one or more large anastomoses with the iliac vein, which, after a short course, unites with its fellow to form the trunk of the vena cava; at the posterior or lower end of the kidney the renal vein emerges, and after receiving some small veins from the cloaca, joins the vein from the opposite kidney, and the common trunk, thus formed, then bends forwards, enters the folds of the mesentery of the rectum, and becomes, in fact, the commencement of the mesenteric veins, receiving the blood from the rectum and ceca. Thus, when the circulation of the portal system is unusually active, the current of the venous blood of the kidneys will naturally tend towards the lower outlet into the mesenteric vein; but when, on the other hand, those causes are in operation which accelerate the current of venous blood through the vena cava, we may reasonably suppose that a greater quantity of the renal blood will flow by the anterior outlets into that great channel.
In the extreme case of the raptorial bird above-quoted, the advantage of such an arrangement appears sufficiently obvious to justify the teleological hypothesis here proposed; and in the rest of the class the like benefit may result from this arrangement of the renal veins to a degree corresponding with the necessity for it which may exist.

In the *Apteryx* the great renal vein (s, Pl. L.) is not imbedded in the substance, but is continued along the anterior or under-surface of the kidney, receiving the blood from the lobules of the gland by many oblique but wide openings; the venous trunks of the two kidneys anastomose, as in other birds, posteriorly, to form the commencement of the mesenteric vein (t, Pl. L.); and, anteriorly, after receiving the iliac veins, they unite to form the *vena cava*, and thus complete the great *circulus venosus renalis*. The modifications of this part of the venous system were less important than I had been led to anticipate in a bird whose comparatively limited powers of locomotion must be attended with less partial and excessive action of the respiratory system than in birds of flight.

The organs of respiration in birds are so eminently characteristic of that class, and so obviously framed with especial reference to the faculty of aerial progression, that in the *Apteryx*—a bird of nocturnal and burrowing habits, and of which the wings are reduced to the most rudimental condition,—the examination of the associated modifications of the respiratory system promised to be replete with peculiar interest. It was, in fact, the first point to which I directed my attention, and having made a preparatory inflation of the pulmonary organs by the *trachea*, I proceeded to open the *abdomen*, and displaced the *viscera* with great care; but, as has been already stated, there was not any trace of the extension of air-cells in the interspaces of the abdominal *viscera*; and the whole of them having been removed, I was not less gratified than surprised to find a complete and well-developed *diaphragm* separating the abdominal from the respiratory cavity. This *septum* did not present any large openings corresponding to those by which the air is continued into the *abdomen* in the other Struthious birds, but was here perforated only for the transmission of the *oesophagus* and large blood-vessels.

The *diaphragm* of the *Apteryx* differs from that which characterizes the class *Mammalia* in the following points: first, in the greater relative extent of the anterior or post-sternal interspace; secondly, in the greater proportion of tendinous or aponeurotic tissue which enters into its composition; thirdly, in being perforated by three different large arteries, and not by the *vena cava* or splanchnic nerves; and lastly, in the different relative positions of the oesophageal and aortic openings. The plane of the *diaphragm* is more horizontal, or rather more parallel with the axis of the trunk, than in the *Mammalia* generally; but some of the aquatic species, as the *Dugong*, present a position of the *diaphragm* almost similar to that of the *Apteryx*.

The origins of the vertebral or lumbar portion of the *diaphragm* are by two well-developed *crura* (Pl. LII. a, fig. 1.), which are attached to slight prominences on the
sides of the last costal vertebra: these crura are almost entirely tendinous; they expand as they advance forwards, and distribute their aponeurotic fibres in a manner remarkably analogous to the disposition of the fleshy fibres of the lesser muscle of the diaphragm in Mammalia. The mesial fibres decussate in front of the aorta: the lateral ones arch outwards; the rest diverge, to constitute the great central tendon. Here they cross each other in various directions, and form distinct and regular decussations around the orifices through which the celiac artery, with the anterior splanchnic nerve, (Pl. LII. l.), and the mesenteric artery and nerves (Pl. LIII. m.), pass into the abdomen: the most notable decussation is formed by two broad bands, immediately behind the large esophageal aperture, which is separated only by a very narrow transverse chord from the anterior fissure through which the pericardium protrudes, and the inferior vena cava passes: the two broad decussating bands expand, to form the anterior boundary of the diaphragm, and are inserted into the lateral processes of the sternum.

The muscular or costal part of the diaphragm is formed, as in the Ostrich, by a number of separate, broad, and thin fasciculi, which come off from the third, fourth, fifth, sixth, and seventh vertebral ribs, near their junction with the sternal ones: these fasciculi expand, and are gradually lost upon the dorsal surface of the aponeurotic part of the diaphragm, but do not form a continuous expanse of muscle, nor constitute the entire thickness or substance of the diaphragm at any point: they are, consequently, invisible on the abdominal side of the diaphragm; and the aponeurosis of the diaphragm, together with the almost aponeurotic cellular layer of the peritoneum, with which it is continuous, requires to be reflected inwards, as at Pl. LII. β. β. fig. 1., to bring the digitations representing the great muscle of the diaphragm into view.

The existence of a diaphragm in a rudimental condition in birds has long been recognized: Hunter left a beautiful figure of the costal portion of the diaphragm in the Ostrich, which has been published in the second volume of the Catalogue of his Physiological Collection, Pl. XXVI. In this, as well as in the other large Struthious birds, there is also a pars vertebralis or analogue of the lesser muscle of the diaphragm, which rises by two tendinous crura from the last dorsal vertebra, and in the Emeu by a double origin on each side. Nevertheless their diaphragm is incomplete; first, by reason of an arrest of its centripetal development, which leaves a permanent defect of union in the mesial plane; and secondly, by the large perforations for the abdominal air-cells.

The mechanism of respiration in the Apteryx is essentially the same as in other birds; and a more muscular diaphragm than it possesses would be unnecessary as a part of that mechanism. The abdominal surface of the diaphragm, as in the Mammalia, is principally in contact with the liver, spleen, and stomach; but its thoracic surface, as we have already seen, does not support the heart, and it is separated from the lungs by the interposition of a series of small but well-marked air-cells. There is no thoracic serous sac or pleura.

Thus, although the respiratory organs are confined to the chest, and the Apteryx offers
the only known instance in the feathered race of a species in which the receptacular part of the lungs is not continued into the abdomen; yet the Struthious type is strictly preserved, and the march of development has only been restricted, not changed.

The lungs, in fact, present all the peculiarities which characterize the class of Birds. They are fixed to the posterior part of the chest, and imbedded in the interspaces of the ribs, presenting a free anterior surface, slightly concave, extended on a plane nearly parallel with the axis of the trunk, and perforated by large apertures, through which the air passes from the bronchial tubes into the air-cells.

Each lung (Pl. LI. figg. 4. & 5.) presents an irregular sub-compressed trihedral figure, broader anteriorly, and gradually contracted towards the posterior extremity, which is thin and rounded off: it is smooth and concave below; smooth and convex above, and outwardly; deeply indented along the upper or dorsal angle with six notches; the intermediate portions occupying the interspaces included between the second and the ninth ribs, and each sending off a small process. In the number of these posterior processes or lobes the Apterix resembles the Emeu; in the Cassowary there are eight lobes; in the Ostrich and Rhea there are only five lobes in each lung.

The bronchial divisions of the trachea enter the lungs about one-fifth of their length from the anterior end, and almost immediately divide into four principal branches; one, a small branch (a, fig. 5.), is lost in the substance of the anterior part of the lung; a second, the largest branch (b, fig. 5.), runs down the concave surface, near to and parallel with the dorsal margin, and supplies the rest of the respiratory portion of the lung; the third branch, which is small, perforates the anterior part of the lung, and opens into the anterior air-cell; the fourth branch (c, fig. 5.) runs down the middle of the concave surface of the lung, and terminates by three successive orifices in the three inferior air-cells. The inner surface of this bronchial tube presents a great contrast with that of the second, which runs parallel with it, in the paucity of the foramina which it presents for the passage of air into the substance of the lung; these being extremely numerous in the second, as shown in the figure.

The pulmonary tissue is as compact, as vascular, and presents the same peculiar spongy texture as in other Birds. A stratum of fat was developed under the pleura, along the anterior margin of each lung. The first or most anterior of the air-cells interposed between the lung and diaphragm is the smallest; the second the largest; this and the third present a cuboid figure: the parietes of these cells consist of an extension of the delicate mucous membrane of the air-passages, and an external thin layer of cellular tissue, by which they adhere to the diaphragm: the anterior air-cell on each side protrudes a little way through the anterior aperture of the thorax. (See Pl. LI. fig. 4.)

The larynx and trachea resemble, in the simplicity of their structure, those of the other Struthious birds. The upper larynx is not defended by any rudimental epiglottis, nor provided with retroverted spines or papillae. The glottis (Pl. XLVIII. d, fig. 1.) is a long and moderately wide aperture: below the external or superior lips of the glottis,
and within the larynx, there are two thinner membranous folds: a small but elongated process projects from the middle line of the under or anterior part of the upper larynx, towards the rima glottidis. Behind the glottis there are two square-shaped tumid processes, with their free margins directed backwards into the pharynx; their texture is more glandular than the surrounding mucous membrane. The trachea corresponds in length with the neck, and preserves a nearly uniform diameter throughout its course; it consists of small and entire cartilaginous rings,—in one specimen, 120,—in another, 130 in number,—alternately overlapping and being overlapped at the sides when the tube is relaxed: they are also alternately narrower on one side and the other, but in a slight degree: they become gradually smaller to the last twenty rings, which are not connected so closely and rigidly together as in the Ostrich and Emu. Remembering the cervical airsac which projects through the ovate aperture discovered by Fremery in the anterior part of the trachea of the Emu, and situated, as that accurate observer describes, between the fifty-third and sixty-second cartilaginous rings, I examined with care the trachea of the Apteryx, but without detecting any trace of an analogous structure in either sex.

There is no lower larynx. The last two tracheal rings increase in breadth, and the bronchial rings are continued from them with only a slight diminution of thickness: a membrane closes the trachea below, and completes the bronchial rings at their under part: near the termination of the bronchiæ the cartilaginous hoops are incomplete above as well as below. Both circular and longitudinal muscular fibres enter into the structure of the short bronchial tubes.

The sterno-tracheales muscles (Pl. LI. a, fig. 4.; Pl. XLVIII. g, fig. 3.) arise, one from the inner surface of each coracoid bone.

It is plain, from the fixed condition of the lungs, and from the space between the lungs and diaphragm being occupied by air-cells, that inspiration could not be effectually performed by the action of the diaphragm alone: but the structure and mobility of the anterior parietes of the thorax indicate that it takes place in the Apteryx, as in other birds, by the sternum being depressed, and the angle between the vertebral and sternal ribs being increased.

All the triangular muscles which converge to be inserted into the costal processes thus become muscles of inspiration, and more especially those which represent the serratus magnus anticus, and which act from the true ribs as a fixed point below, upon the scapula above; for by drawing down that bone they bear upon the sternum, through the medium of the coracoid; and hence the necessity of strong and well-developed coracoid bones in a bird that otherwise could derive no particular advantage from the fixation of the scapula. The adherence to the ornithic type in the characteristic part of the osseous structure due to the sternum, coracoids, and scapulae, is thus not merely explicable

1 De Casuario Nova Hollandiae, Svo. 1819.
on the theory of unity of plan, but relates in the Apteryx to the exigences of respiration with fixed lungs and large air-cells.

Renal and Genital Organs.

The kidneys' of the Apteryx are situated symmetrically, and lodged, as in other birds, in the irregular hollows of the back part of the cavity of the pelvis; their posterior surface presents corresponding projections; the anterior surface is smooth and almost flat: the mesial edges of the kidneys are nearly straight and parallel, and very close to each other, but do not coalesce at any part; the outer edges are notched. Each kidney measures 3 inches in length, 11 lines across the broadest part, which is one-fourth from the anterior extremity, and 4 lines at the thickest part. It is divided into five lobes by oblique fissures, extending into the posterior surface of the gland: the middle lobe is the largest. These lobes appear to have a compact and even surface, but their cerebriform convolutions can be readily unravelled. The weight of both kidneys is 2 drs. 36 grs. avoirdupoise. The tortuous ureter (w, Pl. L.) emerges from the inner side of the posterior extremity of the kidney, and after a course of an inch and a half, terminates, as above described, in the upper and back part of the uro-genital cavity.

The supra-renal bodies (x, x, Pl. L.) were of an oval form, and yellow colour; of a homogeneous texture; each 3 lines in length, and adhering closely to the vena cava (w).

The male organs of generation consist of two pretty, equally developed testes (y, y, Pl. L.) situated on the sternal aspect of the atlantal extremities of the kidneys, and on each side of the crura of the diaphragm. They were of a subcompressed oval figure, with a somewhat angular external margin, about 1 inch in length and 8 lines in breadth in the largest male Apteryx; but the dimensions of these glands are of course liable to vary according to the season or state of sexual excitement. Thus in the younger male Apteryx they were subcompressed, subtriangular bodies, imbedded in the sternal and lateral aspects of the supra-renal bodies, and not exceeding 5 lines in length. The vasa deferentia (z, z, Pl. L.) are formed by the union of numerous most minute efferent tubules, which pass from the testes, without forming an epididymis, into a soft amorphous substance, of a gray colour, which lies between the testes and the bright yellow supra-renal body. Some of the efferent tubules are lost in the gray substance, which seems to be the remnant of the corpus沃尔菲安姆; but the greater part perforate that body, and proceed to form the vas deferens. This tube is continued in the usual transversely undulated course, along the sternal aspect of the kidneys, and towards their mesial margins, to the urethro-sexual compartment, and terminate each on a prominent papilla (h, h, Pl. L.), situated in the uro-genital cavity, four lines below, and to the outer side of the urethral outlets, and three lines above the sides of the crescentic fold which separates the uro-genital from the vestibular compartment of the cloaca. The cresses or

1 Pl. L. v, v.
angles of the fold are continued into the margins of the penis, which projects from below the external orifice of the urethro-sexual cavity into the vestibular or outer compartment of the cloaca. The penis rapidly diminishes to a point, and its extremity is spirally retracted; when stretched out, the whole length of the intromittent organ is 1 inch and a half in length; but this, doubtless, falls short of the dimensions of the penis in the recent and erect condition. An urethral groove traverses the upper, or what, if the penis were drawn out of the cloaca and bent forwards along the abdomen, would be its under surface, by an urethral or rather seminal groove, which is continued to the end of its spiral extremity: the margins of this groove are not beset with papillae, but simply wrinkled transversely, as in the Emeu and Ostrich. The two lateral cavernous crura of the penis are attached to the membranous parietes of the uro-genital cavity, and to a retractor or erector muscle which comes off from the inner surface of the lower edge of the ischium: one of these muscles is represented at Pl. XLVIII. n, Fig. 3. The base of the penis is drawn towards the coccyx, and the veins quitting the corpora cavernosa are compressed by a second pair of muscles (α), narrower but thicker than the erectors, which arise from the fassia at the sides of the coccyx, pass downwards along the sides of the vestibule, and meet at a tendinous raphé on the dorsum penis. Immediately above the base of the penis, on each side, there is a considerable plexus (p) of both arteries and veins, with which also many filaments of nerves are intermingled. The last-described muscles cross over the base of this plexus in their course to the penis, and would doubtless impede, if not arrest the current of blood in the veins; they might be termed, therefore, "compressores venarum penis," as they fulfil the same office as the compressores described by Douglas in the Dog. In this office of maintaining the erect and turgid state of the intromittent organ, the compressores are aided by two broad sphincters: the internal one (Pl. XLVIII. q, fig. 3.) rises from the sides of the coccyx, and more immediately surrounds the cloaca, meeting its fellow at the middle line of the inferior surface: the external sphincter (r) closes principally the external compartment of the cloaca.

The female organs in the specimen dissected presented their full functional development. The left ovarium was, however, too much decomposed to admit of any accurate observation of its structure being made: it consisted of an irregular and obscurely divided mass, of about three inches in length by two in thickness: the largest yolks appeared to have been about one inch in diameter. There was a perfectly distinct right ovarium situated in front of the corresponding supra-renal gland; it consisted of an irregularly oval flattened body, with a slightly granulate surface, nine lines long, six lines wide, and about one line in thickness. The part of the cloaca where a rudimental right oviduct, supposing one to have been present, might have terminated, was cut away.

The left oviduct was of large size, and from the condition of the lining membrane of the calcifying segment or uterus, seemed to have been exercising its function a brief period before death. The whole length of the oviduct was thirteen inches; it was disposed
in three principal convolutions, and its connexions were as usual in birds. It com-
mences with a thin slit-like mouth, with entire margins, two inches in width, but soon
contracts to a diameter of ten lines; it thence proceeds to expand very gradually to the
width of an inch, and is thus continued to the uterine or terminal segment: this portion
is two inches and a half in length, and one inch and a half in diameter: its inner sur-
face was studded with slightly arborescent calcifying follicles, arranged in transverse
rows. The lining membrane of the principal part of the oviduct was thrown into longi-
tudinal rugae; the tube communicated with the cloaca by a short, contracted, and ob-
lique canal and orifice, with tumid margins. Both the upper and lower mesometries
presented the usual radiated muscular structure.

Osseous System.

The skeleton (Pl. LIV.) of the Apteryx offers the same general form as the entire bird;
but while it exhibits the Struthious disproportion between the anterior and posterior
extremities, it shows that all the ordinary bones of the wing exist, though in their feeblest state of development.

With the exception of the parts of the skeleton concerned in the formation of the
nasal and auditory cavities, none of the other bones of the Apteryx are perforated for
the admission of air, nor do they exhibit the pure white colour which characterizes the
skeleton in other birds. In their tough and compact texture they resemble the bones
of the Lizard tribe.

The skull (Pl. LIII.) of the Apteryx is chiefly remarkable for its smooth, expanded,
elevated, pyriform cranial portion, the total absence of supra-orbital ridges, the com-
pleteness and the thickness of the inter-orbital septum, the great development of the
ethmoid, the small size of the lachrymal bones, and the expansion of the nasal cavity
behind these bones: the combination of the depressed with the elongated and slender
form of the beak is of course as well marked in the skull as in the entire head already
described.

The occipital region of the cranium has a pretty regular semicircular contour, and dif-
fers from that of other Struthious birds in the greater relative extent of its base, and in
the comparatively slight lateral sinuosities due to the temporal depressions. The single
hemispherical tubercle in the basi-occipital, for the articulation with the atlas, has not
the vertical notch at the upper part observable in the Ostrich and Emeu, but is entire
as in the Rhea; and the plane of the occipital foramen has the same aspect as in that
bird, in which it is more nearly horizontal than in the Ostrich. The supra-occipital plate
forms a somewhat angular projection, corresponding with the small cerebellum within,
and is bounded on each side by a vertical vascular groove, terminated by a foramen above
and below: external to these grooves the ex-occipitals extend outwards and downwards,
in the form of obtuse processes, compressed in the antero-posterior direction, slightly
convex behind and concave in front, where they form the back part of the wide meatus auditorius externus. All the parts of the occipital bone were ankylosed together, and also to the surrounding bones.

The angle between the posterior and superior regions of the cranium is scarcely produced into a ridge. The superior region is smooth and regularly convex; it is separated from the temporal depressions by a narrow ridge, a little more marked than the occipital one. The sagittal suture runs across a little behind the middle of the upper part of the cranium: the left half of this suture, with the frontal suture, was persistent in one cranium of the Apteryx, which I extracted from a dried skin in Mr. Gould's Museum; but all the sutures were obliterated in the skull of Mr. Bennett's male specimen. The persistent sutures were more denticulated than those in the skull of a young Ostrich with which I have compared them.

The superior is continued into the lateral regions of the cranium by a continuous curvature, so that the upper part of the small orbital cavity is convex, and its limits undefinable, there being no trace of supraorbital ridge or antorbital or postorbital processes: this structure is quite peculiar to the Apteryx among birds, but produces a very interesting resemblance between it and the monotremous Echidna. The temporal bone sends forwards a short and slender zygomatic process, which in its small relative development resembles most that of the Rhea among the larger Struthionidae.

The frontal bones gradually contract to their junction with the nasal bones, between which there is the trace of a small part of the ethmoid bone. The narrow frontal region of the skull is traversed by a mesial longitudinal depression.

The ethmoid bone is remarkably expanded in the Apteryx, and its cells, instead of being restricted to a narrow vertical septum of the orbits, as in the diurnal Struthionidae, occupy not only the ordinary orbital space, but extend outwards for more than two lines beyond the lateral boundaries of the anterior part of the frontals. A small process extends from the frontal to the side of the expanded ethmoid, anterior to the orbital foramina which are distinct, and remarkably wide apart, and the expanded ethmoid is also supported anteriorly by a similar ankylosed conjunction with the lachrymal bone. The entire breadth of the ethmoid is 9 lines. The nearest approach to this peculiar structure of the Apteryx is made by the Ostrich, in which the interorbital septum, though much thinner than in the Apteryx, is also occupied by ethmoidal cells, and is thicker than in any of the other large Struthionidae. The Ibis (Numenius arcanus, Cuv., Pl. LIII. figs. 3 & 4.) offers a striking contrast with the Apteryx in this respect, the interorbital osseous septum being almost entirely absent. In all the other parts of the cranium already noticed it also differs widely from the Apteryx. In the posterior region of the skull of the Ibis the bony covering of the cerebellum is in great part defective: in the superior part the cranial parietes above the cerebral hemispheres form two convexities, separated by a middle longitudinal depression, and the narrow space between the supraorbital ridges is occupied by the impressions corresponding to the nasal or

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supraorbital glands: the whole cranium also is much higher and shorter in proportion to its breadth than in the Apteryx. The Ibis, in thus differing from the Apteryx, deviates also from the other Struthionidae.

At the base of the skull we find in the Apteryx all the peculiarities characteristic of the Struthionous birds. The body of the sphenoid sends outwards on each side two processes, of which the posterior abuts against the tympanic bone, and the anterior one, by a flattened oval articular surface against the pterygoid bone: the latter processes exist, but are much more feeably developed, in the Ibis: in most other birds, including the Grallae, they are wanting: they are well developed in the Lacertine Sauria. A compressed vomerine process is continued forwards from the anterior part of the basisphenoid, and this process is anchylosed to the under part of the expanded and cellular ethmoid.

In the interior of the cranium the olfactory depressions are seen to be proportionally larger than in other birds, and the olfactory nerve, instead of being continued along the upper part of an interorbital septum by a bony canal or groove to the nasal cavity, immediately passes, by many perforations, through a cribiform plate to the complex and extensive pituitary surface of the ethmoid bone.

The optic foramina are distinct both internally and externally, and are half an inch apart; they are perforated, not in the sphenoid ala, but in the inflected margin of the frontal bone. In these peculiarities the Apteryx differs from all the rest of its class: each optic foramen, however, transmits not only the optic nerve and ophthalmic artery, but also the third, fourth, first branch of the fifth, and sixth nerves, as in most other birds. Of these nerves the fifth is the largest, and it is continued forwards to the nasal canal, through two foramina, one circumscribed externally by the process already mentioned, which extends from the frontal to the ethmoid; the other by the corresponding process of the lachrymal. The pituitary fossa, or sella turcica, is a very deep semi-oval depression; the common internal orifice of the two carotid canals communicates with its posterior part. On each side of the anterior part of the floor of the cranium, which supports the medulla oblongata, there is an oblique slightly curved groove, terminated at its anterior extremity by the foramen rotundum, at its posterior by the foramen ovale. These foramina are situated between the basilar and alar elements of the sphenoid; they are nearly of equal size, and are relatively larger than in the diurnal Struthionidae. The foramen rotundum is not only distinct, but is further apart from the foramen opticum than in any other bird. The petrous bone projects internally in the form of a thin semicircular plate of bone, commencing at the foramen ovale and extending backwards to the foramen auditorium internum, which it overhangs: this plate gives attachment to the tentorium. There is not any corresponding bony ridge developed from the upper wall of the cranium in the line of origin of the falx, as in many of the Gallinaceous birds. The anterior or cerebral division of the cranial cavity is larger in proportion to the posterior than in most other birds.
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Of the bones more immediately concerned in the formation or motion of the jaws, that element of the temporal may be first described which in birds is always moveable and articulated at once with the cranium and both the upper and lower jaws.

The tympanic bone is of a subcompressed trihedral form, and sends forwards into the orbit a longer and slenderer process than in the larger Struthionidae: its upper articular surface is a transversely extended convex condyle, which plays in a corresponding cavity internal to the base of the zygomatic process. The opposite extremity is expanded, and presents two distinct articular convexities for the lower jaw, the inner one being the largest: above the external convexity there is a small but deep depression for the reception of the deflected extremity of the jugal bone.

The posterior extremity of the pterygoid bone is securely wedged in between the orbital process of the tympanic and the tranverse process of the sphenoid: as it advances forwards it expands, as in the other Struthionidae, into a thin plate of bone, which is bent upon itself with its concavity turned inwards, and is continued by anchylosis into the palatine bones, so that the limits between them cannot be defined.

The palatine bones are in like manner confluent with the maxillaries. They are pierced by two narrow elliptical posterior nasal foramina, about 3 lines in length, over which the exterior margin of each palatine bone arches from without inwards, and these over-arching laminae gradually approximate, as they advance forwards, and meet about one inch anterior to the nasal foramina, from which an imperforate plate of bone, impressed with a narrow median fissure, and composed of the confluent palatal processes of the maxillary and intermaxillary bones, is continued to the end of the beak. The limits between maxillary and intermaxillary bones are indicated by two fine oblique lines, commencing at the outer margin of the roof of the mouth, about 2½ inches from the apex of the beak.

The jugal style, which in the Ostrich may be separated in the full-grown bird into a zygomatic and malar portion, consists in the Apteryx of a single slender compressed twisted bone, anchylosed with the maxillary bone in front, and terminated behind by an obtuse deflected extremity, which is received into a corresponding vertical cavity in the upper part of the outer process of the tympanic bone. By this mode of attachment the tympanic bone offers increased resistance to the pressure transferred to it by the lower jaw, at the same time that it gives additional strength to the upper mandible. It is continued backwards in the same line with the upper maxillary bone as in other Struthionidae, and is not bent downwards at its junction with the maxillary as in the Ibis and other Grallae.

The superior maxillary bone presents the singular form of a nearly perfectly flat elongated triangular plate of bone, which is imperforate, and is continued by uninterrupted ossification with the intermaxillary. The Rheu among the Struthionidae makes the nearest approach to the Apteryx in the structure of this part of the skull; but the maxillary plate is perforated by large foramina, and sends upwards on each
side a process to join the lachrymal. In the Ibis the superior maxillary bones are in the form of slender round styles, having a wide interspace between them. In the Ateryx the small lachrymal bones are represented by two compressed plates of bone descending obliquely forwards from the anterior extremities of the frontals, and are articulated below to a small depression in the maxillary plate. They are each pierced by a single small foramen. The frontal, nasal, and intermaxillary bones form one continuous bony piece, too strong to admit of any elastic yielding movement between the upper jaw and cranium. The nasal and the upper or mesial portion of the intermaxillary bones form an elongated depressed narrow process, convex above, and with the outer margins bent inwards beneath the long nasal passages, of which they form the outer and part of the lower boundaries.

The lower jaw presents all the usual ornithic characters with the Struthious modifications traceable in the individual peculiarities. The transversely expanded angular and articular extremities offer the inwardly extended process for the attachment of the pterygoidei muscles: the superior transverse plate behind the articular surfaces is thin and concave towards the meatus auditorius externus, and is lined by the mucous membrane of that passage, of which it forms part of the bony parietes. There are two distinct narrow oblique articular surfaces, concave in the longitudinal and convex in the transverse directions; the internal one is the largest, and behind this there is a small excavation into which a small process of the air-sac lining the tympanum is continued; and this is the only part of the skeleton not immediately concerned in the formation of the organs of hearing or smelling into which air is admitted. The entry to the air-cells in the lower jaw of the Ostrich is situated in the part corresponding to the above depression or sinus in the jaw of the Ateryx. Traces of the compound structure of the lower jaw are very evident in that of the Ateryx, and the limits of the angular, articular and coronoid pieces may be in part defined. There is a linear vacancy, bounded by the surangular and angular pieces behind, and by the bifurcate commencement of the mandibular or dentary piece in front: the surangular is compressed, and sends upwards a very slightly elevated coronoid ridge. A second narrower fissure occurs between the thick opercular or splenial element and the upper fork of the mandibular piece. The opercular piece reaches to the posterior part of the symphysis as in the Ostrich, and the rest of the lower jaw in front of this part is formed by the two ankylosed mandibles. In the extent of this ankylosed symphysis the Rhea makes the nearest approach to the Ateryx among the Struthionidae, and the two impressions which diverge from the back part to the front of the symphysis are present in both the Rhea and Emeu as in the Ateryx. The lower jaw of the Ateryx differs from that of the Ibis in its greater posterior expanse, its more depressed form, the lower coronoid plate, the narrower fissure between the angular and surangular pieces, and the absence of the mesial furrow, extending in the Ibis to the end of the symphysis.

1 Pl. LIII. Figg. 6. & 7.  
2 Pl. LIII. Fig. 6. a.
The relations of the modifications of the skull of the *Apteryx* to its peculiar habits and kind of food are well marked and very easily traced; those which concern the maxillary portions have already been noticed in the account of the digestive system, and I need only add here that the ankylosed condition of all the parts concerned in the formation of the upper mandible is more complete than in the larger *Struthionidae*, and relates to the greater force with which the beak is used in obtaining the food.

The nocturnal habits of the *Apteryx*, combined with the necessity for a highly developed organ of smell, which chiefly compensates for the low condition of the organ of vision, produces the most singular modifications which the skull presents, and we may say that those cavities which in other birds are devoted to the lodgingment of the eyes, are here almost exclusively occupied by the nose.

The spinal column is relatively stronger, especially in the cervical region, than in the larger *Struthionidae*: it consists of fifteen cervical, nine dorsal, and twenty-two remaining vertebrae in the lumbar, sacral, and caudal regions.

The dorsal vertebrae are arranged in a straight line, and slightly increase in breadth to the seventh; the transverse processes of the eighth and ninth suddenly diminish. The third, fourth, fifth and sixth dorsal vertebrae are slightly ankylosed together by the contiguous edges of their spinous processes; the seventh, eighth and ninth are overlapped by the iliac bones; but notwithstanding this partial ankylosis, the synovial articulations, both between the bodies and oblique processes, are retained in all the dorsal vertebrae, and a slight, yielding, elastic movement is permitted between those vertebrae: the body of the last dorsal vertebra is ankylosed to the sacrum. The breadth of the bodies of the dorsal vertebrae diminishes, and their length increases very gradually from the first to the fourth; thence the bodies become broader and shorter in the same degree to the sacrum. A short obtuse process is sent off obliquely forwards from the inferior surface of the body of each of the first four dorsal vertebrae; the corresponding surface of the succeeding ones is smooth and slightly concave from side to side. The articulation between the bodies is by the adaptation of a surface slightly concave in the vertical and convex in the transverse direction at the posterior end of one vertebra to opposite curves at the anterior end of the succeeding one. Close to the anterior surface on each side there is a hemispherical pit for the reception of the round head of the rib: this articular pit is supported on a process representing the inferior transverse process, except in the three middle dorsal vertebrae. The transverse processes are broad, flat, and square-shaped, with the anterior angle obliquely cut off to receive the abutment of the tubercle of the rib, except in the second and third, in which a small process is sent down for the same purpose from the under surface of the transverse process: the transverse processes of the three last dorsal vertebra abut against the under or inner surface of the *ilia*, and are probably ankylosed thereto in old birds. The nerves issue from the interspaces of the vertebrae above the articulation of the heads of the ribs. The transverse processes are not connected together by extended long
splints, but are quite detached from each other as in Struthious birds. The oblique processes offer no peculiarity; a process is continued backwards from the upper part of those belonging to the first and second dorsal vertebrae. The spinous process arises from the whole length of the arch of each vertebra; it is truncate above, and with the exception of the first, is of the same breadth throughout: all the dorsal spines are much compressed, the middle ones being the thinnest, slightly expanding at their truncate extremities, especially the three anterior ones, the first spine being notched behind to receive the contiguous angle of the succeeding one: below this there is a considerable interval between these two spines, but the rest of the spines are in contact throughout, and are probably more ankylosed in the older birds than was observed in the specimen here described. The length of the dorsal region of the spine is 4 inches.

The length of the vertebral column behind the dorsal vertebrae included between the ossa innominata is 3 inches. The first four sacral vertebrae send outwards inferior transverse processes which abut against the ilia, and progressively increase in length and thickness. The breadth of these vertebrae also gradually increases; but it diminishes in the four succeeding vertebrae, in which the inferior transverse processes are wanting; then the ninth and tenth sacral vertebrae send outwards each a pair of strong inferior transverse processes to abut against the inner surface of the ossa innominata immediately behind the acetabulum: the ankylosis of the bodies is continued through the four succeeding vertebrae, which are of a very simple structure, devoid of transverse or oblique processes, becoming gradually more compressed and more extended vertically, so as to appear like mere bony laminae; the line of the articulation between the bodies of these posterior sacral vertebrae is obvious, but their spines coalesce to form a continuous bony ridge, which is closely embraced by the posterior extremities of the innominata. The foramina for the nerves are pierced in the sides of the bodies of the sacral vertebrae; they are double in the anterior ones, but single in the posterior compressed vertebrae, where they are seen close to the posterior margin.

There are nine caudal vertebrae, which are deeper, and project farther below the posterior portions of the iliac bones than in the other Struthious birds: these vertebrae, as they descend, progressively increase in lateral and diminish in vertical extent; the spinal canal is continued through the first five, and they are all moveable upon each other, excepting the two last, which combine to form a vertebra analogous to the expanded terminal vertebra in other birds, but which here exceeds the rest only in its greater length, and gradually diminishes to an obtuse point. In the Ostrich the corresponding vertebra is expanded for the support of the caudal plumes, but in the Apteryx it offers the same inconspicuous development as in the Rhea and Emeu.

The cervical vertebrae present all the usual ornithic peculiarities. Their general form and proportions are shown in the figure (Pl. LV.). The single inferior process for the attachment of the complicated longus colli anticus is present in the three last vertebrae.

1 See Pl. LV.
The inverted bony arch for the protection of the carotid arteries is first seen to be developed from the inner side of the inferior transverse processes of the twelfth cervical vertebra, but the two sides of the arch are not ankylosed together; the interspace progressively increases in the eleventh, tenth, and ninth vertebrae, and the groove widens and is lost at the fifth vertebra. The spinous process is thick and strong in the vertebra dentata, but progressively diminishes to the seventh cervical vertebra, where it is reduced to a mere tubercle; from the eleventh it progressively increases to the last cervical, in which it presents the strong quadrate figure which characterizes the same process in the dorsal vertebrae.

The large canal on each side for the vertebral artery and sympathetic nerve is formed by the ankylosis of a rudimental rib to the extremities of an upper and lower transverse process; the costal process diminishes in size in the anterior cervical vertebrae: it is wanting in the dentata, though an arterial canal of very small size is present on each side of that vertebra. In the atlas there are two small inferior transverse processes, but no canal. The superior or neurapophysial bony arch increases in extent as the cervical vertebrae approach the head, and in the third, fourth, and fifth vertebra this part is perforated by a small foramen on each side. The spinal chord is least protected by the vertebrae in the middle of the neck, where there is the greatest extent of motion: there is a depression on the anterior and posterior parts of the spine in the second, third, fourth, and in the last six cervical vertebrae.

The length of the cervical region of the spine is 7 inches.

The close resemblance of the Bird to the Reptile in its skeleton is well exemplified in the young Ostrich, in which even when half-grown the costal appendages of the cervical region of the vertebral column continue separate and movable, as in the Crocodile. I have already observed that they were ankylosed to the first fifteen vertebrae in the Apteryx. The first dorsal rib is a slender style about an inch in length; the rest are remarkable for their breadth, which is relatively greater than in any other bird; the Cassowary in this respect approaches nearest to the Apteryx. The second, third, fourth, and fifth ribs articulate with the sternum through the medium of slender sternal portions; that of the sixth also reaches the sternum, but is attached only to the sternal rib anterior to it, and a considerable interspace exists between its unattached extremity and that of its corresponding vertebral rib. In the first simple and floating rib, the part corresponding to the head and neck, as usual, is not developed, and it is attached to the transverse process by the part analogous to the tubercle. In the second rib a short and strong cervix, terminated by a hemispherical head, is given off below and in front of the tubercle, and works in a corresponding socket at the anterior margin of the vertebra. The head and tubercle, with the points of the vertebrae to which they are attached, intercept large foramina corresponding to the vertebral foramina in the cervical region. Immediately below the tubercle the rib suddenly expands, and then gradually narrows to its lower end: the neck of the rib increases in length in the third and fourth pairs and diminishes in the last two; the sixth rib begins to lose its breadth, and the rest become nar-
rrower to the last. The bony appendages to the vertebral ribs are developed in the second to the eighth inclusive: they are articulated by a broad base to a fissure in the posterior margin of these vertebral ribs a little below their middle part; those belonging to the third, fourth, fifth, and sixth ribs are the longest, and overlap the succeeding rib: these processes are not ankylosed in the specimen described. The Rhea comes nearest to the Apteryx in the size of these costal appendages. The first four sternal ribs are transversely expanded at their sternal extremities, which severally present a concave surface lined with smooth cartilage and synovial membrane, and playing upon a corresponding smooth convexity in the costal margin of the sternum, which thus presents four true enarthrodial joints with capsular ligaments on each side. This elaborate structure is not, however, peculiar to the Apteryx among birds, but relates to the importance of the movements of the sternal ribs, which are the centres upon which the respiratory motions hinge,—the angles between the vertebral and sternal ribs, and between these and the sternum, becoming more open in inspiration when the sternum is depressed, and the contrary when the sternum is approximated to the dorsal region in expiration.

The sternum—the main characteristic of the skeleton of the bird—is reduced to its lowest grade of development in the Apteryx. In its small size, and in the total absence of a keel, it resembles that of the Struthious birds, but differs in the presence of two subcircular perforations on each side of the middle line, in the wide anterior emarginations, and in the much greater extent of the two posterior fissures.

The anterior margin presents no trace of a manubrial process as in the Ostrich: on the contrary, the wide interspace between the articular cavities of the coracoid is deeply concave; in the extent of this interspace the Rhea most resembles the Apteryx, but its contour is almost straight; in the Cassowary the space is narrower but is deeply notched. The articular surface for the coracoid is an open groove, which in the fresh state is covered with articular cartilage: external to this groove the anterior angles of the sternum are produced into two strong triangular processes with the apex obtuse. The costal margin is thickened, and when viewed anteriorly, presents an undulating contour, from the presence of the four articular convexities for the sternal ribs and the intermediate excavations. The sternum of the Emeu presents a similar appearance. The breadth of each sternal perforation is nearly equal to that of the intervening osseous space; in the specimen described they were not quite symmetrical in position. The extent of the posterior notches is equal to one half the entire length of the sternum: the external boundaries of these notches curve towards each other: there is also a slight want of symmetry in the form, position, and extent of these notches, as may be seen in the figures (Pl. LV. Fig. 2 & 3.)

The scapula and coracoid are ankylosed: a small perforation anterior to the articular surface of the humerus indicates the separation between the coracoid and rudimental clavicle, of which there is otherwise not the least trace.

* Pl. LV. fig. 4.
The coracoid is the strongest bone: its inferior expanded extremity presents an articular convexity, adapted to the sternal groove before described.

The scapula reaches to the third rib: it is a simple narrow plate of bone, slightly curved and expanded at both ends, but chiefly at the humeral articulation. Its length is one inch.

The humerus is a slender, cylindrical, styliform bone, slightly bent, 1 inch 5 lines in length; slightly expanded at the two extremities, most so at the proximal end, which supports a transverse oval articular convexity, covered with smooth cartilage, and joined by a synovial and capsular membrane to the scapulo-coracoid articulation. A small tuberosity projects beyond each end of the humeral articular surface. The distal end of the humerus is articulated by a true but shallow ginglymoid joint with the rudimental bones of the antibrachium, and both the external and internal condyles are slightly developed.

The radius and ulna are almost straight cylindrical slender bones, each 9 lines in length. A feebly developed olecranon projects above the articular surface of the ulna. There is a minute carpal bone, two metacarpals, and a single phalanx, which supports the long curved obtuse alar claw. The whole length of this rudimental hand is 7 lines, including the claw, which measures 3 lines and a half. A few strong and short quill-feathers are attached by ligament to the ulna and metacarpus.

The iliac bones in size and shape resemble those of the Struthious tribe: the length is 4 inches and 3 lines. The outer surface presents a slight concavity anteriorly, which gradually passes into a convexity posteriorly, the two surfaces not being separated by the transverse elevation observable above the acetabulum in the four large Struthious birds. A distinct epiphysal piece of bone, of a compressed and triangular form, is wedged in between the posterior extremity of the ilia and the first three caudal vertebrae.

The ischium extends backwards, parallel with the sacrum, in the form of a thin plate of bone which slightly expands to its free extremity, which is truncated.

The pubic element is a slender bony style, connected by ligament to the end of the ischium, but attached by bone at its acetabular extremity only. A short pointed process extends from the anterior margin of the origin of the pubis. In comparing the pelvis of the Apteryx with that of the large Struthious birds, we find that the ischia do not meet below the sacrum as in the Rhea, but are more distant from that and the iliac bones than in any of the Struthious birds; the pubic bones are not joined together at their distal extremities as in the Ostrich; the extremities of the ischia are not anchylosed to the superincumbent ilia as in the Cassowary. It is the Emeu which comes nearest to the Apteryx in the structure of the pelvis, but it also differs in the complete bony boundary of the foramen which transmits the tendon of the obturator internus, and which is completed posteriorly by ligament in the Apteryx.

The acetabulum communicates, as usual, by a wide opening with the pelvis: a surface
covered with a cushion of thick cartilage is continued from its posterior and upper part.

The fibrous capsule of the hip-joint is very strong; the synovial membrane is reflected from it upon the upper margin of the trochanter and upper part of the short neck of the femur; and also upon the ligamentous bridge continued from the upper and extended margin of the acetabulum, to its anterior part. The ligamentum teres is very large, but short; it consists of an infundibular process of synovial membrane, reflected from the circumference of the acetabular perforation to that of the depression on the head of the femur; and this synovial sheath incloses two distinct ligaments, which are twisted about each other like the crucial ligaments of the knee-joint. One of the ligamentous bands passes from the upper margin of the acetabular perforation to the lower edge of the femoral depression; the other comes off from the under part of the acetabular perforation, and winds round the back part of the preceding, to be inserted into the upper part of the femoral depression.

The femur has the usual characters of that bone in the class of birds. Its small round head is supported on a very short and thick neck, placed at right angles to the great and single trochanter: it presents at its superior part a large depression for the strong and complex ligamentum teres. The shaft of the femur is slightly bent, with the convexity forwards, which is increased by a thickening at the anterior part of the middle of the shaft. The condyles are separated by a wide and deep groove anteriorly, and by a triangular depression behind. The outer one is the largest, and is grooved externally, for the articulation of the head of the fibula: the inferior compressed border of the condyle is wedged in between the tibia and fibula. The length of the femur is 3 inches 9 lines. The tibia is five inches in length. Two angular and strong ridges are developed from the anterior part of the expanded head of the tibia; the external one affords attachment to fascia, and to the expanded tendon of the rectus femoris latissimus: the internal ridge has affixed to it the ligament of the small cartilaginous patella. The knee-joint is remarkably complicated. The internal lateral ligament is broad and thin; it gives origin to part of the soleus, and is attached to the internal semilunar cartilage. This fibro-cartilage divides at its anterior extremity into three ligaments: of these one is broad and thick, and goes to the posterior surface of the rotular cartilage; it represents the ligamentum mucosum; the other two ligaments are inserted at the interspace of the condyles. Beneath the internal semilunar cartilage a very strong ligament arises from the inner edge of the tibia, and is also attached to the interspace of the condyles. A strong external lateral ligament extends between the outer condyle and the head of the fibula: beneath or within this there is a second ligament, which passes from the outer condyle to the external semilunar cartilage. A thick ligament extends from the anterior parts of this cartilage to the back part of the ligamentum patellae. From the back part of the external semilunar cartilage a posterior crucial ligament extends to the condyloid interspace; lastly, a strong ligament arises from the fore part of the head of the tibia,
and passes upwards and backwards to be inserted, with the preceding ligament into the back part of the interspace of the condyles. The head of the tibia sends down an angular ridge posteriorly: the shaft of the bone is rounded, slightly compressed, converging to a ridge externally, to which ridge the fibula is attached in two places, beginning half an inch below the head of the fibula, and continuing attached for 10 lines; then again becoming anchylosed, after an interspace of 9 lines. In one specimen I found the fibula also anchylosed to the tibia by its expanded and thick proximal extremity: it quickly diminishes in size as it descends, and gradually disappears towards the lower fourth of the tibia. The distal end of the tibia presents the usual trochlea form, but the anterior concavity above the articular surface is in great part occupied by an irregular bony prominence.

There is a small cuneiform tarsal bone wedged into the outer and back part of the ankle-joint. The anchylosed tarso-metatarsal is a strong bone, 2 inches 3 lines in length; the upper articular surface is formed by a single broad piece. The original separation of the metatarsal bone below into three pieces is plainly indicated by two deep grooves on the anterior and posterior part of the proximal extremity: the intermediate portion of bone is very narrow anteriorly, but broad and prominent on the opposite side. The bone becomes flattened from before backwards, and expanded laterally as it descends, and divides at its distal extremity into three parts, with the articular pulleys for the three principal toes.

The surface for the articulation of the fourth, or small internal toe, is about half an inch above the distal end, on the internal and posterior aspect of the bone. A small ossicle, attached by strong ligaments to this surface, gives support to a short phalanx, which articulates with the longer ungual phalanx.

The number of phalanges in the other toes follows the ordinary law, the adjoining toe having three, the next four, and the outermost five phalanges. The relative size and the forms of these bones are shown in the figures of the skeleton (Pl. LIV.).

Organs of Sense.

The requisite particulars regarding the nervous system of the Apteryx will be given at a subsequent period. The cavity of the cranium indicates the brain to have been proportionally larger than in the diurnal Struthionidae.

Of the organs of special sense, the ear, as we have already seen, resembles that of the larger Struthionidae in the development of the external passage: the structure of the internal organ was conformable to the typical condition of this part in Birds.

The eye, on the contrary, presented a remarkable deviation from the construction which characterizes the feathered class, in the total absence of the pecten or marsupium. We may conceive that this modification relates to the nocturnal habits and restricted locomotion of the present singular species. The eye-ball is relatively much smaller
than in other birds; its antero-posterior diameter is three lines; its transverse diameter four lines. The cornea transparens is very convex, and two lines in diameter. The sclerotic is thin, but the margin supporting the cornea is strengthened by a circle of small osseous plates. The choroid is a delicate membrane; its pigment is of a light brown colour. The ciliary processes commence at the ciliary ring, each process having at its origin a slight linear rising, which becomes gradually wavy and tortuous as it approaches the lens, anterior to the circumference of which it projects freely to a small extent. The iris in the specimen examined was one-third of a line in breadth. The optic nerve terminates by a small round aperture. The lens is two lines in breadth, and nearly one line at the thickest part, being thus more convex than in other birds. The external appendages of the eye presented no peculiarities, except the very great strength of the orbicularis palpebrarum; the membrana nictitans had the usual trochlear muscles: its free margin was black.

The singularly long and narrow nasal passages are closed and defended externally by the inflected outer margins of the nasal and upper process of the long intermaxillary bones. The relative extent and complexity of the turbinated bones, and the capacity of the posterior part of the nasal cavity exceed those of any other bird; and the sense of smell must be proportionally acute and important in the economy of the Apteryx.

Concluding Observations.

On a review of the preceding details of the organization of the Apteryx, it will be seen that, commencing with the skeleton, all the leading modifications of that basis of its structure connect it closely with the Struthious group. In the diminutive and keel-less sternum it agrees with all the known Struthious species, and with these alone. The two posterior emarginations which we observe in the sternum of the Ostrich are present in a still greater degree in the Apteryx; but the feeble development of the anterior extremities, to the muscles of which the sternum is mainly subservient as a basis of attachment, is the condition of a peculiarly incomplete state of the ossification of that bone of the Apteryx; and the two subcircular perforations which intervene between the origins of the pectoral muscle on the one side, and those of a large inferior dermo-cervical muscle on the other, form one of several unique structures in the anatomy of this bird. We have again the Struthious characters repeated in the atrophy of the bones of the wing, and the absence of the clavicles, as in the Rhea. Like testimony is borne by the expansively developed iliac and sacral bones, by the broad ischium and slender pubis, and by the long and narrow form of the pelvis. We begin to observe a

1 In the Ostrich the clavicles are undoubtedly present though anchylosed with the scapula and coracoids, and separate from each other. In the Cassowary and Emeu they exist as separate short styliform bones.
deviation from the Struthious type in the length of the femur, and a tendency to the gallinaceous type in the shortness of the metatarsal segment: the development of the fourth or inner toe may be regarded as another deviation; but it should be remembered that in the size and position of the latter the Apteryx closely corresponds with the extinct Struthious Dodo. The claw on the inner toe of the Apteryx has been erroneously compared with the spur of certain Gallinae, but it scarcely differs in form from the claws of the anterior toes.

In the broad ribs (see the Cassowary), in the general freedom of anchylosis in the dorsal region of the vertebral column, and the numerous vertebrae of the neck, we again meet with Struthious characters; and should it be objected to the latter particular, that some Palmipeds surpass the Ostrich in the number of cervical vertebrae, yet these stand out rather as exceptions in their particular order; while an excess over the average number of cervical vertebrae in birds is constant in the Struthious or Brevipennate group. Thus in the Cassowary 19 vertebrae precede that which supports a rib connected with the sternum, and of these 19 we may fairly reckon 16 as analogous to the cervical vertebrae in other birds. In the Rhea there are also 16 cervical vertebrae, and not 14, as Cuvier states. In the Ostrich there are 18, in the Emeu 19 cervical vertebrae. In the Apteryx we should reckon 16 cervical vertebrae if we included that which supports the short rudimental but moveable pair of ribs. Of the 22 true grallatorial birds cited in Cuvier's Table of the number of Vertebrae, only 9 have more than 14 cervical vertebrae; while the Apteryx with 15 cervical vertebrae, considered as a Struthious bird, has the fewest of its order. Its neck is relatively shorter, in correspondence with the shorter legs; the Cassowary, among the Struthionidae, comes nearest to the Apteryx in these proportions.

The free bony appendages of the ribs, and the universal absence of air-cells in the skeleton, are conditions in which the Apteryx resembles the Aptenodytes, but here all resemblance ceases: the position in which the Apteryx was originally figured is incompatible with its organization.

The modifications of the skull of the Apteryx, in conformity with the structure of the beak requisite for obtaining its appropriate food, are undoubtedly extreme; yet we perceive in the cere which covers the base of the bill in the entire Apteryx a structure which exists in all the Struthious birds; and the anterior position of the nostrils in the subattenuated beak of the Cassowary is an evident approach to that very singular one which peculiarly characterizes the Apteryx. With regard to the digestive organs, it is interesting to remark, that, with the exception of the Ostrich, the thickened muscular parietes of the stomach of the granivorous Struthious birds do not exhibit that apparatus of distinct musculi digastrici and laterales which forms the characteristic structure of the gizzard of the gallinaceous order: thus the Apteryx, in the form and structure of its stomach, adheres to the Struthious type. It differs again in a marked degree from the

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1 Shaw's Miscellany, xxiv. pl. 1075.


Gallinae in the absence of a crop. With respect to the cecal appendages of the intestine, though generally long in the Gallinae, they are subject to great variety in both the Struthious and Grallatorial orders: their extreme length and complicated structure in the Ostrich and Rhea form a peculiarity only met with in these birds. In the Cassowary, on the other hand, the ceca are described by the French academicians as entirely absent. Cuvier\(^1\) speaks of "un cacum unique" in the Emeu. In my dissections of these Struthious birds I have always found the two normal ceca present, but small; in the Emeu measuring from three to five inches long, and half an inch in diameter\(^2\); in the Cassowary measuring about four inches in length. The presence of two moderately developed ceca in the Apteryx affords therefore no indication of its recession from the Struthious type: these ceca correspond in their condition, as they do in the other Struthious birds, with the nature of the nutriment of the species. It is dependent on this circumstance also, that in the grallatorial bird (Ibis), which the Apteryx most resembles in the structure of its beak, and consequently in the nature of its food, the ceca have nearly the same relative size; but as regards the Grallae, taken as an order, no one condition of the ceca can be predicated as characteristic of them. In most they are very small; in many single.

What evidence, it may next be asked, does the generative system afford of the affinities of the Apteryx? A single, well-developed, inferiorly grooved, subspiral intromittent organ attests unequivocally its relations to the Struthious group; and this structure, with the modifications of the plumage of the respiratory organs and of the skeleton, lead to the same conclusion as that at which Mr. Yarrell\(^3\) and myself had arrived\(^4\), from a study of the external organization of the Apteryx, viz. that it must rank as a genus of the cursorial or Struthious order. In deviating from the type of this order the Apteryx manifests a tendency in the structure of the feet to the Gallinae, and in the form of the beak, to the Grallae; but it cannot, without violation of its natural affinities, be classed with either.

\(^1\) Leçons d’Anat. Comp. 1836. iv. p. 291.

\(^2\) The accurate Fremery speaks of "ceca intestina duos pollices tantum longa, dimidium lata," in the Emeu dissected by him, loc. cit. p. 76.

\(^3\) Loc. cit., p. 72.

DESCRIPTION OF THE PLATES.

PLATE XLVII.

Fig. 1. Head of a female *Apteryx*¹.
   a. The external nostril.
2. Head of a male *Apteryx*.
   a. The *cere*.
   b. The ear.
3. Head of a *Rhea Americana*.
   a. The *cere*.
   b. The ear.
4. The external appearance of the wing when the feathers are removed: it exhibits the form of one of the abnormal small quill-feathers described at p. 259.
5. One of the neck-feathers of the *Apteryx*.

PLATE XLVIII.

Fig. 1. Under surface of the head of the *Apteryx*, with the tongue and palate exposed.
   a. The posterior nasal apertures.
   b. The common opening of the Eustachian tubes.
   c. The tongue.
   d. The *glottis*.
   e. The glandular processes of the pharyngeal membrane.
2. The inferior surface of the tongue and hyoid-bone, with the commencement of the *esophagus* and *trachea*.
3. Abdominal *viscera in situ*.
   a. Gastric processes of *omentum*.
   b. *Omental* processes covering the intestines.
   c, c. *Omental* processes in the intestinal loops.
   d. The *pancreas*, in
   e. The *duodenal loop*.
   f. The first loop of *jejenum*.
   g. The *rectum*.

¹ Since the preceding pages were printed Mr. Cunningham has transmitted to the Zoological Society the skin and the trunk of an *Apteryx*, which proves to be a female, and has a beak measuring from the gape to the tip six inches four lines, thus verifying the conjecture put forth at p. 260, that the difference in the length of the beak is sexual, and that the longer one characterizes the female.
h. The *esophagus*.
i. The *sterno-tracheales* muscles.
j. The carotid arteries.
k, k. The right and left lobes of the liver.
n. *Erector penis*.
o. *Compressor venarum penis*.
p. Vascular and nervous *plexus*.
q. Internal *sphincter* of *cloaca*.
r. *External sphincter*.
s. *Penis*: a probe is passed beneath it into the *cloaca*
t. *Coccygeal* gland.

**PLATE XLIX.**

Abdominal sacs.
a. The right hepatic sac, with a style passing through the aperture of communication with
b. The right enteric sac.
b'. Another style, passing by the side of the stomach, into the left hepatic sac.
c. *Omentum*.
d. The *pancreas*.
e. The *duodenum*.
f. The fold of *jejenum*.
g. The *rectum*.
r. The external *sphincter*.
s. The *penis*.
a. The two portions of the *pectoralis major*.
b. *Pectoralis medius*.
c. *Pectoralis minor, seu internus*.

**PLATE L.**

Digestive, Urinary, and Male Generative Organs.
a. The *proventriculus*.
b. The *stomach*.
c. The *duodenum*.
d. The *vitelline cecum*.
e, e. The two *cecum*.
f. The *rectum* laid open, showing the large *glandulae solitariae*. 
g. Bristles inserted into the ureters.

h, k. The papillæ, on which the vasa deferentia terminate.

i. The penis.

k. The bursa Fabricii.

l. The right,—and m, the left lobe of the liver.

n. The gall-bladder: two cyst-hepatic ducts are seen entering its cervix.

o. The cystic duct.

p. The hepatic duct.

q. The pancreas.

r. The spleen.

s, s. The renal veins;

t. Their posterior anastomosis, forming the commencement of the portal system of veins; and u, their anterior anastomosis, forming the commencement of the inferior vena cava, and completing the circulus venosus renalis.

v. The kidneys.

w. The ureters.

x, x. The supra-renal glands.

y, y. The testes.

z, z. The vasa deferentia.

PLATE LI.

Fig. 1. Part of the digestive system of Dr. Logan’s female Apteryx.

a. The proventriculus laid open, showing the thickness of the glandular coat and the internal surface.

b. The gizzard, showing the internal projections produced by the state of contraction of the cavity.

c. The commencement of the duodenum, lined with thick epithelium.

l. The liver.

o. The duct corresponding with the cystic.

p. The hepatic duct.

q. The pancreas.

r. The orifices of the pancreatic ducts.

s. The pedicle or obliterated canal of t, the persistent vitelline sac.

u. The twig representing the omphalo-mesenteric artery.

2. A section of one of the ordinary bilobate proventricular glands. 3. A quadrilobate proventricular gland. Both twice the natural size.

4. Section of the right lung and air-sacs.
a. The sterno-trachealis muscle: bristles are seen passing from the external branch of the bronchus into the three anterior air-sacs.

5. Front view of both lungs.
   a. The anterior or short pulmonic bronchial tube.
   b. The posterior or long pulmonic bronchial tube.
   c. The bronchial tube of the air-sacs.

PLATE LII.

Fig. 1. A dissection, showing the diaphragm of the Apteryx.
   a. The two crura of the vertebral portion or lesser muscle of the diaphragm.
   β, β. Fasciculi of the costal portions of the diaphragm.
   a. The pericardium covering the apex of the heart, and protruding through the anterior fissure of the diaphragm.
   b. The aosophagus.
   l. The trunk of the celiac axis protruding through a foramen in the expanded central tendon of the diaphragm.
   m. The mesenteric artery.
   n. The abdominal aorta.
   o. The spermatic artery.
   p, p. The femoral arteries.
   q, q. The renal arteries.
   r, r. The ischiadic arteries.
   s. The sacro-median artery.

Fig. 2. Front view of the heart.
   a. The right ventricle.
   b. The right auricle.
   c. The pulmonary artery.
   d. The arteries innominate.
   e, e. The internal thoracic arteries.
   f, f. The brachial arteries.
   g. The carotids.

3. The heart, dissected, to show the interior of the right auricle and ventricle.
   b. The inferior vena cava.
   c. The left superior cava.
   d. The right superior cava.
   e & f. The semilunar valves, between the sinus and auricle.
   g. The right auriculo-ventricular valve.
   h. The left auricle.
OF THE SOUTHERN APTERYX.

PLATE LIII.

Skulls of Apteryx Australis and Numenius arcuatus.

Fig. 1. Upper surface of the skull of the Apteryx Australis, male.
2. Under surface of the same.
3. Upper surface of the skull of the Ibis, (Numenius arcuatus.)
4. Under surface of the same.
5. Posterior surface of the skull of the Apteryx.
6. Upper surface of the lower jaw of the male Apteryx.
7. Under surface of the same.
8. Os hyoides.

PLATE LIV.

Skeleton of the male Apteryx, one half the natural size.

PLATE LV.

Fig. 1. Under surface of the bony compages of the thoracic, abdominal, and pelvic cavities, with the sternum and sternal ribs removed.
2. Under or external surface of the sternum.
   a. The perforations.
   b. The posterior fissures.
   c. The broad anterior emargination.
   d. The articular notch for the coracoid.
   e. The coracoid.
   f. The rudiment of an acromial clavicle.
   g. The scapula.
   h, h. The sternal ribs.
3. The upper or internal surface of the sternum.
   h. The articular cavities for the sternal ribs.
4. Posterior or internal surface of the anchylosed scapula and coracoid.
Aphege australis
Apteryx australis.
XXI. Observations upon Pelagic Serpents. By Dr. Theodore Cantor, Bengal Medical Service, C.M.Z.S., M.A.S., &c.

Communicated July 10, 1838.

The Pelagic Serpents have, by several naturalists, been divided into numerous genera, all of which are entirely founded upon external characters. In habits and general appearance, however, nature has characterized this group so markedly, that it may easily be distinguished from all others; and the arrangement proposed by M. Schlegel1 is such, as to make this family, no less than the beautiful sub-family of Mr. Bell’s2 Leptophina, the two best-defined natural groups of the whole order.

The reason why their habits, like those of all the Pelagic animals, are but imperfectly ascertained, is obvious; their geographical distribution is entirely limited to the tropical seas, and the danger attending the study of these highly-venomous serpents is a consideration of no small weight. While I discharged the medical duties on the Hon. Company’s Marine Survey of the sea-face of the Gangetic Delta, our fishing-nets, kept overboard during many months, procured a considerable number of these serpents. Although the flood-tide carries them as high up the rivers as the brackish water, yet they are purely pelagic, and are no more found in fresh water than on dry ground; they form, par excellence, the natatorial type of the order.

A comparison with the terrestrial serpents will easily point out how nature has accomplished her end by the most simple and beautiful modification of the general plan upon which the order is constructed.

The skull is very small, and its bones but little developed; and although the head is formed, like that of the other serpents, with venomous fangs and maxillary teeth, it presents some slight deviations. The rostrum, instead of being arched, to allow a free passage for the tongue, as in the terrestrial serpents, is elongated into a downward-bent, pointed shield, which, closing the mouth, prevents the water from entering. The tongue, covered by a scabbed opening closely to the chin, is much less developed in these than in the terrestrial serpents. As long as the pelagic serpents are below the surface of the water, they never make use of this organ; but when out of water, and the animal is blinded by the light, it appears of material use as a feeler3.

1 Essai sur la Physionomie des Serpens, Partie Déscriptive, p. 488.
3 This is the use generally attributed to the tongue. In a number of Indian terrestrial serpents I have observed another, perhaps more important function, viz. that of bringing into the mouth various small bodies, such as stones, sand, twigs, &c., which they swallow, in order to stimulate digestion.
The nostrils are small, horizontally situated, as in the genera Homalopsis and Cerberus, and furnished with a membranous valve, which is opened to admit the air, and closed to prevent the entrance of the water.

The venomous gland is a narrow pyriform sac, divided into numerous little cells, which pour the venom into a common straight duct, communicating with the superior opening in a remarkably small venomous fang, the structure of which is described by T. Smith, Esq.⁴

The fresh poison is a pellucid, tasteless fluid, like that of the Cophias viridis, Merrem; Vipera elegans, Daudin; Naja tripudians, Merrem; Hamadryas ophiophagus, Cantor; Bungarus annularis and caruleus, Daudin. It possesses the property of turning litmus paper red.⁵

The general shape of the body is much compressed, particularly towards the abdomen, so that the vertical diameter is much larger than the transverse; the short, strong tail is flattened, like the blade of a two-edged sword, thus at once serving as a propelling organ, and also as a rudder to direct the movements.

The highly-compressed form, which proves the animal to be aquatic, is calculated for the element in which it lives, and also for the form of the prey, consisting of fishes, the dimensions of which will be found exactly to correspond to those of the serpents. Of all serpents, these are provided with the longest, most slender, and least arched ribs, which articulate by an oblique oval socket, with a corresponding ball on the lower surface of the corpus vertebrarum, while the abdominal extremity of the one rib lies in contact with the same part of the opposite rib. The ribs are more freely moveable in a lateral than in a backward direction, the progress in the water being produced by a quick succession of lateral curvatures of the tail and body. The functions of the ribs, as organs of motion, are therefore less complicated than in those serpents, which have to move over, and support their bodies, on a solid surface: in the latter, as observed by Sir Joseph Banks⁴, the abdominal scuta form a number of moveable broad surfaces, brought into action and moved as hoofs, by the corresponding pair of ribs. This kind of progressive motion is not required by animals who never leave the water, the progress in which is accelerated by the sharp keeled form of the abdomen.

While in all other serpents the anterior set of ribs only is subservient to respiration, in the pelagic, whose lung extends to the anus, the entire number assists in the performance of this function. In a specimen of Hydrophis schistosa, Schlegel, measuring 3' 10" in length, I counted 168 pair of ribs, and 224 vertebrae.

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¹ One of the Indian vipers, the Vipera elegans, Daudin, is provided with a similar valve, to guard against dust and other foreign bodies entering the spacious nostrils.

² Vide the excellent memoir in Philosophical Transactions, 1818, p. 471.

³ The same fact with the venom of the Crotalus has been noticed by Dr. Harlan, Med. and Phys. Researches, p. 501, et seg.

⁴ Philosophical Transactions, 1812, p. 163.
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The spinous processes of the dorsal column are small, whereas those of the caudal vertebra are very large and compressed, gradually diminishing in size towards the point of the tail.

The greater number of terrestrial serpents are covered with scales, the points of which are free, acting like stoppers, which, by catching the nearest objects, prevent retrograde motion; the water offers no such obstacles, and we find the pelagic serpents in general covered with small broad scales, with their whole circumference attached to the skin, and either slightly keeled, or having an elevation in the centre, like the umbo of a shield.

Of the internal organs, the respiratory offer the most striking differences from those of the terrestrial serpents. The trachea consists of a long gradually-widening cylinder, with numerous short cartilaginous rings, which extend as far backwards as the liver, without dividing into bronchi. At some distance before the heart the trachea becomes cellular, and from this place commences the single lung, which is a long narrow cylinder, in several places widened into spacious sacs, which again assume the contracted form at the posterior extremity of the liver, continuing thus through the entire length of the abdominal cavity, and is fixed by a short round ligament near the anus. The cancellated structure of the paries is continued throughout, although the cancelli decrease in size in the posterior part of the lung. The great development of the latter organ bespeaks its high importance, and it has two distinct functions to perform, the one of which is to serve as the organ of respiration, or as a reservoir for atmospheric air, which, when the mouth and the nostrils are closed, allows the oxidation of the blood to be carried on a considerable time under the surface of the water, by the vibration of the cilia which line the whole interior of this cavity, and thus enables the serpent to go to great depths in search of food. Secondly, the lung filled with air floats the body, particularly when the food is swallowed, and the specific gravity increased by the weight of a foreign body; the part situated behind the stomach becomes, by the pressure of the filled stomach, an isolated sac,—in fact an organ analogous to the air-vessel in fishes.

The oesophagus is funnel-shaped, widening into a large bulb, communicating by a short cylinder with the pyliform stomach. The intestines, after forming a number of circumvolutions, terminate by a short straight portion, entering the spacious rectum. The liver is short, divided by a longitudinal furrow into two lobes, the interior of which is again divided by a short transverse furrow. In the pelagic serpents the situation of this organ is remarkable, as being in immediate contact with the heart. In the Hydrophis striata and gracilis, Schlegel, the hepatic, cystic, and pancreatic ducts enter jointly the duodenum, but in the H. schistosa, Schlegel, the hepatic duct divides into a number of little branches, which terminate in the cystic duct to form the ductus com-

1 Next to the pelagic serpents, the lungs are most developed in the aquatic genera, Aechrocordus, Chersydrus, Homalopsis, and Cerberus, all of which, notwithstanding their being innocuous, are, in habits and anatomical structure, closely allied to the pelagic serpents.
munis coledochus, which enters the duodenum a little behind the pancreatic duct; the latter has an entrance separated from that of the former.

The glands, generally speaking, are remarkably little developed in the Hydrophis schistosa, striata, nigrocincta, and gracilis, Schlegel. The lachrymal is entirely hidden in the orbits; the nasal is very minute, crescent-shaped, surrounding the posterior margin of the nostrils; the upper salivary appears like a short thread, bordering the venomous gland; the inferior is larger, of a flat pyriform shape. The gland situated before the heart, and by some physiologists considered analogous to the thymus, by others to the thyroid gland of Mammalia, is reduced to a minute oval body.

Habits.

Out of the seven species into which M. Schlegel has divided the Genus Hydrophis, the geographical distribution of which this author considers to be limited to the tropical seas between the 90th and the 230th degrees east longitude of Ferro, six inhabit the Bay of Bengal, viz. Hydrophis, striata, nigrocincta, gracilis, Pelamis, and pelamoides.

Out of this number I have observed the H. schistosa and striata to be the most common, and the H. gracilis comparatively rare in the northern part of the bay and the estuaries of the Ganges.

Although fewer in species than the terrestrial serpents, the pelagic are much more numerous in individuals, and, unlike the former, are always met with in numbers together, which circumstance even serves as a sea-mark to mariners. On my approach to Bombay, I remember the sailors looking out for this phenomenon, until shoals of these animals (H. pelamoides, Schlegel, Shiddil, Russell, II. No. xiii.) made their appearance, as signs of approaching land. Another remarkable dissimilarity between the terrestrial and pelagic serpents is, that all the latter are venomous, whereas by far the greater number of the former are innocuous.

M. Schlegel has expressed the opinion, that the pelagic serpents are of more peace-

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1 I have observed a similar distribution in an Indian species of Homalopsis, closely allied to the H. aer, Schlegel.

2 The discovery of this gland has shared the fate of many other organs, the functions of which, for want of inductive reasoning on the part of the discoverers, have been guessed, but never proved. The acme of this kind of discoveries is however afforded by an anatomist, who, on finding a vascular organ in the nasal cavity of some Mammalia, gravely asserted this to be the seat of the sixth sense. The like assertions, unsupported by anything like proof, prove at the most, a remarkable want of inductive powers in the observer, while they also tend to show that a knife in expert hands may easily make new discoveries, the merit of which is solely due to the philosopher who tests and proves the truth—which is beyond the keenest knife.

3 "Cependant, il existe des serpents tant venimeux qu' inoffensifs, qui ne font presque jamais usage de leurs armes pour se defendre contre leur agresseur : tels sont parmi les premiers, les Hydrophis," &c.—Essai sur la Physiognomie des Serpens, Partie Generale, p. 94.

"Il paraît que les Hydrophis ont des mœurs plus douces, que la plupart des serpens venimeux," &c.—Partie Descriptive, p. 493.
able disposition than the greater number of terrestrial venomous serpents, and on the authority of several naturalists, has arrived at the erroneous conclusion, that these animals are of a nature but little ferocious. An assertion like this, in a work devoted to the natural history of serpents, may easily mislead travellers, who, by carelessly handling animals provided with weapons of the most dangerous description, are, if wounded, certain to pay with the loss of life for their temerity. I must therefore, from my own experience, assert that those species, which I have observed in the Bay of Bengal and the Gangetic estuaries, are of very ferocious habits, as well in as out of water. In the latter case they attempt to bite the nearest objects, nay, even like the vipers *Najas* and *Bungari*, turn round and wound their own bodies, from which I often found some difficulty in disengaging the fangs and teeth. When removed from the sea they become blinded, by the light contracting the pupil, which, in addition to the difficulty which they experience whilst attempting to support their sharply-keeled bodies on dry land, render then their movements just as uncertain and maladroit as they are nimble and swift in their own element. To corroborate the truth of my statement, I shall refer to the record in the Asiatic Researches, of a number of accidents at Madras, caused by the venom of pelagic serpents, and also to a later melancholy occurrence which took place in the latter part of 1837, on board of Her Majesty's Brig Algerine, while in Madras Roads, where the unfortunate victim expired within four hours of the infliction of the wound.

The breeding season of the *Hydrophis schistosa* and *striata* occurs in the months of February and March, during which period I observed numerous pairs, with their posterior extremities twisted round each other, floating near the surface of the sea, each now and then making a slow undulating movement with the free anterior part of the body.

The female is ovo-viviparous; in *H. gracilis* Dr. Russell discovered by dissection nine young ones; in a gravid *H. schistosa* I observed seven eggs, each containing a developed foetus, while eleven such were found by a gentleman in another, thrown on shore on the Tenasserim coast.

The time of gestation I have not been able to ascertain; if that of the *Homalopsis* might serve as a guide, I should fix upon a period of about seven months.

Dr. Russell has observed, that none of these serpents are able to live out of their element, either when confined in sea-water or in fresh. Such as I have kept in jars filled with salt water all died in the course of two or three days. They were in the habit of occupying the bottom, occasionally raising their head over the surface, to breathe, and would repeatedly throw out the tongue against the wall of the jar.

From dissections, it would appear that the young serpents exclusively feed upon

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1 This serpent, a six-feet long specimen of *Hydrophis nigrocineta*, Schlegel, has been deposited in the United Service Museum.
small pelagic crustacea, while the adult ones prey upon fishes of the following kind, all of which were found with their heads towards the bottom of the stomach:

**Percide.**
- *Polynemus quadrifilis*, Cuvier.
- *Sillago acuta*, Cuvier.

**Scleride.**
- *Sciena pana*, Cuvier.
- *Coreina nigrocaudata*, Cantor's MSS.

**Mugilide.**
- *Mugil corsula*, Hamilton.

**Siluride.**
- *Bagrus aur*, Cuvier.
- *Pimelodus giglio*, Hamilton.
- *— pangasius*, Hamilton.
- *— ? Vana motta*, Russell, No. CLXXI. 'Bummaloh.'

**Clupeide.**
- *Clupea affinis*, (Hardwicke's 'Indian Zoology'.)

The *Siluridae*, which appear to be the favourite food, are all ground fish. Through the clear water of the tanks and streamlets cut across the rice-fields, I have often observed the *Tropidonotus dora*, Russell, II. No. V., one of the most common of the innocuous serpents in Bengal, lying in ambush at the bottom, with the head against the stream, behind some object sufficiently large to hide the animal, until chance brings a passing fish near enough, when the enemy darts upon the prey, before it is able to resort to flight; from which I should conclude a similar mode is pursued by the pelagic serpents, when in search of food at the bottom of the sea or estuaries.

From M. Péron's observations, the sharks appear to be the natural enemies of the pelagic serpents: in two fishing eagles (*Haliatus*) which were shot in the Gangetic Delta I found remains of these serpents in the stomach.

The process of changing the integuments appears to occur very frequently, and during all seasons, when the skin comes off in pieces, as in the larger kind of terrestrial serpents; whereas the *Homalopsis* and *Cerberus*, although aquatic, shed the integuments entire.

The terrestrial serpents are known to be infested with parasitic insects (*Ixodes*'). I have observed animals attaching themselves in great numbers to the pelagic. Unlike, however, the former parasites, which derive their nourishment from the animals upon which they are found, the latter derive no more nourishment from the pelagic serpents than they would from the rocks or any other objects the sea might offer as places of

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fixture. Unlike the *Ictodes*, their nature is such, that when once fixed, they have no power to loose their hold and move from one place to another.

Of the two species of *Anatifua* figured, I constantly found numbers of the one (Pl. LVI. Fig. 8.) firmly adhering to the integuments of the *Hydrophis schistosa*, Schlegel, and the other (Fig. 9.) to those of the *H. nigricincta*, Schlegel. The serpents are freed from these parasites as often as the integuments are changed. To Dr. Grant, who has kindly inspected some specimens in spirits of wine, I am indebted for the following observations.—In the young state of the *Cirrhipeds*, they float freely in the ocean, like the young *Monoculi* of Linné, which they much resemble, and thus they come in contact with the pelagic serpents. The *Anatifua* found in this situation are, judging from their small size, very young animals, and the constantly-changing of the serpents' integuments is most probably the cause of their never being found of a larger size. The circumstance of the two distinct species accompanying two distinct species of serpents, cannot depend upon a voluntary action of the parasite, which, as above stated, derives no nourishment from the serpent; but must be attributed to difference of habitat, and thus very likely may indicate a difference in the habits of the two species of serpents. The latter remark also holds good as regards the Zoophyte (Pl. LVI. Fig. 10.), great numbers of which were attached to the *Hydrophis gracilis*, Schlegel. It is a *Cellepora*, which Dr. Grant observes bears some resemblance to the *Cellepora pertusa*, Esper. The animals are very small, and are found together in great numbers, each animal contained in a calcareous transparent campanulate cell, dotted with dark brown. The *polypi* of this *Zoophyte* appear to be highly irritable, as a slight touch either on the microscope or the table upon which it was placed, made them instantaneously withdraw the *tentacula*.

*Experiments.*

The virulence of the venom of the pelagic serpents upon the human body is equal to that of the most pernicious terrestrial serpents; and the experiments of Dr. Russell and those which I have had opportunity of instituting myself, tend to prove the deleterious effects to be equal upon such animals as have been submitted to trial. I therefore cannot subscribe to the opinion of M. Schlegel, that wounds inflicted by the pelagic serpents are less dangerous than those of some of the terrestrial venomous species, on account of the venomous weapons being more developed in the latter. The following

1 Esper, *Pflanzenthiere,* Cellepora, Tab. X.
2 . . . . 'J'ai lieu de croire que la morsure des serpents vénimeux proprement dits est plus dangereuse que celle des vénimeux colubriformes et des serpents de mer, à cause de la puissance des armes dont les premiers sont munis.' Schlegel, Essai sur la Physionomie des Serpents, Partie Générale, p. 36.
3 Mr. Hodgson, the Hon. Company's Resident at the Court of Nipal, whose labours in the Himalayan Zoology are well known to all naturalists, speaking of the *Cophias viridis*, Merrem, (*Trigonocéphalus viridis*, Schlegel,) writes me, in a letter dated July 18, 1837, . . . . 'We have only that one noxious species, and I have
experiments were made on board the Hon. Company’s surveying brig ‘Meriton,’ during the latter part of 1836 and the commencement of 1837.

A Hydrophis schistosa, measuring 4' 2" in length, was made to bite a fowl on the inside of the left thigh. The bird immediately couched, and made several unsuccessful attempts to rise. Four minutes after being bitten, it was seized with purging, and slight spasms of the whole body; the eyes were closed, the pupil immoveable, dilated, and a quantity of saliva was discharged. The fowl expired in violent spasms eight minutes from the time it was wounded.

Another fowl, bitten in the right thigh, immediately after the former, by the same serpent, expired under similar symptoms in less than ten minutes after it had received the wound.

By dissection half an hour after death, I found in both of the birds a slight extravasation of blood where the fangs had penetrated, and a little bloody lymph under the skin covering the wounds; but besides this I was not able to observe anything anormal.

A fowl wounded in the same place as the former by a Hydrophis nigrocincta, 2' 3" in length, expired within seven minutes in violent spasms.

Of two other fowls successively bitten in the same place as the former by a Hydrophis striata, 3' 1" long, the one was killed in eight, the other in eleven minutes, under similar symptoms.

A Hydrophis schistosa, 2' 9" in length, bit a good-sized Trionyx Gangeticus in the lip. Five minutes after, the Tortoise commenced rubbing the bitten part with his fore paws, and continued this manœuvre for some time; about sixteen minutes from the time he was bitten he became paralysed, and unable to make use of the legs, and remained motionless, with the eyes closed. When forcibly opened, the pupils appeared immovable and dilated. With a few spasmodic movements the Tortoise expired, twenty-eight minutes after the wound was inflicted. With the exception of the bitten part being somewhat swollen, nothing anormal appeared by the dissection.

Another Trionyx, wounded in the same place as the former by a Hydrophis striata, nearly three feet in length, manifested similar symptoms, and was killed in forty-six minutes.

A Coluber catenularis, Daudin, measuring nearly 3 feet and a half in length, was wounded in the abdomen, a little before the heart, by a Hydrophis nigrocincta of about never heard of a fatal case from its bite, although I have seen a man suffer fearfully from swelling and pain. The fangs and the venomous gland of this very species are as fully developed as they are in the Crotali, the Vipers, or indeed in any of the venomous serpents, and yet the effects are less far dreadful than those produced by the Naja or the Hydrophis, notwithstanding the less-developed venomous organs of the latter."

1 The Trionyx Gangeticus is not unfrequently found in the Bay of Bengal, entirely beyond the influence of the fresh-water stream of the Ganges. I mention this fact, as I believe the Genus Trionyx is generally supposed to be confined to rivers (fresh water).

2 Tur Tutta, Russell, I. No. XV.; Col. trigonata, Schneider; Dipsas trigonata, Schlegel.
the same size, whose fangs remained for more than half a minute in the wounds. Three minutes after being disengaged from the enemy the *Coluber* commenced showing symptoms of the venom by rolling from one side to another, which having lasted for about four minutes, he remained motionless for a few minutes, when he tried to move with the anterior part of the body. By this time the tail, and subsequently the posterior part of the body, became paralysed, which parts would retain any position I might give them with the end of a stick. Sixteen minutes from the time when the wounds were inflicted, the serpent commenced yawning and distorting the mouth during short intervals, which ended in a protracted separation of the jaws, and within half an hour after having been bitten, the serpent expired.

A large-sized *Tetraodon potoca*, Hamilton, was bitten in the under lip by a *Hydrophis schistosa*, measuring about four feet in length, and immediately after set at liberty in a tub with sea-water. The fish continued swimming lively, and, as usual, on the back, the *abdomen* being inflated for about three minutes, when the *abdomen* gradually commenced to collapse, notwithstanding the efforts of the fish to prevent it. He kept thus floating on his back until, after a few violent movements of the tail, he expired, ten minutes after being wounded. It ought to be observed, I have kept living specimens of the *Tetraodon* for a considerable time confined in sea-water; and besides, I found them able to live a considerable time out of their element; I feel convinced therefore that the present fish, caught at the same time as the serpent, was killed by the virulence of the venom, although the dissection showed nothing anormal, and I should not have been able to discover where the fish had been bitten had I not previously known the place.

**EXPLANATION OF THE PLATES.**

**PLATE LVI.**

*Hydrophis gracilis*, Schlegel (young, nat. size), of which Russell has given an indifferent figure. Ind. Serp. i. No. XLIV. 'Tutta Pam.'

Fig. 1. & 2. Integuments of the head. (Magnified.)

3. Scales of the neck. (Magnified.)
4. ——— trunk. (Magnified.)
5. Section of the neck.
6. ——— trunk. (Nat. size.)
7. ——— tail.
8. Young Anatifa found on *Hydrophis schistosa*.
8 a. The same, natural size.
9. Young Anatifa found on *Hydrophis nigrocincta*.
9 a. The same, natural size.
10. *Cellepora* found on *Hydrophis gracilis*.

10 a. The same, natural size.

**PLATE LVII.**

Fig. 1. Dissection of a young *Hydrophis schistosa*, Schlegel (reduced one half). The *viscera*, which in the sketch are brought out of *situs* so as to be seen, lie in the following order. By opening the abdominal cavity, the *oesophagus*, the stomach, and the intestinal canal, cover entirely the other organs, of which the *trachea* and the lung lie uppermost, in immediate contact with the vertebral column.

a. *Oesophagus*.
b. The stomach. The total length of the *oesophagus* and the stomach is about 2' 4"; that of the intestinal canal 4' 6".
c. *Duodenum*.
d. *Rectum*.
e. The heart.
f. The liver.
g. *Pancreas*.
h. The gall-bladder.
i. The spleen.
k. The kidney.
l. The *trachea*.
m. The lung. Total length of the *trachea* and the lung, 3' 2" 6".

2. (Nat. size.)
a. The hepatic duct.
b. The gall-bladder.
c. *Pancreas*.
d. *Duodenum*.

3. (Nat. size.) Internal surface of that part of the lung which receives the *trachea*.

4. *Hydrophis schistosa*. Lateral view of the venomous organs and surrounding parts. (Magnified.)
a. *Temporalis anterior*.
b. *Temporalis medius*.
c. —— posterior.
d. *Digastricus*.
e. *Tendo articulo-maxillaris*, spreading its fibres over the sac covering the venomous gland.
f. Pterygoideus externus.
g, g. Salivary glands.

Fig. 5. The venomous gland detached. (Magnified.)
6. The same, longitudinally cut through.
7. Skull of Hydrophis schistosa (young). Magnified.
8. Lateral view of the same.

(The straight lines denote the natural size of the skulls.)
XXII. Outlines of a Classification of the Marsupialia. By Richard Owen, Esq., F.R.S., &c., Hunterian Professor of Anatomy at the Royal College of Surgeons.

Communicated January 8th, 1839.

The present essay is offered as an introduction to a series of observations tending to establish the species of Marsupial animals on anatomical, and principally on osteological characters.

Whoever has been led to compare an unknown or doubtful Marsupial with the brief notices of a few external peculiarities, on which many nominal species have been founded, must have felt the want of more detailed and surer grounds of comparison.

M. Temminck, in his Monograph of the genus Phalangista, has left nothing to desire in this respect; and the figures of the crania and other parts of the skeleton with which his zoological descriptions are illustrated, have been of essential service in establishing, and enabling subsequent naturalists to recognize, the species of that subdivision of the genus which is distributed chiefly through the Indian Archipelago.

The philosophic use which the celebrated naturalist of Leyden has made of the rich collections at his disposal is well worthy of imitation; and I propose to apply the materials which I already possess, and those that may hereafter be afforded me by the enlightened travellers and collectors in Australia, to illustrate in a similar manner the Marsupial genera which are peculiar to that continent.

Before, however, pointing out the particulars by which the skeleton of one species differs from another, some general remarks on those osteological peculiarities which characterize the Marsupialia as a distinct group of Mammals, seems to be called for; and to these general observations I here premise an outline of a classification of the Marsupial animals which has had its origin in an endeavour to express in general propositions the more important facts relative to their organization.

As the Australian continent, the great metropolis of the Marsupial quadrupeds, still remains but very partially explored; and since new species and even genera of Marsupials continue at each expedition to reward the researches of the scientific traveller; and as moreover the recovery of two lost but distinct genera from the ruins of a former world makes it reasonable to suppose that other types of Marsupials remain still hidden in the crust of the earth, it can hardly be expected that the zoologist should be able to arrange in a natural series, with easy transitions according to the order of their affinities, the few and diversified forms of this implacental subclass which are now known.
In the present classification the modifications of the digestive system have been taken as the guide to the formation of the primary groups of the Marsupialia.

The continent, however, in which the Marsupials exist in greatest number and variety is characterized by the paucity of organized matter upon its surface, and few of the species, consequently, are nourished by a very well-defined diet. Any large carnivorous quadruped could with difficulty have found subsistence in the wilds of Australia prior to the introduction of civilized man and his attendant herds: and we find, in fact, that the native genera which are the most decidedly carnivorous, do not include species larger than the dog: we can only reckon among these strictly carnivorous species the Thylacines and the Dasyures; and, on the other hand, not more than two or three Marsupial genera feed exclusively on vegetable substances. The remainder derive a promiscuous nutriment from dead or decaying animal and vegetable matter, crustacea, and the refuse of the sea-shore, insects in their perfect and larva states, live birds, young and succulent sprouts, leaves, fruits, &c. The terms, therefore, which will be given to the different primary subdivisions in the present classification of the Marsupialia must not be understood to indicate strictly or exclusively the nature of the food of the species severally included in these groups, but rather their general tendency to select for their support the substances implied by those designations.

Tribe I. SARCOPHAGA.

The genera in this tribe are the most decidedly carnivorous of all the Marsupialia, and are characterized by an important anatomical condition, viz. the absence of an intestinum cæcum.

Genus I. Thylacinus.

Incisors $\frac{1}{3}--\frac{4}{3}$; canines $\frac{1}{1}--\frac{1}{1}$; præmolars $\frac{3--3}{3}$; molars $\frac{4--4}{4}$: = 46.

The incisors are of equal length, and regularly arranged in the segment of a circle with an interspace in the middle of the series of both jaws. The external incisor on each side is the strongest.

The laniary or canine teeth are long, strong, curved, and pointed, like those of the dog tribe.

The spurious molars are of a simple, compressed, conical form, each with two roots; the last with a small additional posterior cusp. The true molars in the upper jaw are unequally triangular with three tubercles. Those in the lower jaw are compressed, tricuspidate, the middle cusp being the longest, especially in the two last molars, which resemble closely the sectorial teeth (dens carnassiiërs) of the Dog and Cat.

I apply this term, for the sake of brevity, to the teeth usually called 'spurious' or 'false molars,'—the bicuspides of human anatomy; they are always situated anterior to the true molars.
The fore-feet are 5-digitate, the hind feet 4-digitate. On the fore foot the middle digit is the longest, the internal one or pollex the shortest, but the difference is slight. On the hind foot the two middle toes are of nearly equal length, and longer than the two lateral toes, which are equal. All the toes are armed with strong, blunt, and almost straight claws. The only known species of this genus, the Thylacine (Thylacinus Harrisii, Temm., Didelphys Cynocephalus, Harris), is a native of Van Diemen’s Land, and is called by the colonists the ‘Hyæna.’

Genus Dasyurus.

Incisors $\frac{4}{3}-\frac{4}{3}$; canines $\frac{3}{1}-\frac{3}{1}$; præmolars $\frac{2}{2}-\frac{2}{2}$; molars $\frac{4}{4}-\frac{4}{4} = 42$.

The eight incisors of the upper jaw are of the same length and simple structure, and are arranged in a regular semicircle without any middle interval: the six incisors of the lower jaw are similarly arranged but have thicker crowns than the upper ones. The canines present the same or even a greater relative development than in the Thylacinæ: in an extinct species of Dasyurus they present the same form and relative proportions, as in the Leopard. The spurious molars have two fangs and a pointed compressed triangular crown with a rudimental tubercle at the anterior and posterior part of its base. The grinding surface of the true molars in the upper jaw is triangular; the first presents four sharp cusps, the second and third each five, the fourth, which is the smallest, only three. In the lower jaw the last molar is nearly of equal size with the penultimate one, and is bristled with four cusps, the external one being the longest; the second and third molars have five cusps, three on the inner and two on the outer side; the first molar has four cusps: these are all sharply pointed in the young animal, in which the tubercle of the posterior molar of the lower jaw is divided into two small cusps.

The carnivorous character of the above dentition is most strongly marked in the Dasyurus laniarius, Ursine Dasyure, or Devil of the Tasmanian colonists, the largest existing species of the genus, and a most destructive animal in the poultry yard or larder.

Genus Phascogale.

Incisors $\frac{4}{3}-\frac{4}{3}$; canines $\frac{3}{1}-\frac{3}{1}$; præmolars $\frac{3}{2}-\frac{3}{2}$; molars $\frac{4}{4}-\frac{4}{4} = 46$.

In the present dental formula may be discerned a step in the transition from the Dasyures to the Opossums, not only in the increased number of spurious molars, but also in the shape and proportions of the incisors. In the upper jaw the two middle incisors are longer than the rest, and separated from them by a brief interval; they are more curved, and project more forward. The three lateral incisors diminish in size to the outermost. The middle incisors of the lower jaw also exceed the lateral ones in size, and project.

1 Dasyurus laniarius, mibl: the fossil remains of this species were discovered with the remains of two gigantic species of Kangaroo in the bone-caves of Wellington Valley, Australia, by Major, now Sir Thomas, Mitchell.
beyond them but not in the same degree, nor are they separated from them by an interval as in the upper jaw. The canines are relatively smaller than in the Dasyures. The spurious molares present a similar form, but the third is much smaller and simpler than the two preceding ones. The true molars resemble in their structure those of the Dasyures. The general character of the dentition of these small Marsupials approximates to the insectivorous type as exhibited in the Shrew, Hedgehog, &c., among the placental Mammalia; and corresponds with the food and habits of the species which thus lead from the Zoophagous to the Entomophagous tribes.

Other links which once bound these tribes more closely together are now lost, and are indicated only by the few fossil remains which have rendered the Stonesfield oolite so celebrated. One of these extinct genera, which I have called Phascolotherium, presents the same numerical dental formula, apparently, as in the Thylacinus and Phascologale; but, if another incisor existed in each ramus of the lower jaw, as seems to be indicated by the fossil, then the dentition would agree with that of the genus Didelphys.

Incisors $\frac{?}{3-3}$; canines $\frac{?}{1-1}$; præmolars $\frac{?}{3-3}$; molars $\frac{?}{4-4}$.

or

$\frac{?}{4-4}$

The incisors and canines are separated by vacant interspaces, and occupy a large proportion of the dental series: the true molars resemble those of Thylacinus.

**Tribe II.ENTOMOPHAGA.**

This is the most extensive and varied of the primary groups of the Marsupial order. In the system of Cuvier, the species of this tribe are united with those of the preceding to form a single group characterized by the presence of long canines and small incisors in both jaws; but in most of the Entomophagous genera of the present classification, the canines present a marked inferiority of development, and the species are consequently unable to cope with animals of their own size and grade of organization, but prey, for the most part, upon the smaller and weaker classes of invertebrate animals. Their intestinal canal is complicated by a moderately long and large cæcum; and, while in the Sarcophaga, the feet are constructed, as in the ordinary placental Digitigrades, they present in the present tribe a variety of well-marked modifications, according to which the species may be arranged into ambulatory, saltatory, and scansorial groups.

**a. Ambulatoria.**

The only known existing representative of this family is the animal described by Mr. Waterhouse, which constitutes the type of his genus *Myrmecobius*, of which the following is the remarkable dental formula:

Incisors $\frac{4-4}{3-3}$; canines $\frac{1-1}{1-1}$; præmolars $\frac{3-3}{3-3}$; molars $\frac{5-5}{6-6}$: = 52.
From this formula it will be seen, that the number of molars, sixteen in the upper and eighteen in the lower jaw, exceeds that of any other known existing Marsupial, and makes an approach to the dentition which characterizes some of the insectivorous Armadillos. The resemblance to Dasypus is further carried out in the small size of the molar teeth, their separation from each other by slight interspaces, and their implantation in sockets which are not formed by a well-developed alveolar ridge. The molars, however, present a distinct tuberculate structure; and both the true and false ones possess two separate fangs as in their Marsupial congener: the crowns of these teeth are, however, less produced than in any other Marsupials; for only the triturating tubercles appear above the gum.

The false molars present the usual compressed triangular form, with the apex slightly recurved, and the base more or less obscurely notched before and behind. The canines are very little longer than the false molars; the incisors are minute, slightly compressed and pointed; they are separated from each other and the canines by wide intervals.

The Myrmecobians are insectivorous, and shelter themselves in the hollows of trees, frequenting most, it is said, those situations where the Port Jackson Willow abounds. In the structure and proportions of its hinder feet the Myrmecobius resembles the Dasyurine family; and in the slightly developed canines, the smooth external surface of the skull, the breadth between the zygomata, and the absence of the interparietal ridges, as well as in the general external form and bushy tail, it offers an especial approximation to the genus Phascogale.

Intermediate however between Myrmecobius and Phascogale would seem to be the station held by the interesting extinct genera above alluded to. In Phascolotherium the affinity is manifested in the simple form, small size, and straggling disposition of the incisors and canines: in the other genus, Thylacotherium, it is displayed in the size and number of its molares.

This, one of the most ancient mammiferous genera hitherto discovered, presents ten molars on each side of the lower jaw, which resemble in structure and close arrangement those of Phascogale and Didelphis, while they are intermediate in their proportional size to the teeth of these genera and Myrmecobius. The exact condition of the incisors and canines of the Thylacotherium has not yet been displayed in the fossil jaws which have been discovered.

β. Saltatoria.

Genus Perameles (Bandicoots).

Incisors 5−5; canines 1−1; præmolars 3−3; molars 4−4: = 48.

This dental formula characterizes a number of Marsupials commonly known in Australia by the name of Bandicoots; the hind legs are longer and stronger than the fore, and exhibit in a well-marked manner the feeble and slender condition of the se-
cond and third digits counting from the inside, and the sudden increase in length and strength of the third and fourth digits, which are chiefly subservient to locomotion. In consequence of the inequality of length in their extremities, the mode of progression in the Bandicoots is by bounds; the hind and fore-feet being moved alternately as in the Hare and Rabbit; and the crupper is raised higher than the fore quarter. The teeth which offer the greatest range of variation in the present genus are the external or posterior incisors and the canines: the molars, also, which originally are quinque-cuspidate, have their points worn away, and present a smooth and oblique grinding surface in some species sooner than in others.

The Bandicoots which approach nearest to the Myrmecobius in the condition of the incisive and canine teeth are the Perameles obesula and P. Gunnii. There is a slight interval between the first and second incisor, and the outer or fifth incisor of the upper jaw is separated from the rest by an interspace equal to twice its own breadth, and moreover presents the triangular, pointed, canine-like crown which characterizes all the incisors of Myrmecobius; but the four anterior incisors are closely arranged together and have compressed, quadrate, true incisive crowns. From these incisors the canine is very remote, the interspace being equally divided by the fifth pointed incisor, which the canine very slightly exceeds in size. In Peram. nasuta the incisor presents the same general condition, but the canines are relatively larger.

The marsupial pouch in the Bandicoots, at least in the full-grown females of Per. nasuta, Per. obesula, and Per. Lagotis, has its orifice directed downwards or towards the cloaca, contrariwise to its ordinary disposition in the Marsupials: this direction evidently relates to the position of the trunk when supported on the short fore and long hind legs. In the stomach and intestines of a Perameles nasuta Dr. Grant found only the remains of insects; and in the examination of the alimentary canal of a Per. obesula I obtained the same results. Nevertheless the Perameles Lagotis now living in the Society’s Menagerie refuses meat and meal-worms, and subsists on vegetable food exclusively.

Genus Charopus.

The singular animal on which Mr. Ogilby has founded this genus is briefly noticed and figured in Major Mitchell’s Australia, (vol. ii. pl. 38. p. 131.) and the individual described is preserved in the Colonial Museum, at Sydney, N. S. Wales, (No. 35. of Mr. George Bennett’s Catalogue). It would appear that the two outer toes of the fore foot, which are always very small in the true Bandicoots, are entirely deficient in the Charopus, unless some rudiments should exist beneath the skin; at all events only two toes are apparent externally, but they are so developed and armed as to be serviceable for burrowing or progression. The inner toe is wanting on the hind foot. Dental formula:

Incisors $\frac{3}{2}$; canines $\frac{1}{1}$; præmolars $\frac{3}{2}$; molars $\frac{4}{4}$: $= 46$.

All the teeth are of small size; the canines resemble the spurious molares in size and
shape, and these are separated by intervals, as in Myrmecobius. The marsupium opens downwards in the Chaeropus, as in the true Bandicoots. The species described has no tail. The genus would seem by its dentition to rank between Myrmecobius and Perameles. Its digital characters are anomalous and unique among the Marsupialia.

7. Scansoria.

Genus Didelphys (Opossums).

These Marsupials are now exclusively confined to the American Continents, although the fossil remains of a small species attest the former existence of the genus Didelphys in Europe contemporaneously with the Paleothere, Anoplothere, and other extinct Paechyderms whose fossil remains characterize the Eocene strata of the Paris Basin. The dental formula of the genus Didelphys is,

Incisors $5-5$; canines $1-1$; praemolars $3-3$; molars $4-4$: = 50.

The Opossums resemble in their dentition the Bandicoots more than the Dasyures, except in the structure of the molars.

The two middle incisors of the upper jaw are more produced than the others, from which they are separated by a short interspace. The canines are well developed, the upper being always stronger than the lower. The false molars are simply conical, but more compressed than in the Zoophagous Marsupials. The posterior false molar is the largest in the upper jaw; the middle one is the largest of the three in the lower; the anterior one is the smallest in both jaws: in the upper jaw it is separated from the middle false molar by a short interspace, and the same character occurs in the lower jaw in Didelphys Virginiana; but in the species Canivora, Crassicaudata, Nudicaudata, Opossum, and others, this diastema is very slightly marked, or is wanting. A small accessory posterior cusp, and sometimes, though rarely, a still smaller anterior cusp, are added to the base of the principal compressed cone, which forms the crown of the spurious molars. The sharp cusps of the true molars wear down into tubercles as the animal advances in age.

The true molars in the upper jaw present a triangular horizontal section: in the posterior molar the base of the triangle is directed forwards; in the rest one side of the triangle looks outwards; another forwards, at right angles to the preceding; and the third obliquely inwards and backwards. The triturating surface of the crown in recently formed teeth is bristled with several sharp tubercles, of which the largest rises from the middle of the posterior side, and others at each of the angles of the crown: there are smaller tubercles intermediate to these. The posterior molar is smaller than the rest, and has fewer tubercles. In the lower jaw the true molars are narrower, of more equal size than in the upper: there are five tubercles on each, four in two transverse pairs, the anterior being the highest, and a fifth forming the anterior and internal angle of the tooth: the anterior and external angle seems as if it were vertically cut off.
In the Didelphys Yapock,—the type of the subgenus Cheironectes,—the anterior extremities, besides being web-footed, present an unusual development of the pisiform bone, which supports a fold of the skin, like a sixth digit; it has indeed been described, as such, by M. Temminck; this process has not of course any nail. The dentition of the Yapock resembles that of the ordinary Didelphys. All the Opossums have the inner digit of the hind foot converted by its position and development into a thumb, but without a claw. The hinder hand is associated in almost all the species with a scaly prehensile tail.

In some of the smaller Opossums the subabdominal tegumentary folds are rudimental, or merely serve to conceal the nipples, and are not developed into a pouch; the young in these species adhere to the mother by entwining their little prehensile tails around hers, and cling to the fur of the back; hence the term dorsigera applied to one of these Opossums1.

Tribe III. CARPOPHAGA.

Stomach simple; cæcum very long.

In this family, the teeth, especially those at the anterior part of the mouth, present considerable deviations from the previously described formula; the chief of which is a predominating size of the two anterior incisors, both in the upper and lower jaws. Hitherto we have seen that the dentition in every genus has participated more or less of a carnivorous character; henceforth it will manifest a tendency to the Rodent type.

The Phalangers, so called from the phalanges of the second and third digits of the hinder extremities being inclosed in a common sheath of integument, have the innermost digit modified, to answer the purposes of a thumb; and the hinder hand being associated in many of the species with a prehensile tail, they evidently, of all Frugivora, come nearest to the arboreal species of the preceding section. In a system framed on locomotive characters they would rank in the same section with the Opossums. We have seen, however, that they differ from those Entomophagous Marsupials greatly in the condition of the intestinal tube. Let us examine to what extent the dental characters deviate from those of the Opossums.

In the skull of a Phalangista Cookii, now before me, there are both in the upper and lower jaw four true molars on each side, each beset with four three-sided pyramidal sharp-pointed cusps; thus these essential and most constant teeth correspond in number with those of the Opossum: but in the upper jaw they differ in the absence of the internal cusp, which gives a triangular figure to the grinding surface of the molars in

1 Few facts would be more interesting in the present branch of zoology than the condition of the new-born young, and their degree and mode of uterine development in these Opossums. Since the marsupial bones serve not, as is usually described, to support a pouch, but to aid in the function of the mammary glands and testes, they of course are present in the skeleton of these small pouchless Opossums, as in the more typical Marsupials.
the *Opossum*; and the anterior single cusp is wanting in the true molars of the lower jaw.

Anterior to the grinders in the *Phalanger*, there are two spurious molars, of similar shape and proportions to those in the *Opossum*; then a third spurious molar, too small to be of any functional importance, separated also, like the corresponding anterior false molar in the *Opossum*, by a short interval from those behind.

The canine tooth but slightly exceeds in size the above false molar, and consequently here occurs the first great difference between the *Phalangers* and *Opossums*; it is however only a difference in degree of development; and in the *Ursine* and other *Phalangers*, as well as in the *Petaurists*, the corresponding tooth presents more of the proportions and form of a true canine.

The incisors, which we have seen to be most variable in number in the carnivorous section, are here three instead of five on each side, in the upper jaw; but their size, especially that of the first, compensates for their fewness.

In the lower jaw, there is the same number of true molars and of functional false molars, which form a continuous and tolerably equable series, as in the *Opossums*, on each side; then two very minute and rudimentary teeth on each side represent the small spurious molar, and small canine of the upper jaw; and anterior to these, there is one very small and one very large and procumbent incisor on each side.

The constant teeth in this group are $4 + 4$ true molars, and $3 + 3$ incisors. The canines $\frac{1}{1}$ are constant in regard to their presence, but variable in size; they are always minute in the lower jaw. With respect to the spurious molars, $\frac{1}{1}$, they are always in contact with the true grinders, and their crowns reach to the same grinding level; sometimes a second spurious molar is similarly developed on each side of both jaws, as in the *Phal. Cookii*, and as in all the flying *Phalangers*, or *Petaurists*; but in other *Phalangers* it is absent or replaced by a very minute tooth, shaped like a canine: so that between the posterior spurious grinder and the incisors we may find three teeth, of which the posterior is the largest, as in *Phal. Cookii*; or the smallest, as in *Phal. cavifrons*; or there may be only two teeth, as in *Phal. ursina* and *Phal. vulpina*, and the species, whatever that may be, which Fr. Cuvier has selected as the type of the dentition of this Genus.

In the lower jaw similar varieties occur in these small and unimportant teeth; e. g. there may be between the procumbent incisors and the posterior false molar, either four teeth, as in *Phal. Cookii*; or three, as in *Phal. cavifrons*; or two, as in *Phal. ursina*, *Phal. maculata*, *Phal. chrysorrhoos*; or lastly, one, as in *Phal. vulpina*, and *Phal. fuliginosa*.

The most important modification is presented by the little *Phal. gliriformis* of Bell, which has only three true molars on each side of each jaw.
Genus *Petaurus*.

There are many species of *Marsupials* limited to Australia, and closely resembling or identical with the true *Phalangers* in their dental characters and the structure of the feet. I allude to the *Petaurists* or *Flying Opossums*; these, however, present an external character so easily recognizable, and influencing so materially the locomotive faculties, as to claim for it more consideration than the modifications of the digits or spurious molars, which we have just been considering in the *Phalangista*. A fold of the skin is extended on each side of the body between the fore and hind legs, which, when out-stretched, forms a lateral wing or parachute, but which, when the legs are in the position for ordinary support or progression, is drawn close to the side of the animal by the elasticity of the subcutaneous cellular membrane, and then forms a tegumentary ridge. These delicate and beautiful *Marsupials* have been separated generically from the other *Marsupials* under the name of *Petaurus*¹: they further differ from the *Phalangers* in wanting the prehensile character of the tail, which in some species of *Petaurus* has a general clothing of long and soft hairs, whilst in others the hairs are arranged in two lateral series.

Now in the *Petaurists* there is as little constancy in the exact formula of the dentition as among the *Phalangers*. The largest species of *Petaurus*, *Pet. Taguanoides*, *e.g.*, is almost identical in this respect with the *Phalangista Cookii*, which M. Fr. Cuvier has therefore classed with the *Petauri*. Those teeth of *Pet. Taguanoides*, which are sufficiently developed, and so equal in length, as to exercise the function of grinders,—or in other words, the functional series of molars,—include six teeth on each side of the upper jaw, and five teeth on each side of the lower jaw. The four posterior molars in each row are true, and bear four pyramidal cusps, excepting the last tooth in the upper jaw, which, as in *Phal. Cookii*, has only three cusps. In the upper jaw, the space between the functional false molars and the incisors is occupied by two simple rudimentary teeth, the anterior representing the canine, but being relatively smaller than in *Phal. Cookii*. The crowns of the two anterior incisors are relatively larger. In the lower jaw the sloping alveolar surface between the functional molars and large procumbent incisors is occupied, according to M. Fr. Cuvier, by two rudimentary minute teeth: I have not found any trace of these in the two skulls of *Pet. Taguanoides* examined by me. In *Phal. Cookii* there are three minute teeth in the corresponding space, but these differences would not be sufficient ground to separate generically the two species if they were unaccompanied by modifications of other parts of the body. In *Petaurus sciureus* and *Petaurus flaviventer* the dentition more nearly resembles that of *Phalangista vulpinus*. In the upper jaw the functional molar series consists of five teeth on each side, the four hinder ones being, as in *Pet. Taguanoides*, true tuberculate molares, but diminishing

¹ First by Dr. Shaw in the Naturalist's Miscellany.
more rapidly in size, as they are placed further back in the jaw: the hinder tooth has three tubercles, the rest four; their apices seem to be naturally blunter than in Pet. Taguanoides. Between the functional false molar and the incisors there are three teeth, of which the representative of the canine is relatively much larger than in the Pet. Taguanoides; the first false molar is also larger, and has two roots; the second, which is functional in Pet. Taguanoides, is here very small; the first incisor is relatively larger and is more produced. In the lower jaw the functional series of grinders consists of the four true tuberculate molars only, of which the last is relatively smaller, and the first of a more triangular form than in Pet. Taguanoides. The space between the tuberculate molars and the procumbent incisor is occupied by four small teeth, of which the one immediately anterior to the molars has two roots, the remaining three are rudimentary and have a single fang. Among the species exhibiting this dental formula, viz., incisors \(3^{1-3} \frac{1-1}{1-1}\); canines \(1^{1-1}\); premolars \(3^{3-3} \frac{3-3}{3-3}\); molars \(4^{4-4}\): = 40: are Pet. sciu-reus, Pet. flaviventor, and Pet. breviceps.

The Pigmy Petaurist differs from the preceding and larger species in having the hairs of the tail distichous or arranged into two lateral series like the barbs of a feather; and in having the spurious molars large and sharply pointed; and the true molars bristled each with four acute cusps. This tendency in the dentition to the insectivorous character, with the modification of the tail, induced M. Desmarest to separate the Pigmy Petaurist from the rest of the species, and constitute a new subgenus under the name of Acrobata.

In four adult specimens, two of which had young in the pouch, I find the following dental formula to be constant;—incisors \(3^{3-3} \frac{1-1}{1-1}\); canines \(1^{1-1}\); premolars \(3^{3-3} \frac{3-3}{3-3}\); molars \(3^{3-3}\): = 36.

The important difference in the number of the true molares was first pointed out by Mr. Waterhouse; it is analogous to that which obtains in the Phalangista gliriformis, and renders the parallelism in the modifications of the dental system between the Phalangers and Petaurists remarkably close.

The three quadricuspidate grinders of the upper jaw of the Petaurus pygmaeus are preceded by three large spurious molars, each of which has two fangs, and a compressed, triangular, sharp-pointed crown, slightly but progressively increasing in length, as they are placed forwards. An interspace occurs between these and the canine, which is long, slender, sharp-pointed, and recurved. The first incisor is longer than the two behind, but is much shorter than the canine. In the lower jaw the true molars are preceded by two functional false ones, similar in size and shape to the three above; the anterior false molar and the canine are represented by minute, rudimental, simple teeth; the single incisor is long and procumbent, as in the other Petaurists.
Genus *Phascolarctus*.

The absence of anomalous spurious molars and of inferior canines appears to be constant in the only known species of this genus. The dental formula in three of this species, (*Phas. fusca* Desm.) is: Incisors $3-3$; canines $1-1$; præmolars $1-1$; molars $4-4$; $= 30$.

The true molars are larger in proportion than in the *Phalangers*; each is beset with four three-sided pyramids, the cusps of which wear down in age, the outer series in the upper teeth being the first to give way; those of the lower jaw are narrower than those of the upper. The spurious molars are compressed, and terminate in a cutting edge; in those of the upper jaw there is a small parallel ridge along the inner side of the base. The canines slightly exceed in size the posterior incisors; they terminate in an oblique cutting edge rather than a point; their fang is closed at the extremity; they are situated, as in the *Phalangers*, close to the intermaxillary suture. The lateral incisors of the upper jaw are small and obtuse, the two middle incisors are of twice the size, conical, subcompressed, beveled off obliquely to an anterior cutting edge, but differing essentially from the *dentes scalprarii* of the *Rodentia*, in being closed at the extremity of the fang. The two incisors of the lower jaw resemble those of the upper, but are longer and more compressed: they are also formed by a temporary pulp, and its ossification is accompanied by a closure of the aperture of the pulp cavity, as in the upper incisors. The *Koala* therefore, in regard to the number, kind, and conformation of its teeth, closely resembles the *Phalangers*, with which it agrees in its long *cæcum*, but the stomach has a cardiac gland as in the *Wombat*. The extremities of the *Koala* are organized for prehension; each is terminated by five digits; the hind feet are provided with a large thumb, and have the two contiguous digits enveloped in the same tegumentary fold; the anterior digits are divided into two groups, the thumb and index being opposed to the other three fingers. The fore-paws have a similar structure in some of the small *Phalangers*; it is very conspicuous in some of the *Petaurists*. The *Koala*, however, differs from the *Phalangers* and *Petaurists* in the extreme shortness of its tail and in its more compact and heavy general form. It is known to feed on the buds and leaves of the trees in which it habitually resides.

Tribe IV. *Poephaga*.

The present tribe includes the most strictly vegetable feeders; all the species have a complex sacculated stomach and a long simple *cæcum*.

Guided by the modifications of the teeth we pass from the *Koala* to the *Kangaroo*
family (Macropodidae),—animals of widely different general form. The Potoroos, however, in this group, present absolutely the same dentition as the Koala, some slight modifications in the form of certain teeth excepted. The spurious molars, in their longitudinal extent, compressed form, and cutting edge, would chiefly distinguish the dentition of the Potoroo, but the Koala evidently offers the transitional structure between the Phalangers and Potoroos in the condition of these teeth, of which one only is retained on each side of each jaw, in both Phascolarctus and Hypsiprymnus.

The dental formula of the genus Hypsiprymnus is: incisors $3^{3-3}$; canines $1^{1-1}$; pre-molars $1^{1-1}$; molars $4^{4-4}: = 30$.

The two anterior incisors are longer and more curved, the lateral incisors relatively smaller than in the Koala. The pulps of the anterior incisors are persistent.

The canines are larger than in the Koala; they always project from the line of the intermaxillary suture; and while the fang is lodged in the maxillary bone, the crown projects almost wholly from the intermaxillary. In the large Hypsiprymnus ursinus the canines are relatively smaller than in the other Potoroos, a structure which indicates the transition from the Potoroo to the Kangaroo genus. In the skeleton of this species in the Leyden Museum the canines present a longitudinal groove on the outer side.

The characteristic form of the trenchant spurious molar has just been alluded to; its maximum of development is attained in the arboreal Potoroos of New Guinea (Hypsiprymnus ursinus, and Hyps. dorcocephalus); in the latter of which its antero-posterior extent nearly equals that of the three succeeding molar teeth.

In all the Potoroos the trenchant spurious molar is sculptured, especially on the outer side and in young teeth, by many small vertical grooves. The true molars each present four three-sided pyramidal cusps, but the internal angles of the two opposite cusps are continued into each other across the tooth, forming two concave transverse ridges. In the old animal these cusps and ridges disappear, and the grinding surface is worn quite flat.

In the genus Macropus the normal condition of the permanent teeth may be expressed as follows:—incisors $3^{3-3}$; canines $0^{0-0}$; pre-molars $1^{1-1}$; molars $4^{4-4}: = 28$.

The main difference, as compared with Hypsiprymnus, lies in the absence of the upper canines; yet I have seen them present, but of very small size, and concealed by the gum, in an adult specimen of a small species of Kangaroo (Macropus rufiventris, Ogilby.). This, however, is a rare exception; while the constant presence and conspicuous size of the canines will always serve to distinguish the Potoroo from the Kangaroo. But besides this, there are other differences in the form and proportions of certain teeth.

The upper incisors of the Macropi have their cutting margins on the same line, the
antior ones not being produced beyond that line as in the *Hypsiprymni*; the third or external incisor is also broader in the Kangaroos, and is grooved and complicated by one or two folds of the enamel continued from the outer side of the tooth obliquely forwards and inwards, into the substance of the tooth. In most species the anterior fold is represented by a simple groove; the relative size of the outer incisor, the extent and position of the posterior fold of enamel, and consequently the proportions of the part of the tooth in front or behind it, vary more or less in every species of *Macropus*: there are two folds of enamel near the anterior part of the tooth in *Macr. major*; the posterior portion is of the greatest extent, and the entire crown of the tooth is relatively broadest in this species. The middle incisor is here also complicated with a posterior notch and an external groove. These modifications of the external incisors have been pointed out in detail by M. Jourdan; and subgeneric distinctions have been subsequently based upon them, but they possess neither sufficient constancy nor physiological consequence, to justify such an application. M. Fr. Cuvier has proposed a binary division of the genus *Macropus* as here defined, founded on the absence of permanent spurious molars and a supposed difference in the mode of succession of the true molars in certain species of *Kangaroo*, combined with modifications of the muzzle or upper lip, and of the tail.

The dental formula which I have assigned to the genus *Macropus* is restricted by that naturalist in its application to some small species of *Kangaroo*, grouped together under the term *Halmaturus*, originally applied by Illiger to the *Kangaroos* generally. The rest of the *Kangaroos*, under the generic term *Macropus*, are characterized by the following dental formula:—incisors 6/2; molars 4—4/4—4: = 24.

The truth, however, is, that both the *Halmaturi* and *Macropi* of Fr. Cuvier, have their teeth developed in precisely the same number and manner; they only differ in the length of time during which certain of these teeth are retained. In the great *Kangaroo*, for example, the permanent spurious molar which succeeds the corresponding deciduous one in the vertical direction, is pushed out of place and shed by the time the last true molar has cut the gum: the succeeding true molar is soon afterwards extruded; and I have seen a skull of an old *Macropus major* in the Museum at Leyden, in which the grinders were reduced to two on each side of each jaw by this yielding of the anterior ones to the vis a tergo of their successors.

1 M. Fr. Cuvier was aware that a deciduous spurious molar existed in the great *Kangaroo* and other species of his subgenus *Macropus*, but he believed that it was peculiar to an early period of life, and then existed only in a rudimental state or 'en germes,' and that instead of being displaced and succeeded in the vertical direction by a permanent spurious molar, as in the *Halmaturi*, it was displaced by the true molars, which are developed from behind forwards. I have however detected the crown of the permanent spurious molar in the jaws of the *Macropus major* in a concealed alveolus, and have observed it completely formed and in place in an individual which had nearly attained its full size. See F. Cuvier's account of the *Halmaturus Thetis* in the 'Histoire des Mammiferes,' folio.
Tribe V. RHIZOPHAGA.

The characters of this tribe are taken from the stomach, which is simple in outward form, but complicated within by a large cardiac gland; and from the caecum, which is short and wide, with a vermiform appendage.

Genus Phascolomys.

In its heavy shapeless proportions, large trunk, and short equally developed legs, the Wombat offers as great a contrast to the Kangaroos as does the Koala, which it most nearly resembles in its general outward form and want of tail. But in the more important characters afforded by the teeth and intestinal canal the Wombat differs more from the Koala than this does from either the Phalangers or Kangaroos. The dental system presents the extreme degree of that degradation of the teeth intermediate between the front incisors and true molars which we have been tracing from the Opossum to the Kangaroos: not only have the functionless spurious molars and canines now totally disappeared, but also the posterior incisors of the upper jaw, which we have seen in the Potoroos to exhibit a feeble degree of development as compared with the anterior pair; these in fact are alone retained in the dentition of the present group, which possesses the fewest teeth of any Marsupial animal. The dental formula of the Wombat is thus reduced to that of the true Rodentia:

Incisors $\frac{2}{2}$; canines $0$; præmolars $\frac{1-1}{1-1}$; molars $4-4$; = 24.

The incisors, moreover, are true dentes scalprarii, with persistent pulps, but are inferior, especially in the lower jaw, in their relative length, and curvature, to those of the placental Gliræ: they present a subtriangular figure, and are traversed by a shallow groove on their inner surfaces.

The spurious molars present no trace of that compressed structure which characterizes them in the Koala and Kangaroos: but have a wide, oval, transverse section; those of the upper jaw being traversed on the inner side with a slight longitudinal groove. The true molars are double the size of the spurious ones: the superior ones are also traversed by an internal longitudinal groove, but this is so deep and wide, that it divides the whole tooth into two trihedral portions, with one of the angles of each prism directed inwards. The inferior molars are in like manner divided into two trihedral portions, but the intervening groove is here external, and one of the faces of each prism is turned inwards. All the grinders are curved, and describe about a quarter of a circle; in the upper jaw the concavity of the curve is directed outwards, in the lower

1 All the placental Rodents which have more than three molars in each lateral series have the additional ones situated at the anterior part of the series, and subject to vertical displacement and succession, and consequently these are essentially præmolars: the Wombat strikingly manifests its marsupial character in having four true molars on each side of both jaws.

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jaws inwards. The false and true molars, like the incisors, have persistent pulps, and are consequently devoid of true fangs: in which respect the Wombat differs from all other Marsupials, and resembles the extinct Toxodon, the dentigerous Bruta, and herbaceous Rodentia.

Although none of the Marsupialia possess teeth composed of an intermixture of layers of ivory, cement and enamel through the body of the crown; yet the layer of cement which covers the enameled crown is thickest in the vegetable-feeding Marsupials, and is remarkably distinct in the Wombat.

I may add, that the Wombat deviates from the other Marsupials in the number of its ribs: as these are very constant in the rest of the order, the difference in the Wombat, which has 15 pairs, instead of 13 or 12, is the more deserving of notice. The Koala, like the Phalangers and Kangaroos, has 13 pairs of ribs.

A few words, in conclusion, as to the claims of the Marsupialia to be regarded as a natural association. It may be admitted, that at the period when that most judicious and learned naturalist, the then Vice-Secretary of the Zoological Society, published his reasons for rejecting the Marsupialia as a distinct group in the 'Systema Mammalium,' and for distributing them among different placental orders, according to their supposed closer affinities, the contrary views set forth by M. De Blainville were defective in that kind of evidence which could alone render them convincing. The organization of the Marsupial animals was not at that time sufficiently elucidated to render any opinion as to their natural affinities really valid. Subsequent dissections have, however, shown that the hypothesis which Cuvier had sanctioned by his authority was correct. The Marsupial animals have been proved to agree among themselves, and to differ from the analogous placental species by several important organic modifications not suspected when the Mammalia in the Museum of the Zoological Society were arranged according to the Quinary System.

I have shown that in their cerebral conformation the Marsupialia manifest a close correspondence with the Ovipara in the rudimental state of the corpus callosum: the difference which the most closely analogous placental species offer in this respect is broadly marked. The correspondence of the Marsupials with each other is not less constant in the structure of the heart, of which the right auricle manifests no trace of a fossa ovalis and anulus ovalis, and receives the two venæ caveæ superiores by two separate in-

1 'Gardens and Menagerie of the Zoological Society delineated,' vol. i. p. 265.
2 Mr. Bennett asks in 1831, "What is there of importance in the structure of the Wombat except this solitary character of the marsupium to separate it from the Rodent Order?" We may now suggest, in reply, the marsupial number of true molar teeth, the transverse condyle of the lower jaw, the rotatory muscle of the hindfoot,—important in the present question on account of its frequency in the marsupial species, to which it is peculiar; and, besides other characters, I would more particularly refer to the difference in the structure of the brains of the Wombat and Beaver, described in the Phil. Trans. 1837, p. 89, pl. vi. figs. 3 and 4.
OF THE MARSUPIALIA.

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lets. This generalization is, however, less cogent in the present question than the preceding, because the same modification, as regards the separate entry of the venæ cave superiores, obtains in a few placental species, as the Elephant and some of the Rodentia. But the cardiac characters, of which one is common and peculiar to the implacental quadrupeds, and the other, while it is universal in them, occurs only as an exceptional condition in the placental series, cannot be rejected in a philosophical consideration of the affinities of the Marsupialia.

Several peculiarities of the osseous system, besides the well-known one of the ossa marsupialis, and unconnected with the generative peculiarities, will be pointed out in the subsequent essay on the osteology of the Marsupialia. And while on the present question I may observe, that had the Sarcophagous Marsupials of the present system been subjected to the scrutiny of the myologist as members of the ordinary group of Feræ, he must have noted them as presenting a very remarkable modification of the muscles of the hind leg; for whereas in all the placental Feræ the flexor longus digitorum pedis sends tendons to the toes, as its name implies; in the Dasyures and Phasogales it is inserted fleshy into the fibula, and the knee- and ankle-joints are so modified as, through the action of the muscle so inserted, to admit of rotatory movements of the hind foot analogous to the pronation and supination which in the placental quadrupeds are peculiar to the fore-feet. But the myologist would have been still more surprised if in dissecting the Opossums and Phalangers, when associated with the Monkeys and Lemurs in such a group as Illiger's 'Daumenfisser' (Pollicata), characterized by hinder hands, he should have found precisely the same modification of the flexor longus digitorum—the same conversion of that muscle, by corresponding modifications of the knee- and ankle-joints, into a rotator of the hind-leg; and that notwithstanding the difference in the general structure and powers of the hind foot in the ferine or calcutate and the pollicate orders, the marsupial species should have differed in both groups from the placental ones by precisely the same singular modification. And if now the myologist were to proceed to compare the Wombat with the Beaver or any other placental Rodent, and were to discover here also precisely the same difference in the muscles and motions of the hind legs, he could hardly avoid suspecting that some closer affinity must subsist between the species enjoying the common properties of rotation of the hind foot than was indicated by the classification under which I have supposed them to have been presented to his notice. It is, in fact, only in those Marsupials in which the offices of support and locomotion are devolved exclusively or in great part upon the hind-legs, as in the Kangaroos, Potoroos, and Perameles, that the hind-feet are strengthened at the expense of the loss of the movements of rotation.

Finally, I may observe, that in the dental system itself, the varieties of which have been chiefly appealed to as sanctioning the disparition of the Marsupial order, we find an important peculiarity, by which the carnivorous, omnivorous, and strictly vegetable-feeding genera alike agree with each other, and differ from the corresponding placental
Mammalia. In the ordinary Fera, for example, in the Quadruped and in the Rodentia, as likewise in the Pachyderma and Ruminantia, the number of grinders developed on each side of each jaw, which are not subject to vertical displacement and succession, is never more than three, while in the corresponding groups of Marsupials it is always four.

These coincidences in the Marsupialia, of more or less important peculiarities of structure, which cannot be connected with their reproductive economy, are truly remarkable, and their detection and generalization give peculiar interest to anatomical investigations of the Marsupial animals.

The following is a tabular view of the subordinate groups of the Marsupialia regarded as a distinct Order of Implantental Mammalia.

CLASSIFICATION OF THE MARSUPIALIA.

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</thead>
<tbody>
<tr>
<td>Sarcophaga.</td>
<td>Dasyuridae</td>
<td>Thylacinus.</td>
<td></td>
</tr>
<tr>
<td>Three kinds of teeth; canines long in both jaws; a simple stomach; no intestinum cecum.</td>
<td>Dasyurus.</td>
<td>Phascolotherium</td>
<td>Fossil.</td>
</tr>
<tr>
<td>Extinct transitional forms</td>
<td></td>
<td>Thylacotherium.</td>
<td></td>
</tr>
<tr>
<td>Entomophaga.</td>
<td>Ambulatoria</td>
<td>Myrmecobius.</td>
<td></td>
</tr>
<tr>
<td>Three kinds of teeth in both jaws; a simple stomach; a moderately long intestinum cecum.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carpophaga.</td>
<td>Saltatoria</td>
<td>Cheropus.</td>
<td></td>
</tr>
<tr>
<td>Anterior incisors large and long in both jaws; canines inconstant; stomach simple, or with a special gland; a very long intestinum cecum.</td>
<td>Perameles.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phalangistidae</td>
<td></td>
<td>Phalangista.</td>
<td></td>
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<tr>
<td>Phascolarctidae</td>
<td></td>
<td>Petaurus</td>
<td></td>
</tr>
<tr>
<td>Phascolomyidae</td>
<td>Phascolarctus.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phascolomyidae</td>
<td>Hypsiprymnus.</td>
<td></td>
<td></td>
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<tr>
<td>Macropodidae</td>
<td>Macropus.</td>
<td></td>
<td></td>
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<tr>
<td>Poephaga.</td>
<td></td>
<td>Didelphys.</td>
<td></td>
</tr>
<tr>
<td>Anterior incisors large and long in both jaws; canines present in the upper jaw only, or wanting. A complex stomach; a long intestinum cecum.</td>
<td></td>
<td>Cheironecetes.</td>
<td></td>
</tr>
<tr>
<td>Rhizopha.</td>
<td></td>
<td>Cuscus.</td>
<td></td>
</tr>
<tr>
<td>Two cuspiform incisors in both jaws; no canines. Stomach with a special gland; cecum short, wide, with a vermiciform appendage.</td>
<td></td>
<td>Phascolomys.</td>
<td></td>
</tr>
</tbody>
</table>

1 I need hardly remind the zoological reader, that the teeth which are displaced by a second set succeeding them in the vertical direction, are, in Man, the incisors, canines, and false molars, the successors of which are
called bicuspid; and that the three true molars on each side are not so displaced. So also in the lower Mammalia, it is the canines, incisors, and false molars only which are subject to vertical displacement and succession. To the general rule, that in Marsupialia there are four true molars developed on each side of both jaws, there occur the two exceptions already noticed of Phalangista gliriformis and Petaurus pygmaeus. Whether the genera Myrmecobius and Thylacotherium actually possess more than four true molars, as appears from external form, can be determined only by ascertaining how many of the molar series are displaced and succeeded by others in the vertical direction. The Chrysorchore among the placental Feræ offers a similar exception to the rule of three true molars in that group.

Communicated October 23, 1838.

In the various works on Mammalia there is much confusion as regards the species of Galeopithecus. M. Geoffroy St. Hilaire, in the 'Magazin Encyclop. VII.,' indicated by imperfect descriptions what he considered three species. The Gal. rufus, which is, according to the description, rather more than one foot (English measure) in length; Gal. variegatus, measuring a little more than six inches in length; and thirdly, the G. Ternatensis, which is said to be smaller than the last. The single dimension of the length of each of these species, together with a description of their colouring, and the statement that the head of G. variegatus is proportionately broader, and has the muzzle more elongated than G. rufus, are all the facts relating to the distinguishing characters that I can procure of the animals in question.

Audebert states that the size of the head and the varied colours of G. variegatus appear to indicate that this species is merely a variety of G. rufus.

After the description of G. Ternatensis, M. Desmarest has the following note. "This species, admitted by M. Geoffroy upon the incomplete description given by Seba, is not known to me. The fur, by which the body is covered, is adpressed, short, and soft, resembling that of a mole." I may add that such is the character of the fur in a very young Galeopithecus now before me.

In the 'Manuel de Mammalogie' of M. Lesson, the three species above mentioned are admitted without comment: his account is in fact the same as that found in M. Desmarest's 'Mammalogie.'

Fisher, in his 'Synopsis Mammalium,' sinks the three species in question, and so does Cuvier in the 'Règne Animal.'

M. Temminck, in his 'Monographies de Mammalogie,' states that there are two species of Galeopithecus, possessing well-marked osteological characters, and that the animals named variegatus, rufus, and Ternatensis ought to be united.

Such is the state in which I find the genus Galeopithecus, and with a fine series of specimens before me I am unable to identify either of them with any published description. Of all the specimens which have come under my observation, I have never seen any adult animal so small as those described.

As M. Temminck states, there are decidedly two very distinct species; species which may easily be distinguished by an inspection of their skulls, or even by their external characters. I regret that for these two species I cannot find appropriate names among
those already published, nor can I adopt either of them without running the risk of producing further confusion, since I cannot ascertain to what animals they refer. In Fischer’s ‘Synopsis Mammalium,’ it is stated that the two species distinguished by M. Temminck bear the names variegatus and marmoratus, both of which names will apply equally well to either of the species. For these reasons I shall describe the species I am acquainted with under new specific names, one in honour of the author of the ‘Mongraphies de Mammalogie,’ and the other to commemorate the locality in which it is found.


General colour of upper parts usually deep grey or blackish, variegated with white, and of the under parts pale greyish fulvous; the fore and hind-feet are blackish above, spotted with white. The flank membrane is sometimes sooty black above, and variegated with white near its junction with the body and thighs; or it is of a greyish colour, with narrow undulating black lines. On the back there is sometimes either a yellowish or a brown hue, and the under parts occasionally incline to rust-colour. Adult specimens vary from about twenty-two to thirty inches in length, measuring from the tip of the nose to the end of the tail. The length of the ear is 6\(\frac{1}{2}\) lines. The principal dimensions from a skeleton of this species are as follows:

<table>
<thead>
<tr>
<th>Dimension</th>
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<tbody>
<tr>
<td>Total length</td>
<td>27</td>
<td>0</td>
</tr>
<tr>
<td>Length of head</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>———— tail</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>———— humerus</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>———— fore arm</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>———— fore foot (without the claws)</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>———— femur</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>———— tibia</td>
<td>5</td>
<td>3(\frac{1}{2})</td>
</tr>
<tr>
<td>———— tarsus</td>
<td>2</td>
<td>7</td>
</tr>
</tbody>
</table>

The skull of G. Temminckii approaches somewhat to an oval form: its greatest width is towards the posterior part of the lower boundary of the orbit, and supposing the whole length of the cranium to be 46, the diameter at this part is 32. A little in front of the orbits the skull is suddenly contracted, and from this part to the apex it gradually decreases in width. The length of the portion anterior to the orbits is to that behind this part as 19 to 27, and the width of the hinder portion of the cranium (behind the auditory canal) is to the length as 21 to 46. The nasal bones extend backwards rather beyond

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1 The former of these, the G. variegatus, is said to be from Java and the islands of the Indian Archipelago, and the latter from Sumatra and Borneo.

2 In applying the name Philippinensis, it must not be understood that the species is not found elsewhere than in the Philippine Islands, but that the specimens upon which I found my descriptions are from that locality: in this sense the name of a locality applied to a species is useful.
the line between the anterior boundary of the orbits; they are very narrow in front, and expanded posteriorly, the width at the base being more than double that of the apical portion. The intermaxillary bones are large, and approach to a quadrate form, the intermaxillary suture being at right angles with the nasal bones. The palatal portion of the intermaxillary is but of small extent, being encroached upon by the maxillaries. There are two large, oval, incisive foramina, the posterior boundary of which is formed by the bones last mentioned; they are situated, however, almost wholly in the intermaxillaries. The palate presents an even and slightly concave surface. The palatine portion of the palate-bone has but a small antero-posterior diameter, being deeply emarginated posteriorly by two notches, in the form of two segments of a circle. The frontal bones articulate in front with the nasal, maxillary, and lachrymal bones; they are produced laterally, so as greatly to increase the depth of the orbits, and posteriorly into a large post-orbital process, which in some adult skulls is separated from the corresponding process of the malar bone by an interspace scarcely more than three lines in width. The lachrymal bones are large, and constitute the chief portion of the anterior boundary of the orbit; they extend on to the face about 2 lines, and into the orbit about 3½ lines. The lachrymal duct is large, and is situated within the orbit, but close to its anterior margin.

The malar bone is of considerable extent, broad, and compressed, and forms an almost horizontal platform for the eye to rest upon; it is articulated anteriorly to the lachrymal bone, and internally to the maxillary; posteriorly it assumes a nearly perpendicular position, and is bifurcated, the upper portion forming a post-orbital process, and the lower division being extended backwards, beneath the zygomatic process of the temporal bone, and enters into the composition of the glenoid cavity. The glenoid cavity is transverse, and very slightly concave from front to back; the posterior descending process is proportionately larger than in other Lemuridae, whose skulls I have had an opportunity of examining, and differs in being decidedly recurved, so as partially to enclose the condyle of the lower jaw. The temporal ridges are well-marked; they converge as they approach the occiput, but never meet, being separated by a space of seldom less than four lines. The occipito-parietal ridge is very marked; the condyles are extensive and project, and between these and the large mastoid processes there is a deep depression, giving a singular irregularity to the occiput viewed posteriorly. The auditory bullæ are small, but the mastoid portion of the temporal bone is inflated, and forms a large cellular cavity. The rami of the lower jaw diverge somewhat suddenly, and with a bold curve, from the symphysis menti; the coronoid process is small, of a prismatic form, pointed, and almost perpendicular: the aper, however, is directed slightly outwards and backwards; this process has its origin about 2½ lines behind the last molar tooth. The articular portion of the condyle is situated a little above the plane of the grinding surface of the molars, and about 2½ lines behind the coronoid process. The
descending *ramus* is large, approaches to a quadrat form, but the angles are rounded. The lower posterior angle is directed outwards.

<table>
<thead>
<tr>
<th></th>
<th>In.</th>
<th>Lin.</th>
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<tbody>
<tr>
<td>Length of skull</td>
<td>2</td>
<td>11½</td>
</tr>
<tr>
<td>Width</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Vertical diameter of orbit</td>
<td>0</td>
<td>10½</td>
</tr>
<tr>
<td>Length of palate</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Width of ditto between canines</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Width of posterior nares</td>
<td>0</td>
<td>6½</td>
</tr>
</tbody>
</table>

The longitudinal extent of grinding surface of the five posterior molares, upper jaw 0 9

The dentition, as it appears to me, is as follows: incisors, \( \frac{3}{4} \); canines, \( \frac{6}{7} \); false molares, \( \frac{3}{4} \); true molares, \( \frac{4}{4} \); = 34.

The anterior incisor on each side of the upper jaw is placed remote from the *apex* of the intermaxillary bone, of a small size and compressed form, suddenly dilated above its insertion in the jaw, serrated at the edge, and presenting three or four nearly equal denticulations. The second incisor on either side resembles the first false molar in form, and, like that, has two fangs. The first false molar is compressed, of a triangular form, and has the anterior and posterior edges serrated. The second false molar is less compressed than the first, and is divided by a transverse indentation into two nearly equal, acutely pointed, triangular cusps; the *apex* of the posterior cusp is directed inwards. The grinding surface of each of the true molares presents a triangular figure, and consists of three pointed cusps, two external and one internal: on the posterior part, and at the base of the inner cusp, there is a small pointed tubercle; and on the opposite side of the same cusp there is a corresponding tubercle of still smaller size. The molares of the lower jaw resemble those of the upper, excepting that the position of the three principal cusps is reversed, these being parallel to the inner side of the *ramus*, and the other cusp is on the outer side of these. The false molares are compressed; the anterior one resembles its opponent of the upper jaw; the posterior one differs from the last mentioned, chiefly in having the hinder portion broader, and separated from the anterior portion by an indentation. The small lobe thus separated has an outer and an inner pointed tubercle. The tooth which I imagine represents the canine is comparatively small, compressed, and considerably expanded at the *apex*, where it is serrated, having five or six denticulations. The incisors are almost horizontal in
their position, compressed, narrow at the base, and suddenly expanded immediately above the base: each incisor is deeply pectinated, or subdivided by incisions into slender laminae. These laminae vary in number in the teeth of different individuals of the same species. In the present species of Galeopithecus, I find, in the middle pair of incisors, either seven or eight, and in the outer pair either eight, nine, or ten laminae: each of these slender processes is dilated, and slightly recurved the apex, and on the outer and apical portion there is a broad longitudinal groove. The lateral laminae are broader than those intervening¹. The incisors and false molares of the upper jaw are detached: between the first and second canine there is an intervening space of nearly half a line, and the latter is distant about one line from the first false molar on either side: between this and the second false molar the space is about one quarter of a line, and behind the second false molar there is a vacant space of about one third of a line. The canines and false molares of the lower jaw are also detached.

Sp. 2. G. Philippinensis.

Colour very variable; sometimes deep blackish-brown above, and brown beneath, with a few scattered small white spots on the upper parts; or the upper surface is grey, variegated with black and white, and the under surface brownish white.

This species is so variable in its colouring, that in this respect I can find no characters in common. I may observe, however, that the two males sent by Mr. Cuming agree in being of a dark blackish brown colour, and almost uniform; one of them has a large white spot on the upper surface of the muzzle, and a similar patch of white is observable in the two females, but varying in size; in the other male, however, there is no trace of this spot. The two females are of a much paler colour than the males; one is of an ashy-grey colour above, variegated with black and white, and of a very pale brown or brownish white colour beneath. The other female is of a yellowish grey tint above, clouded with deep brownish grey on the fore part of the arms and on the feet; the latter are spotted with white. A large patch of grey is observable on the upper side of the flank membrane, near the sides of the body, in which there are two or three small white spots; and towards the hinder feet there is a large dirty yellowish white patch. The under parts are brownish white, with a faint yellow tint.

¹ The six foremost teeth in the lower jaw of the Lemur (four of which are incisors, and the remaining two I agree with Geoffroy in considering as canines,) together bear a remarkable resemblance to a single incisor of Galeopithecus. The two canines may be compared to the outer lamina of one of these incisors. Like one of these lamina, the Lemur's canine is dilated immediately above the base, and has a longitudinal ridge on the upper side, whilst the incisors, like the intermediate lamina, are grooved on the outer side, near the apex. In their almost horizontal direction there is also a resemblance. In the number of teeth the Galeopithecæ agree with the Lemurs, excepting that in the former the upper canines are wanting. In both these groups of animals the incisors of the lower jaw are opposed to a toothless portion of the intermaxillaries.
This species is of a smaller size than *G. Temminckii*; the limbs, however, are considerably stronger, the bones being proportionately thicker; the hands and feet are larger, and the ears are also larger. Upon comparing the skull of *G. Philippinensis* with that of *G. Temminckii*, the most striking differences consist in its smaller size, its narrower and more ovate form, the shorter and more obtusely terminated muzzle. The temporal ridges in the adult animal meet near the occiput, or are separated but by a very narrow space. The *rami* of the lower jaw are shorter, and proportionately deeper and thicker. They diverge less suddenly from the *symphysis menti*.

In the dentition there are also many marked differences. The molares of the present animal are considerably larger than those of *G. Temminckii*, the longitudinal extent of the grinding surface of the five posterior molares of the upper jaw being $10\frac{1}{4}$ lines, the
width of the penultimate molar 3 lines. The anterior incisor is smaller, whereas the posterior incisor is much larger and stronger; its vertical extent is considerably greater: viewed laterally this tooth presents the form of an arrow-head; the anterior and posterior edges are simple. The same differences are observable in the anterior false molar of the upper jaw; this, however, is less acutely pointed than the last. The anterior false molar of the lower jaw differs from the corresponding tooth in *G. Temminckii*, in the same manner as does the false molar of the upper jaw, but it is acutely pointed. In the present animal the false and true molares of both upper and lower jaws each form a continuous series, and are not interrupted by intervening spaces, as in *G. Temminckii*.

*Galeopithecus Temminckii* is the most common species in collections, and I believe is found in many of the islands of the Indian Archipelago. As regards the second species (*G. Philippinensis*) the only specimens which I have examined are those from which the foregoing description is drawn up, consisting of two males and two females, all of which were sent from the Philippine Islands by Hugh Cuming, Esq. The paper containing the dimensions accompanying these specimens is dated "Isle of Bohol, August 1837"; I presume therefore the animals were procured in that island. Mr. Cuming states that the eyes are of a nut-brown colour, with black pupils. The principal dimensions, taken by Mr. Cuming from the specimens when fresh, are as follows:

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Male</th>
<th>Female</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length from tip of nose to root of tail</td>
<td>15 6</td>
<td>15 3</td>
<td>17 0</td>
<td>17 0</td>
</tr>
<tr>
<td>—— of tail</td>
<td>9 9</td>
<td>9 3</td>
<td>11 0</td>
<td>10 6</td>
</tr>
<tr>
<td>Circumference of the body at the chest</td>
<td>8 0</td>
<td>7 9</td>
<td>8 0</td>
<td>7 6</td>
</tr>
<tr>
<td>—— of the body immediately before the hind legs</td>
<td>6 0</td>
<td>6 0</td>
<td>5 6</td>
<td>5 9</td>
</tr>
</tbody>
</table>
PLATE LVIII.

Figs. 1. *Galeopithecus Temminckii.*

Fig. 1 a. Upper side of the skull.
   1 b. Under side of the same.
   1 c. Under side of the lower jaw.
   1 d. Side view of the same.

1 e. The three foremost teeth, on either side, of the upper jaw: the two first of these, commencing with the smallest tooth, are situated in the intermaxillary bone, and are therefore incisors. It is worthy of observation, however, that the posterior of these two teeth (on each side) has a double fang.

1 f. & 1 g. Outer and inner incisor of lower jaw.

Figs. 2. *Galeopithecus Philippinensis.*

(The same letters refer to corresponding parts.)
XXIV. *On the Skull of the North American Badger, Meles Labradoria of Authors.* By **George R. Waterhouse, Esq., Curator, and Assistant Secretary for Scientific Business, to the Zoological Society.**

Communicated November 13, 1839.

**Although** very many of the North American animals bear so great a resemblance to those of Europe that they have often been supposed to be specifically identical, yet upon careful examination the greater portion of them have proved to be distinct; and in those cases where no good characters have been found, by which certain North American and European species can be distinguished, such species are, for the most part, inhabitants of the arctic portions of the two continents.

The North American *Badger* is one of those animals which might possibly be regarded as a mere variety of the European species. Cuvier, in the *Règne Animal,* after briefly describing the European *Badger,* observes, "le Blaireau d’Amérique n’en diffère pas beaucoup;" and although, previously to the publication of the last edition of the work in which this passage occurs, Capt. Sabine had carefully described certain points of distinction, still it would appear that Cuvier did not consider the characters pointed out as very important.

The collection of the Zoological Society containing several specimens, both of the *Meles Labradoria* and the *Meles vulgaris,* I was induced to examine their crania; and when a skull taken out of one of the skins of the former animal was brought to me, I found it so unlike that of the Common *Badger,* that I thought my assistant must have made some mistake, nor was I satisfied until I had myself seen a second skull removed from a similar skin.

I have now before me three skulls of the American *Badger,* which belonged to animals of different ages, young and adult; their peculiarities I will endeavour to point out.

The most striking peculiarity in the skull of the *Meles Labradoria* consists in the great expanse of the occipital region, which in width is equal to that of the skull measured transversely from the outer surfaces of the zygomatic arches. In the adult animal all the sutures are obliterated.

The general form of the skull is conical, the occipital or basal portion being the broadest; viewed laterally, the outline of the upper surface is most elevated at, or very near, the *occiput*; thence it runs downwards, with a slightly convex curve, to the nasal

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1 It is probable that North Asia and North America have at some former period been united; and if so, the specific identity of certain species, whose constitutions are fitted for the arctic regions, may be thus accounted for.
bones; a faint depression is observed towards the base of the nasal bones, and about the middle of the frontal bones there is another depression, which, however, is indistinct. The interorbital portion is considerably contracted, and is narrowest posteriorly; from between the orbits to about the middle of the frontal bones, the sides of the skull are nearly parallel (interrupted, however, by a short, strong, post-orbital process); from this part to the occiput the cranial cavity somewhat suddenly increases in width; the sides, when viewed from above, presenting almost straight, but diverging lines. The occipital or lambdoidal crest is strong, considerably elevated, and directed backwards and upwards, and runs forward, and in the mesial line of the skull, to join the very faint longitudinal ridge which represents the sagittal crest. This crest, I suspect, is never well developed as in the Common Badger. The plane of the occipital portion of the skull is almost vertical: a considerable concavity is observed on each side in the ex-occipitals, and situated about midway between the foramen magnum and the outer boundary of these bones. The foramen magnum is of a transversely ovate form; its upper boundary slightly overhangs the lower one. The auditory bullae are very large and convex, and the meatus auditorius, or bony canal leading to them (which is nearly horizontal, and directed slightly backwards), is proportionately large. The zygomatic process of the temporal bone is produced at right angles from the skull, to form a broad articular surface for the condyle of the lower jaw; this glenoid cavity, like that of the Common Badger, has its anterior and posterior processes; these, however, merely serve to prevent the protrusion or retraction of the lower jaw, and not to enclose and lock the condyle, as in the last-mentioned animal. The zygomatic arches are moderately strong, curve upwards and outwards; the outer surface is most convex near the hinder part. The malar bone is extended backwards to within about two lines of the glenoid cavity; its upper surface is produced into a short and somewhat obtuse, post-orbital process, and in front it is extended to form both the anterior boundary of the orbit and the upper boundary of the ant-orbital foramen, articulating with the superior maxillary and lachrymal bones, which latter appear not to extend on to the face. The almost vertical ant-orbital foramen is of moderate size (less than in the Badger), and is separated from the orbit by a narrow space about one line in width. There is considerable depression in the superior maxillary bone just above the ant-orbital foramen, and near the orbit, somewhat resembling that observed in the Otter. The facial portion of the skull is short, broad, and obtusely terminated. The nasal opening is rather broader and shorter than in Meles vulgaris. The nasal bones are rather short, dilated anteriorly; thence they gradually decrease in width, and at their junction with the frontals they are suddenly contracted, so that the posterior portion forms two slender, long, pointed processes. The nasal processes of the intermaxillaries are short; the palatal portion is also short: the incisive foramina are ovate, and do not encroach upon the maxillaries, though their posterior boundary is formed by them. The palatal process of the maxillary bones, and that of the palatal bones, are about equal in longitudinal extent; the palato-maxillary suture
being situated opposite the interstice between the penultimate and last molars. The palatal bones terminate about half an inch behind the posterior molars. A more clear idea of the form of the lower jaw may be conveyed by comparing it with that of the Common Badger, than by describing it; I will therefore do so. Thus compared, the most striking differences consist in the form of the coronoid process, the anterior margin of which is less oblique than in that animal; its apex is somewhat pointed, whereas in the Common Badger it is rounded; the posterior margin is formed of two lines, an upper one running backwards and downwards, from the apex of the coronoid process; and a lower one, which is perpendicular, and forms an obtuse angle with the first. In this form of the coronoid process the American Badger more nearly resembles the Otter (Lutra vulgaris) than the Common Badger, where the posterior boundary of the coronoid process forms a vertical line. The condyle of the jaw has proportionately a much greater diameter than that of the Common Badger. The descending ramus is deeper, and does not form so acute an angle; the horizontal ramus, if measured beneath the carnassière, is less deep, but behind the carnassière the alveolar portion rises rapidly towards the coronoid process: the symphysis menti is less oblique, and there is a corresponding difference in the direction of the incisors. The lower boundary of the horizontal ramus forms a straight line beneath the dental portion of the jaw, but the part which lies behind the line of the last molar is raised, forming an obtuse angle with the fore part.

Dentition.—In the number of the teeth the present animal agrees with the Common Badger, excepting that the molar corresponding to the small first false molar of the lower jaw of that animal is here wanting. In the relative size and form of the teeth there is much difference. The incisors of the upper jaw are arranged in an arch, but form together a segment of a larger circle than those of Meles vulgaris; they are proportionately smaller and shorter. In the canines there is but little difference: the posterior cutting edge observed in the Badger is here almost obliterated. The false molars likewise scarcely differ. In the carnassière and true molar, however, there is much difference, the former being of great size and equal to the last molar. It is nearly in the form of a right-angled triangle; the cutting edge is much raised, and there is a large tubercle on the inner lobe of this tooth, which has no analogue in the Badger. The true molar is also nearly triangular; the tubercles with which it is furnished are but slightly raised, and are much less developed than in the corresponding grinding molar of the Badger. The principal differences observable in the teeth of the lower jaw, consist in the smaller size of the incisors, the larger size of the last false molar, and its being furnished with two distinct tubercles at its apex; that of the Common Badger being simply pointed: it differs moreover in the smaller size of the carnassière, which is not distinctly dilated posteriorly, as in the Badger, and the cutting edge being higher; the true molar is a trifle smaller. The carnassière of the lower jaw may be divided into two portions, that which is opposed to the corresponding tooth in the upper jaw, and which is the cut-
ting portion, having high sharp cusps; and that which is opposed to the true molar, which is the grinding portion. Now in the Common Badger the latter portion decidedly exceeds the former in bulk, whereas in the American Badger the reverse is the case, arising from the comparatively large size of the carnassière of the upper jaw, and smaller size of the true molar. The two false molars of the upper jaw and the three of the under, on either side, have each an anterior and posterior fang; the carnassière of the upper jaw, and the true molar, have each three fangs, two external and one internal; the inner fang on the last-mentioned tooth is very broad, as in the Common Badger: the carnassière of the lower jaw has two fangs, and the last molar has also two fangs, but they are only partially divided. Such in fact is the normal or more constant condition of the teeth in the Mammalia; and however they may depart from this type, we may always observe a tendency towards this disposition of the fangs; the number, moreover, varies less than might perhaps be supposed.

The skull from which the foregoing description is drawn, was removed from a skin stated to be from Mexico, and is evidently that of an adult animal: the cranium from a second specimen which belonged to the same collection exhibits all the sutures tolerably distinct, and possesses the milk teeth; the crowns of the permanent teeth, however, are visible. The second false molar of the upper jaw of this young animal is compressed, presents a high and sharp central tubercle, a small anterior cusp, and a large posterior one, which is joined to the central tubercle by a sharp, cutting edge: within, and opposite the central cusp, is a small, round lobe, which projects at a right angle from the body of the tooth. This tooth has three fangs, and presents the normal form of the carnassière in the more typical Carnivora, whilst the tooth which is afterwards replaced by the carnassière is tuberculous, like the true molars; it is in the form of an isosceles triangle, the apex being placed outwards. The third skull is from a skin sent by Mr. Douglas, and the animal in all probability was killed in California: it agrees with that from which the description is taken, excepting in being rather smaller, and in having the auditory bullæ decidedly larger. The animal had at the time of its death just shed its milk teeth.

The skins here alluded to agree with each other and with a specimen in the Society's museum, which is the one referred to by Dr. Richardson in his 'Fauna Borealis Americana', excepting that in this specimen the fur is longer and softer, and the markings are not quite so dark, being brownish-black, instead of black.

The dimensions of the adult skull are as follows:—

<table>
<thead>
<tr>
<th>Description</th>
<th>Ins.</th>
<th>Lin.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total length of skull</td>
<td>4</td>
<td>10(\frac{1}{4})</td>
</tr>
<tr>
<td>Width at occiput</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>——— from outer side of zygomatic arches</td>
<td>3</td>
<td>1(\frac{3}{4})</td>
</tr>
<tr>
<td>——— between orbits</td>
<td>1</td>
<td>1(\frac{1}{4})</td>
</tr>
<tr>
<td>Height of orbit</td>
<td>0</td>
<td>9</td>
</tr>
</tbody>
</table>
It will be seen from the foregoing description that the American Badger affords us a modification of dentition differing considerably from that of the common European species. This difference in the dentition, combined with the short, broad form of the skull, the truncated appearance of the posterior part (owing to the comparatively short extent of the portion behind the zygomatic arch), the large size of the auditory bullae, and the great extent of the occipital region, in my opinion should be regarded as indicating subgeneric characters rather than specific. The subgeneric name Taxidea may therefore be applied to the American Badger, and such species as may hereafter be discovered with incisors $\frac{6}{6}$, canines $\frac{2}{2}$, false molars $\frac{2-2}{2-2}$; the posterior false molar of the lower jaw with an anterior large tubercle, and a posterior smaller one; molars $\frac{2-2}{2-2}$; the carnassière and the grinding molar of the upper jaw each of a triangular form, or nearly so, and about equal in size.

As regards the external characters, I may observe, that in addition to the differences of colouring and marking displayed by the Taxidea Labradoria and the Meles vulgaris, the former may be distinguished by the tip of its muzzle being hairy above, it being naked in the Common Badger, the fore limbs stouter, and the claws stronger, and also by the short, conical form of the head.

The typical Mustelidae have the true molars of the upper jaw transverse; in the Skunks (Mephitis) it assumes nearly a quadrate form, and in Meles it is longer than broad; the modification observable in the form of the molars of the upper jaw of Taxidea, therefore, furnishes us with an interesting link between Mephitis and Meles, whilst the former of these genera links the Badgers with Mustela and its subgenera.
PLATE LIX.

Skull of *Meles Labradoria*.

Fig. 1. The upper side.
2. Under side.
3. Side view.
4. ——— of lower jaw.
5. View of the hinder portion of the lower jaw, showing the form of the condyle.

Communicated November 27, 1838.

In submitting to the Society an account of the fishes of Dukhun, it will scarcely excite surprise, that out of 46 species described, no less than 42 are new to science, since they are from a hitherto untrodden field, and from peculiar localities, on the great plateau of the Dukhun (Deccan), none of them coming from a less elevation than 1500 feet above the sea; many from near 2000 feet, and others from yet higher situations. The chief features in the collection are the paucity of orders to which the collection belongs, and the remarkable prevalence of the members of the families of Siluridae and Cyprinidae. There is but one apodal Malacoptygian, but four Acanthopterygii; and the whole of the rest of the fishes belong to the order Abdominal-Malacoptygians. Of the families there are only eight: Percidae, Scombridae, 'Pharyngiens Labyrinthiformes,' Gobiidae, Siluridae, Cyprinidae, Esocidae, and Murenidae, comprising fifteen genera and nine subgenera, including one subgenus, which I have been compelled to add to the Cyprinidae. An attempt has been made to methodize and distinguish the multitudinous members of the families of Siluridae and Cyprinidae. The fact is, the continued insolation in the character of the teeth, of the cirri, of the spines (serrated or not), of the fins, of the armature of the head, and of the position of the fins, in the Siluridae; and of the number of cirri, and form and position of the fins in the Cyprinidae; together with the character of the mouth, produce such approximations in species to each other, and in individuals of one genus to another, that not only is there infinite difficulty in determining the genera of the fishes of these families, but their identity as species is occasionally not less difficult. Some of my Siluridae do not exactly correspond with the generic characters of the genera of this family as now constituted, and I might have added to the number of genera; but to this I have an objection, unless as an evidently necessary measure. In the Cyprinidae, however, I was obliged to set aside my repugnance, for three species were not referrible to any one even of the numerous subgenera which Buchanan Hamilton wished to establish. It only remains to state, that the whole of my fishes were drawn from absolute measurement, and have a scale of size attached to each figure: they were caught in the various rivers on whose banks I encamped, as individuals were required; so that my draftsman, who worked constantly under my own eye, never had to finish his drawings from shriveled and discoloured

Note.—In spelling native names the "u" has the sound of the "u" in the English word "but," and the other letters have their usual English sounds.
specimens. I have to a great extent adopted the names by which the fishes are called by the Mahrattas, as specific names, so that naturalists who travel the country can always obtain them.

Ord. Acanthopterygii.

Fam. Percide.

Genus Ambassis, Agass.

This genus belongs to Cuvier's second subdivision of the family Percidae. Buchanan Hamilton proposed the name Chanda for the same genus, but this name has not been adopted.

Ambassis Barlovi.

Tab. LX. Fig. 1.

An Ambassis, with the two back fins united; with the first ray indented on the edge, and containing 7 spines, and the second 14 spines; all the spines longer than the membrane; with 18 rays, longer than the membrane, in the anal fin; and with a short, vertically compressed, diaphanous body.

Form short, very compressed, and high: of a yellowish silvery colour, and diaphanous: dorsal fin of 22 unequal bony rays; anal fin of 18 rays; pectoral fin of 10 rays; ventral with 6 rays, of which the first is bony: tail forked, and having 27 rays, including 5 minute rays on the outer side of each of the longest rays. Greatest size of the fish 3 inches. Under jaw projecting beyond the upper: shortest dorsal rays in the centre of the fin: rays generally bony or spiny: scales remarkably thin, and with difficulty discoverable.

The natives say it is an ocean fish: the name given to it by them is revolting, and it is considered unwholesome.

This species closely corresponds in its form to the Chanda Ranga of Dr. Hamilton's drawing, but it has two rays more in the dorsal fin and three in the anal, and moreover, has its rays mostly prickles, the membranes shorter than the prickles, and the fins not arched: it has not the gill cover-plates at all indented, and is not greenish in colour: it must therefore be considered a distinct species, and the difference of location justifies the inference. Found in the Beema river, at Pairgaon. Native name, 'Gandreechree.'

I at one time thought the present species was the Ambassis Commersonii of Cuvier and Val., but the formula of the fin-rays in that species differs, being — D. 7 — 1 | 9; A. 3 | 9; C. 17; P. 12; V. 1 | 5. I have named this fish after my friend the Secretary of the Zoological Society.

Fam. Scombride.

Genus Mastacembelus, Gron.

Mastacembelus armatus.

Tab. LX. Fig. 2.

A Mastacembelus, with the fins of the tail, hack, and vent, united; with thirty-nine to forty short, sharp, bony spines along the back, and two behind the vent.
This fish is nearly cylindrical, but towards and at the tail, the body is compressed. Head rather depressed, and acuminate from the eyes to the upper lip (which terminates in a mucronate point): upper jaw ridged, like the roof of a house. General colour dark olive, adorned with black blotches. The skin has a beautiful appearance, like that of plaited work; the gills are placed almost longitudinally, and the opening is one inch and a quarter long; the pectoral fins are nearly circular and contain more than 25 rays, it being difficult to count the very minute rays. The dorsal fin commences one inch behind a perpendicular raised from the vent, and is lost in the tail, which is rounded. From the shoulder to the commencement of the dorsal fin, the back has a line of 30 or 40 sharp, white, bony spines, without membrane between them, those on the shoulders being very short, and gradually lengthening to the last spine, which is $\frac{1}{10}$ths of an inch long. The vent is a little behind the middle of the fish, and close behind it are two white bony spines, of unequal length, the longest of which is half an inch. The anal fin commences at the same distance from the tail as the dorsal fin, and corresponds with it, excepting in not being quite so deep. The dorsal and abdominal spines are usually lying along the back, but the fish has the power of erecting them; and the severe wounds they are capable of inflicting render it dangerous to handle the fish when alive.

The length of the specimen described is 21 inches; diameter at the cylindrical part of the body one inch and $\frac{3}{10}$ths. The mouth and palate are furnished with dental processes, more nearly resembling the roughness of a file than teeth; the mouth is small.

This is the fish so commonly known to Europeans as the Eel; it is highly palatable, and in much esteem fried for breakfast. It is rather abundant in all rivers in Dukhun, particularly in rocky pools in the beds of rivers. The usual price is four seers per rupee,—7 lbs. 14 oz. 2 dr. avoirdupois for 2 shillings.

The fish above described differs from Macrognathus armatus, of Dr. Hamilton’s ‘Fishes of the Ganges’ in the palate being beset with dental processes, in the dorsal spines consisting of 40 instead of 37, and in the rays of the pectoral fins exceeding 25. This fish moreover differs from the generic characters of Macrognathus of Lacepède, in the dorsal, anal and ventral fins being united, and in other matters; the fish, in fact, rather belonging to the genus Mastacembelus of Gronovius, figured in the ‘Règne Animal’ (p. 205, fig. 2, pl. 30 of Guérin’s ‘Iconographie du Règne Animal’), but has the characteristic of Notacanthus of Bloch in the union of the dorsal, anal and caudal fins; and it is a question whether it may not constitute a genus intermediate between Mastacembelus and Notacanthus, not having the exact characters of either of these two genera, nor yet those of Macrognathus.

Native name, ‘Waam.’
Fam. *Pharyngiens Labyrinthiformes,* Cuv.

Genus *Ophicephalus,* Bloch.

*Ophicephalus leucopunctatus.*

Tab. LX. Fig. 3.

An *Ophicephalus,* with from 51 to 53 rays in the dorsal, and 6 in each ventral fin, and with the rays of the dorsal and anal fins undivided; the pectoral fins ending in a central point; and the fish covered with white dots.

This fish is of a long and roundish form, and of a reddish or brown-black colour: the head is very flat; the eyes close to the snout, circular, and having yellow *irides.* The dorsal fin has from 51 to 53 rays, and extends from near the shoulders almost to the tail; the anal fin has from 33 to 35 rays, and, commencing at the middle of the fish, terminates near the tail; the pectoral fins have each from 15 to 17 rays; the ventral fins are situated beneath the pectoral, and near to each other, and have each six rays; the rays are divided; the caudal fin has 13 rays, exclusive of two or three minute outer rays: the tail is compressed, not forked, but oval-acuminate at the end. The scales are numerous; the mouth wide, and furnished with very small teeth in double rows. The tail is speckled with white spots, and so are the dorsal and anal fins, and the body is partially speckled with white. A faint longitudinal line is observable on each side of the body, extending from the upper insertion of the pectoral fins to the tail. The length of a specimen brought me at Munchar from the Goreh river was 36 inches, and its weight was 3\(\frac{1}{4}\) seers (6 lbs. 6 oz. 8 drs. 7 grs., avoirdupois). The fish sometimes weighs 6 seers (11 lbs. 13 oz. 4 drs. 8 grs.). The flesh is remarkably firm and sweet, and the bones are small and not numerous: it is much esteemed by the natives, and sells at 4 seers (7 lbs. 14 oz. 2 drs. 18 grs.) per rupee. Found in all the rivers of the Dukhun.

This species differs from the *O. Maulius* of Dr. Hamilton, in having two rays less in the pectoral fins, in the absence of the ocellated spots on the tail-fin, in the dorsal, anal, and tail fins not being rounded behind, and in having numerous white spots; neither is it identical with any one of the species of *Ophicephalus* figured in Russell's *'Coromandel Fishes.'*

I never knew this fish to crawl on shore, or in the grass, as some species of the genus are said to do.

Native name, *'Murrul.'*

Fam. *Gobiadæ.*

Genus *Gobius,* Linn.

*Gobius Kurpah.*

Tab. LXI. Fig. 1.

A *Gobius,* with 7 rays in the first dorsal fin, 11 in the second, which is of similar size with the anal fin; 19 in the pectoral, and 10 in the anal fin.
Subcylindrical, long, straight, greenish-white, chequered brown, semi-diaphanous. Greatest length 7\(\frac{1}{2}\) inches. Very delicate: eyes large, prominent, on the top of the head, and approximating; under jaw longer than upper; head flattened, wider than any part of the body: pectoral fins round, of 19 rays; ventral fins of 6 rays, insertions of both adjoining forming a kind of hood; first dorsal fin of 6 strong rays, rapidly sloping from the first; second dorsal fin with 10 strong rays, nearly equal in length, excepting the first ray, which is only half the length of the others; anal fin in size, situation, and number of rays, corresponding to the second dorsal fin, situated far from the tail-fin: tail oval, acuminate at the end, of 14 rays, independently of 5 conglomerate rays on each external edge. The whole of the rays of the fins, with the exception of those of the ventral, are barred with transverse red-brown bars, which in the tail-fin are confined to the membrane between the rays. Lateral line not discoverable: scales imbricate. Fish not bony, and excellent eating. In an examination of a Kurpah 7\(\frac{1}{2}\) inches long (its largest size) I found the ventral fins united at both extremities, and arranged in a circle on the thorax. The dorsal fins were distinct, but instead of the first fin consisting of 6 rays, it had only 5, and the second dorsal fin had 11 instead of 10 rays. A third specimen examined had 7 rays in the first dorsal fin, and 11 in the second. A fourth specimen was found exactly the same. I have experienced in other genera of fishes that the rays are not rigidly definite in number in different individuals of the same species. Found in the Beema river, at Paigaoon. The Mahratta name is 'Kurpah.'

This fish corresponds very closely in its outline to Dr. Hamilton's drawing of the Gobius giurus, and in its general description; but, independently of discrepancies in the number of the rays of the fins, all the rays of the second dorsal and anal fins of Dr. Hamilton's fish are divided, whereas in the Kurpah they are strong undivided prickles. The first dorsal fin also differs in form. The red-brown bars are also wanting in the Gobius giurus, and it has a marked lateral line. This Gobius has also a general resemblance to Nos. 51 and 53 of 'Russell's Fishes' Koku and Bullee Kokah, but the number of rays and the markings are not the same.

Ord. Malacopterygii Abdominales.

Fam. Cyprinide.

Genus Cyprinus, Linn.

Cyprinus Abramoides.

Tab. LXI. Fig. 2.

A Cyprinus, with 20 rays in the dorsal, 8 in the anal, and 18 in the pectoral fins; without tendrils; with tuberculated nose; red-edged fins; and with a red lunule on each scale.

This is a very large, fleshy, deep fish, somewhat compressed on the sides: the back is ridged, and the belly rounded. Scales large, of a silvery flesh-colour, and each marked with a red lunule, the edges of all the fins being tinged with bright copper-colour: back
much arched: belly nearly as much so: head obtuse-conic. Lateral line in the centre of the body, running straight from the eye to the fork of the tail. Dorsal fin of 20 strong rays, the first two undivided, sloping rapidly; pectoral fins of 18 rays, sharp; ventral fins nearly triangular, of 9 rays, situated a little behind a perpendicular from the first dorsal ray; anal fin of 8 rays, including an anterior double ray, sloping rapidly behind: tail deeply forked, of 19 rays, besides three minute rays outside each longest ray; lobes very sharp, but the line between them sublunate. Fish described, 21 inches long by 7 inches high; width 2\(\frac{3}{4}\) inches. Nose or upper lip with minute tubercles: flesh firm, sweet, and agreeable: bones numerous, but sufficiently large not to be troublesome. The fish is highly esteemed, and to me appears the most valuable of the Corps in India.

The outline of the body of this fine fish, which is called 'Tambra' from the general prevalence of a copper colour in it, is exactly that of the European Bream (Cyprinus Brama), supposing the anal and the dorsal fins changing places.

In 86 species of Cyprinus described by Dr. Hamilton, there are only two which, from the composition of their fins, will admit of the Tambra being compared with them—the Cyprinus Nandina and the Cyprinus Nancea; but the former has 26 rays in the dorsal fin, fringed lips, 4 tendrils, and a smooth nose, and must therefore be set aside. The latter has in every fin precisely the same number of rays as in the Tambra, and corresponds in form, but it has 4 tendrils, no tubercles, and its lateral line and colour are quite different. The Tambra has certainly a close affinity to the Cyprinus Gibellio of Bloch, and, like it, wants the tendrils; but its tuberculated nose, greater size, and remarkable colour, sufficiently distinguish it.

**Cyprinus Potail.**

A Cyprinus proper, deep and fleshy; slightly compressed; without tendrils; with the dorsal fin of 13 rays, pectoral of 14, and anal of 9.

A very deep, high-backed, fleshy fish, compressed but slightly. Scales large and silvery: dorsal fin on the highest part of the back, and having 13 rays, including the first treble ray; pectoral fins of 14 rays; ventral fins of 10 rays, including a very minute bony ray in front of the longest ray; vent far back: anal fin of 9 rays, including the first treble ray: tail forked, of 19 rays, besides 4 or 5 rays outside each longest ray. Length of the fish described, 10 inches; height, 3\(\frac{3}{4}\) inches; width, 1\(\frac{1}{2}\) inch. Brought from Nursewpoor, on the Beema river.

This is a true Cyprinus agreeably to Dr. Hamilton’s subgeneric distinctions, but the number and arrangement of the rays in its different fins will not admit of its being identified with any of the species described by him.

Found in the Beema river, near Taimboornee.
FISHES OF THE DUKHUN.

Cyprinus Nukta.

A Cyprinus, with two tendrils on the under jaw, and with two short horns or bosses on the space between the eyes, which, together with the reflected upper lip, are tuberculated; large scales.

I have mislaid my notes of the number of rays in the fins of this fish, but it is too remarkable, from the character of its head, to be mistaken for any other species of Cyprinus; and as I have drawings of two individuals of the same species, I am enabled to give a sufficient description of it. The natives call it 'Nukta,' from the two knobs or short horns on the nose, between the eyes. I have met with it but at Mahloongeh, 18 miles north of Poona: brought from the Inderanee river. Body subcyindrical and elongated, but higher at the shoulders than in any other part. Of a rich brown colour, softening towards the belly, with a golden reflection, and each scale furnished with a carmine lunule. It does not exceed the length of 5 or 6 inches. Head abrupt; upper lip reflected; chin supplied with two short fleshy feelers; gill-covers rounded; the space between the eyes furnished with two short horns or bosses, which, together with the upper lip, are tuberculated; eyes circular, high up; irides reddish. Dorsal fin before the centre; ventral a little behind a perpendicular from the last dorsal ray; pectoral fins very low down; tail two-lobed; lobes sharpish. Both Mr. Rüppell and Mr. Yarrell, who have done me the favour to look over my fishes, express their belief that the present fish is only a monstrosity of C. auratus, but it is worthy of notice, from its peculiarities. In the domesticated state we meet with these deviations from nature, but where man does not interfere I had thought them rare, and yet in the Dukhun I found them so common as to have a specific native name.

Genus Varicorhinus, Rüppell.

Varicorhinus Bobree.

Tab. LXI. Fig. 3.

A Varicorhinus, with tuberculated nose; without tendrils; with 17 rays in the dorsal, and 8 in the anal fin; with the form of a tench.

An erect tench-like fish, attaining a foot in length. Pectoral fins of 16 rays; dorsal fin of 17 rays, including the first double dorsal ray; ventral fins of 9 rays; anal fin of 8 rays, including minute rays before the longest ray: tail forked, of 19 rays, exclusive of 6 outer minute rays: scales rounded, darkish on the back, softening to silvery towards the belly, with a gloss of greenish-gold; and some of the scales on the centre of the body have a carmine spot. Length of the fish described, 6 inches; height before the dorsal fin, 1/5ths. Head conic; nose tuberculated; head and gill-covers of a brown chestnut colour; gill-plates rounded; eyes far back, circular; pupils surrounded by a yellow and carmine ring; nostrils near the lips: ventral fins situated a little behind a perpendicular from the first dorsal ray. The lateral line is a little below the centre, bent slightly, with the concave side uppermost. Fish full of minute bones, but very
sweet. This species has quite the outline of the Tench, the arch of the back being greater than that of the belly. The Bobree also has the outline, including the fins, of the C. Catla figured by Dr. Hamilton. The discrepancies are in the Catla having one ray more in the dorsal fin, in its nose not being tuberculated, in a larger head, in the scales being marked with vertical lines of dots, and being large, and in its greater size; but all these differences may be dependent on age or locality.

In Rüppell’s ‘Fishes of the Nile’ there is a figure of a species of his genus Varicorhinus (Tab. III. fig. 2.). Cuvier classes the Cyprinus Catla of Buchanan Hamilton, to which the Bobree is so nearly allied, with the division of the gold and silver Carps; but it is a question whether it is not a real Labeo of Cuvier, with long dorsal, no spines or cirri, and thick fleshy lips, frequently crenated.

**Genus Barbus, Cuv.**

**Barbus Mussullah.**

Tab. LXI. Fig. 4.

A Barbus, with 12 rays in the dorsal, 8 in the anal, and 16 in the pectoral fins; with the mouth furnished with 4 very short cirri; and tuberculated nose: sometimes 3 feet and more long, and a foot high, and weighing 42 pounds.

Pectoral fins of 16 rays; ventral of 9 rays; dorsal fin of 12 rays, including the first double ray; anal fin of 8 rays, including the first double ray: tail forked, of 24 rays, including the short rays at each exterior side of the insertion of the tail: a remarkable projecting prominence between the upper lip and nostrils, giving to the fish the appearance of being Roman-nosed: the eyes are situated far back, and between the eyes and the corners of the mouth there are a number of circular, rough, prominent papillae, but these are not constant: corners of the mouth furnished with a short feeler, and the base of the nasal prominence, near the tip, also furnished with one on each side: dorsal fin in the centre of the back, on a prominence which slopes suddenly behind; ventral fins on the centre of the belly, on a perpendicular from the first dorsal ray: tail suddenly narrows below, after the anal fin; anal fin with the posterior angle bluntly rounded off. The lateral line is slightly arched at the shoulder, then falls, and runs straight to the anal fin; over this it rises a little, and then runs straight to the centre of the fork of the tail. The whole of the upper parts of the fish are covered with large, coarse, silvery scales, having blue and red reflections, and on the under parts a yellow tinge prevails; it is very bony, and its length, to the end of the fork of the tail, is 12 inches, and height, 3 inches; but its greatest growth is 5 feet. When small this species resembles the Kolus, but in the latter, the colour is more reddish-silvery: the fins are reddish, and the Mussullah is a much coarser, and infinitely larger fish. A male brought to me at Seroor, from the Goreh river, measured in length 3 feet 4 inches, and in height 1 foot, and weighed nearly 42 lbs. avoirdupois. The flesh
wanted flavour. The Mussullah differs from the Mosal of Dr. Hamilton, in having 1 ray less in the dorsal and pectoral fins, and in the first-rays of these fins being double instead of quadruple; in the latter respect, and indeed in many others, resembling the C. Putitora: it also differs in having the nose and upper lip tuberculated, and in colour. The prominence on the nose is also marked. Russell describes three Barbels, calling them Cyprini, but none of them are identical with the present fish.

Barbus Khudree.

A Barbus, with 4 cirri; blood-stained fins; large hexagonal scales; elongated body; and with 14 rays in the dorsal, 14 in the pectoral, and 7 in the anal fins.

Dorsal fin of from 10 to 12 rays; first long ray a thick strong bone, with 3 very short bones before it; the whole four compact: pectoral fins of 12 perfect rays, and 2 incomplete rays; ventral fins of 9 rays; anal fin of 7 rays: tail forked, of 18 rays, besides 4 short rays outside the longest rays: scales large, hexagonal, and of a silvery bluish-green colour: mouth furnished with 4 short feelers: anal, ventral and pectoral fins tipped with blood-colour. Lateral line concave, below the centre, and corresponding to the arch of the belly: the scales along the lateral line emarginate. Length, 10 inches; height, 2½ inches; greatest length, a foot and a half; weight, from half to three-quarters of a seer. This fish has a considerable resemblance in form, size, and habits, to the Cyprinus Mrigala of Dr. Hamilton; but its blood-stained fins, 4 feelers, and the discrepancies in the number of its fin-rays, sufficiently distinguish it. It is sweet and agreeable food. The same fish, under varied circumstances of age, has the fins tipped with bluish instead of red.

Found in the Mota Mola river, 8 miles east of Poona.

Barbus Kolus.

Tab. LXII. Fig. 1.

A Barbus, with 13 rays in the dorsal fin, 8 in the anal, and 10 in the ventral; with moderate-sized scales; with callous tubercles on the head, and a short cirrus at each corner of the mouth.

Dorsal fin of 13 rays, including the first treble ray; pectoral fins of 14 perfect and 2 imperfect rays; ventral fins of 10 rays; anal fin of 8 rays, including the first double ray: tail forked, of 19 rays, besides four external minute rays beyond each of the longest rays: scales small, silver-grey: snout with minute white tubercles. Length, 11 inches; height 3½; grows to the length of 18 inches, and weight of 1½ seer. Ventrals barely behind a perpendicular from the first dorsal ray. Fish subcylindrical, slightly compressed, fleshy: arch of the back and belly similar: posterior angle of anal fin rounded off. Lateral line sinks a little from the middle of the gills to the end of the ventral fins; thence it rises a little, and afterwards continues straight to the tail. A scaly appendage above the base of each ventral fin: back reddish silver-grey: corners of the mouth furnished with a short feeler. This fish resembles the Mussullah much in form, but the
latter is a larger and coarser fish, and bluer in colour. Very bony, but sweet. Differs slightly from the *Cyprinus Carmeca* of Hamilton, in having 2 rays in the dorsal and 1 in the ventral more, and in the scaly appendage to the ventral fins.

Found in the Mota Mola river, 8 miles east of Poona.

We have in this fish another proof of the extreme difficulty of making generic characters rigidly embrace all the species of a genus. The *Barbels* have four *cirri* ; it ought not, therefore, to be a *Barbel*. But the species of the next genus, *Gobio*, are without *cirri* and without spines, whilst the present species has two *cirri* and a spine in the dorsal; it cannot, therefore, be a *Gobio*; and as its chief characteristics are rather those of *Barbus* than *Gobio*, I have classed it accordingly. However, Cuvier, in the ‘Règne Animal,’ considers the *Cyprinus Carmeca* of Buchanan Hamilton as a *Gobio* or *Gugeon*.

**Genus Chondrostoma, Agassiz.**

The first division of the genus *Leuciscus* of Klein. Dorsal fin in the centre of the back.

**Chondrostoma Kawrus.**  
Tab. LXII. Fig. 2.

A *Chondrostoma*, without lateral line, tubercles, or *cirri*: with 12 rays in the dorsal, 8 in the anal, and 16 in the pectoral fins.

A subcylindrical fish, with a narrow profile and lance-shaped head: back of a reddish-green grey, silvery below. Fins with the extremity of the rays tinted reddish; dorsal fin of 12 rays, situated in the centre of the back, but two rays undivided; pectoral fins of 16 rays; ventral fins of 9 rays, situated on a perpendicular let fall from the centre of the dorsal fin; anal fin of 8 rays, including one short ray before the longest ray. Tail forked, of 19 rays, exclusive of 4 rays on each side of the longest ray; lobes of the tail sharp and equal; lateral line very rare, and when occurring obscure. Length 6 inches (grows to a foot); height 1\(\frac{3}{4}\)ths. This fish has precisely the same number of rays in all its fins as the *Cyprinus Angra* of Dr. Hamilton, but it is abundantly distinct not only in its colour and in the absence of a dotted stripe, but more particularly in the want of a lateral line, which is of more importance than the difference of a ray or two in the fins. The *Kawrus* belongs to Dr. Hamilton's "Morulius" division of the *Cyprinus* family, and it has a close affinity to his *Cyprinus Musiha*, but it is not identical with it. It has much the figure of the European *Barbel*, or rather of the *Salmo fasciatus*. Found in the Beema river, at Seedataik.

**Chondrostoma Fulungee.**

A *Chondrostoma*, with dorsal fin of 10 rays, anal 6, and pectoral of 10; of an elongated, and not much compressed shape.

Pectoral fins small, of 10 rays, situated close to the gills; ventral fins small, of 8 rays, situated in the middle of the abdomen; anal fin of 6 rays, an inch from the caudal fin;
caudal fin of 20 rays, in two divisions; dorsal fin on the centre of the back, of 10
strong rays. General form of the fish salmon-like: scales large, silvery: gills without
bony rays: length about a foot; height nearly 4 inches. Bones somewhat numerous,
of several prongs at each end, easily separating from the flesh: flesh remarkably sweet
and firm. The Fulungee, which bears the same name as the fish closely allied to the
Cyprinus Bacaila, would be referred to Dr. Hamilton’s third subgenus of Cyprinus
"Bangana," but it is not to be identified with any of the species, although in outline it
has a close resemblance to the figure of Cyprinus Mrigala, and has other general points
of resemblance. In 86 species described by Dr. Hamilton, only one, like the Fulungee,
has an anal fin with 6 rays (C. Puntio), but the resemblance ceases here; nor does the
Fulungee belong to the sub-genus Puntio.

Chondrostoma Boggut.

A Chondrostoma, without tendrils or tubercles on the nose; with 12 rays in the dorsal, 15 in the pectoral,
and 8 in the anal fin; body of an elongated form.

Pectoral fins small, of 15 rays, sharp, situated low; ventral fins of 9 rays, small,
situated on a perpendicular let fall from the centre of the dorsal fin; anal fin of 8 rays,
including the first two undivided rays, first ray short; caudal fin of 10 rays, in 2 lobes,
lobes sharp; dorsal fin of 11 rays, besides one short ray in front of the longest, two first
rays osseous and undivided. Fish elongated; from 7 to 11 inches long; 1/3ths to 2
inches high. Scales hexagonal, silvery, reflecting gold and purple, each with a mar-
ginal line of very minute dots. Lateral line in the centre, straight: arches of the back
and belly very low, that of the back somewhat more convex than that of the belly:
eyes large, high up; irides broad, silvery: nostrils double, seated near the eyes. Fish
very bony: flesh dry, somewhat insipid.

This fish has much the aspect of the Cyprinus Orfus; possibly it is a little less deep.
The Boggut belongs to Dr. Hamilton’s third division, or sub-genus ‘Bangana’ of the
Carp family, but differs, in having 2 rays less in the pectoral fins, from the Cyprinus Cata,
and in the scales having strie. The Boggut has much the aspect also of the Cyprinus
boga of Dr. Hamilton’s drawings. In some parts of the country it is called ‘Kolees.’

Chondrostoma Mullya.

Tab. LXII. Fig. 3.

A Chondrostoma, with a short obtuse head, without tubercles or tendrils; sub-cylindrical body, with 11
rays in the dorsal, 14 to 16 in the pectoral, and 8 in the anal fins.

Fish sub-cylindrical: head very short, obtuse; upper lip projecting far over the
mouth; mouth small; a red process or protuberance on the snout, between the nostrils;
a reddish transverse process on the upper lip. Dorsal fin situate a little before the
centre of the fish, of 11 rays, including the first double ray, its edge concave; pectoral
fins of 16 rays, situated very low, longest rays in the centre; ventral fins of 9 rays,
situated a little behind a perpendicular from the first dorsal ray; anal fin of 8 rays, including first double ray. Tail barely two-lobed, the line between the points being concave, of 19 rays, besides minute rays outside the longest rays; lateral line above the centre, straight. This fish does not exceed the length of 5 or 6 inches, and is 1½ to 2 inches in diameter. There are some few handsome spots of carmine about the head, and the eye has a narrow, bright orange iris. The general colour is dark olive, with a play of faint red and copperas-green sometimes on the scales: the fins have a faint orange tint at their extremities: fish firm, sweet, but bony. Found in the Beema river, at Downde.

In 86 species of Cyprinus described by Dr. Hamilton there is not one corresponding to the Mullya, in the arrangement of the rays of the fins; I am constrained, therefore, to consider it a new species. The Mullya approaches a good deal in figure to the Dace of Europe.

**Chondrostoma Wattanah.**

Tab. LXII. Fig. 4.

A Chondrostoma of an elongated form, without tubercles or tendrils, with the dorsal fin high, and having 11 rays; 9 or 10 rays in the ventral, and 8 in the anal fin; and of a sub-cylindrical body. **Length 4½ inches; height ⅚ths of an inch.**

A long sub-cylindrical fish: reddish-brown on the back, softening to silvery under the belly: head not obtuse; eyes far back, circular; irides silvery. Dorsal fin on the centre of the back, of 11 rays, first ray undivided, large and high for the size of the fish; pectoral fins of 14 or 15 rays, sharp; ventral fins of 9 or 10 rays, situated a little behind a perpendicular dropped from the first dorsal ray; anal fin of 8 rays. Tail forked, of 19 or 20 rays, besides 6 short rays outside the longest rays. Lobes sharp, but small, there being some depth of tail-fin previous to the divarication. Lateral line straight, in the centre of the fish. **Length of the fish 4½ inches; height ⅚ths of an inch; does not grow larger.** Found in the Beema river, near Pairganon.

This fish has quite the figure and aspect of the Dace of Europe. The Wattanah belongs to Dr. Hamilton’s ninth, or ‘Garra’ division of the genus Cyprinus, but there is not any species with which it can be identified.

**Genus Chela, Buchanan Hamilton.**

A sub-genus of Leuciscus, with the dorsal fin very far behind over the anal; straight back, and nose on the level of the line of the back.

**Chela Balookee.**

A Chela, of the size of a Minnow: back straight; body elongated; dorsal fin situated far back, and having 8 rays, 14 rays in the anal, and 12 in the pectoral fins.

Size and form of a Minnow: general colour silvery: pectoral fins of 12 rays; dorsal fin of 8 rays, situated where a second dorsal fin is usually found; anal fin of 14 rays:
tail forked, of more than 24 rays, including outer rays: ventral fins of 9 rays, situated on the centre of the belly: point of nose forming a continuation of the line of the back: length, 3 inches. Fish very sweet eating, bones and all, and it is usually served at breakfast, fried; the fishes (ten or a dozen) being arranged laterally, with a silver skewer run through them. Common in all the rivers.

The Balookee belongs to Dr. Hamilton's first division of the genus Cyprinus, having an affinity to the Clupanodon, but it is not to be identified with any of the species described by him.

Chela Oweni.

Tab. LXIII. Fig. 1.

A Chela, with straight back, elongated and vertically compressed body; dorsal fin situated far back, with 11 rays, 12 in the pectoral, and 19 in the anal fins: with scales so minute as to be scarcely discoverable.

Length 5 inches; greatest size 7 inches.

A straight, elongated, much compressed fish: the line of the back being straight, and the snout on a continuation of the same line: the belly arched: top of the head flat, the lower part curving upward from below. The back is of a very light olive-grey: the abdomen shining silvery: pectoral fins of 12 rays, very sharp; dorsal fin of 11 rays, situated very far back near the tail, edge rapidly sloping; ventral fins of 9 rays each, situated a little behind the centre of the fish; anal fin of 19 rays, including three minute rays before the first longest ray: tail forked, of 19 rays, besides 6 small rays outside the longest rays. One lateral line, and this is quite straight, and situated a little above the centre. Length to the end of the rays of the tail 5 inches; depth 1/3ths of an inch: does not grow larger than 7 inches: scales barely discoverable. This fish belongs to Dr. Hamilton's 'Chela,' or first division of the genus Cyprinus, and has quite the outline of the Cyprinus bocaita; but its want of a double lateral line, of scale-like appendages about the ventral and pectoral fins, and its having 2 rays more in the dorsal, and 3 in the anal fins, disable me from considering them identical. Found in most of the rivers in Dukhun.

Russell's figure (199) is a species of this sub-genus, and Russell supposes his fish to be the Clupea Dorab of Forskal (No. 108). Cyprinus Cultratus of Bloch would appear to be the type of the sub-genus.

I have dedicated this fish to my friend Mr. Owen, the distinguished naturalist.

Chela Jorah.

A Chela, with straight back, convex belly, dorsal fin far behind; size of a large Minnow; with 10 rays in the dorsal, 12 in the pectoral, and 8 rays in the anal fin.

A somewhat compressed fish: straightish back, convex belly: size of a large Minnow: back dark, with a purplish shade softening into silver down the sides and abdomen: dorsal fin of 10 rays, situated far back; pectoral fins of 12 rays; ventral fins of 3 and 2
8 rays, situated behind the centre of the fish; anal fin of 11 rays: tail forked, of 18 rays, besides outer short rays: length about 4 inches; height, 1/10ths of an inch: good eating. This fish belongs to Dr. Hamilton's first sub-genus of Cyprinus, 'Chela,' as far as the situation of the back-fin and elongated compressed form is concerned, but it is not described by him. Found abundantly in the Beema river, near Pairgaon.

Chela Teekanee.

A small Chela, with nearly straight back; snout on the continuation of the line of the back; belly arched; with 10 rays in the dorsal, 12 in the pectoral, and 14 in the anal fins.

A compressed fish: back very slightly arched: snout nearly in a continuation of the same line: body deep: belly convex: dorsal fin situated far back, of 10 rays, large for the size of the fish; pectoral fins of 12 rays; ventral fins of 9 rays, situated in front of a perpendicular let fall from the first dorsal ray; anal fin of 14 rays: tail forked, of 18 rays, besides external minute rays. Colour on the back light reddish-brown, softening into silver. Length, 2½ inches; depth, 3/4ths of an inch. Found in the Beema river, at Pairgaon.

This fish also belongs to Dr. Hamilton's sub-genus 'Chela,' for the reasons assigned with respect to the Jorah; but it is not described by Dr. Hamilton.

Chela Alkootee.

An elongated, silver-white, slightly compressed, minute Chela, with the dorsal fin of about 8 rays, very far back; ventral of about 7, and anal of about 10 rays, with burnished silver gill-covers and black orbits.

Although rarely more than an inch long and not much thicker than a good-sized crow-quill, this fish is very beautiful, and is sweet eating. The sides are slightly compressed: the back and belly rounded: back straight: the gill-covers quite smooth, and of a polished silver: pupils black; a black circle surrounds the eyes, and there is a patch of faint yellow on the forehead: all the rest of the fish is of a silver-white colour, and the body is semi-diaphanous. The rays are all so delicate that it is only with a microscope they can be counted, and then not with absolute certainty. Dorsal fin of about 8 rays, situated near to the tail, first ray half as long as the second; ventral fins a little behind the centre of the fish, of about 7 rays; anal fin of about 10 rays, first ray half as short as the second, situated on a perpendicular from the dorsal fin; pectoral fins longer than the head, very sharp, situated low, of about 10 rays. Lobes of the tail sharp, lowest the longest: lateral line quite straight: scales excessively minute.

Genus Leuciscus, Klein.

First division. The dorsal situated a little behind the centre of the back, above the space between the ventral and anal fins.
**Leuciscus Morar.**

*Cyprinus Morar*, Buchanan Hamilton.

A *Leuciscus* allied to *Chela*, but with the dorsal fin a little behind the centre of the back, with 8 rays in each ventral fin, 12 in the anal, and 10 in the dorsal, and with the edge of the belly smooth.

Head and back on the same line: thickish, fleshy fish, somewhat compressed, reddish-grey on the back, softening into silvery below: edges of the scales so raised as to give the fish a reticulated appearance: outline of the fish nearly that of a *Smelt*. Dorsal fin situated a little behind the centre of the back, of 10 rays, including the first double ray; pectoral fins of 14 rays; ventral fins of 8 rays, situated a little before a perpendicular from the first dorsal ray; anal fin of 12 rays, including the first double ray: tail forked, of 19 rays, besides 8 minute rays outside the longest rays: length 4 3/4 inches; depth $1\frac{1}{4}$ inch.

With the exception of a single ray less in the pectoral fins, the *Amlee* has precisely the number of rays of the *C. Morar* of Dr. Hamilton; the situation of the fins and the size and form of the fish correspond with sufficient exactness; and although there are some discrepancies with respect to colour, and one or two other matters, I conceive myself justified in considering them identical.

**Leuciscus Sandhkol.**

A *Leuciscus*, with nearly cylindrical body; dorsal fin of 12 rays, pectoral of 14, and ventral of 10 rays.

Long sub-cylindrical fish: gibbous head: olive on the back; silvery on the belly: dorsal fin of 12 rays, a little before the centre of the fish; pectoral fins of 14 rays; ventral of 10 rays, situated on a perpendicular from third dorsal ray; anal fin of 8 rays, including 1 double ray: tail forked, of 19 rays, besides minute outer rays. 8 to 10 inches long, by 1 1/2 to 2 inches high. Bony: eyes with whitish narrow irdes.

Found in the Goreh river at Kullumb.

**Leuciscus Chitul.**

A *Leuciscus*, with 14 rays in the dorsal, 14 in the pectoral, and 8 in the anal fins; of a reddish-grey colour, and rounded head.

Small sub-cylindrical fish: 5 inches long; height 1 1/2 inch: tail deeply forked: dorsal fin of 14 rays; pectoral fins of 14 rays (possibly 15); ventral fins of 9 rays, situated on a perpendicular from the centre of the dorsal fin; anal fin of 8 fleshy rays: tail of 19 rays, besides small rays outside, tinged with reddish. General colour of the fish reddish-grey. Head rounded.

Found in the Inderanee river, near Chakun.

It being found impracticable to arrange, in any of the sub-genera described, the following fishes of the *Carp* family, it is proposed to place them in a new sub-genus, which I will call by the native Mahratta name of 'Rohtee.'
Rohtee, nov. genus.

Carps, with a lozenge-shaped body, rather long dorsal and anal fins, the former seated on the angle of the back, with the first complete ray serrated posteriorly; scales minute.

Rohtee Ogilbii.

Tab. LXIII. Fig. 2.

A Rohtee, with 12 rays in the dorsal, 9 in the ventral, and 17 in the anal fins; the body very compressed, and very high, with the back sloping to each end from the centre.

An erect, compressed, deep fish: lance-headed: reddish-purplish silvery on the back, softening into silvery below: back angular: dorsal fin situated on the angle, of 10 rays, besides 2 rays before the longest ray; first long ray a strong bone, serrated posteriorly; pectoral fins of 15 rays; ventral fins of 9 rays, situated on a perpendicular let fall from the first dorsal ray; anal fin of 15 rays, besides 2 before the longest ray; tail forked; lobes sharp, but not deep, of 19 rays, besides 8 minute rays on the outside of the longest rays. Eyes very large: head short; mouth descending obliquely. Lateral line arched near the shoulders, thence straight to the tail. Scales not large; uniform over the body. Length, 4½ inches; height, 1½ inch. Fish bony. Found abundantly in the Beema river, near Paigaoon.

The Rohtee has the appearance of Clupanodon Chanpole of Dr. Hamilton; also of Cyprinus decario in the outline of the body; and were it proper to consider it a Cyprinus, which its armed back-fin renders impossible, it would be placed in Dr. Hamilton's eighth sub-genus 'Cabdio.' I have named this fish after my friend Mr. Ogilby, whose contributions to natural history are so well known.

Rohtee Vigorsii.

Tab. LXIII. Fig. 3.

A Rohtee, with armed dorsal fin of 11 rays, ventral of 10, and anal of 28 rays; compressed body; high in the middle, and sloping to each end.

A compressed, lance-head-form silvery fish, with the snout turned up: upper line of the head straight, lower curved upwards from below: greyish light green on the back, white on the abdomen: dorsal fin of 11 rays, including the first ray, which is bony and double, and the second ray long-toothed posteriorly; pectoral fins, including minute rays, 16; ventral fins of 10 rays, and anal fin of 28 rays, including 2 minute rays before the first long ray: tail deeply forked, of 27 rays, including 4 on the outer side of each longest ray; ventral fins in advance of a perpendicular dropped from the dorsal fin: line of the dorsal and anal fins concave: lobes of the tail long and very sharp: dorsal fin situated on the top of a keeled process from the back. Scales very minute, roundish, quite transparent, and becoming invisible on the abdomen: back angular: eyes very
large, and high up. Length, 6 inches; depth, \( \frac{9}{10} \)ths inch: extreme length, 8 inches. Found abundantly in the Bcema river, at Pairgaon. The native name is 'Phenk.'

I have dedicated this fish to my friend Mr. Vigors, the distinguished naturalist.

### Rohitee Pangut.

A Rohitee, of a compressed and deep form, with an angular back, and having 12 rays in the dorsal, 14 or 15 in the pectoral, and 8 in the anal fins, and with the first 3 or 4 rays of the dorsal fin black at their tips.

An erect and somewhat compressed fish: line of the back somewhat angular: dorsal fin situated at the angle: scales rather large: dorsal fin of 12 rays, including the first double ray; pectoral of 14 rays, possibly 15; ventral of 9 rays, situated a little behind a perpendicular from the first dorsal ray; anal fin of 8 rays, including the first double ray: tail forked, of 19 rays, besides minute rays on the outer side of the longest rays: back and head yellowish-brown; silvery towards the abdomen. Brought from the Bcema river, at Nursewpour. Length 5 inches; height 1\( \frac{1}{4} \); width \( \frac{9}{10} \)ths of an inch. First 3 or 4 rays of the dorsal fin black at the tips. I found the same name for the Pangut at Chakun, brought from the Baum river. The Pangut belongs to Dr. Hamilton's eighth sub-genus ('Cabdio') of Cyprinus, and has the outline of body of Cyprinus Coto, but the size of the fins render it otherwise quite distinct, and there is not any other fish of this sub-order with which it can be identified.

### Rohitee Ticto.

Cyprinus Ticto of Buchanan Hamilton.

A Rohitee, 1\( \frac{1}{4} \) inch long, with 4 to 6 black spots on the body; the second ray of the dorsal toothed behind with sharp incurved teeth; with 10 rays in the dorsal, 8 in the anal, and 8 in the ventral fins.

A very beautiful little fish, with a gloss of golden green along the back, and with a lake-silver gloss along the sides and belly, with from 4 to 6 black spots on the body, made up of minute dots; one small spot above each pectoral fin, one larger one is situated on the tail, above the last anal fin ray, and one minute spot, sometimes wanting, near the base of the first dorsal ray. It has the shape of a Sprat, very rarely exceeds 1\( \frac{1}{2} \) inch in length, and most commonly does not approach an inch. Dorsal fin situated on a ridge on the centre of the back, and consisting of 10 rays; the first and second undivided; the first, half the length of the second, the second a bone sharply but minutely toothed behind; pectoral fins of 10 or more rays, situated low down, and very narrow and sharp, the first ray being the longest; ventral fins, situated on a perpendicular let fall from the first dorsal ray, of 8 rays; anal fin of 8 rays, situated midway between the ventral fins and base of the fork of the tail; first ray half as long as the second: the tail suddenly contracts after the anal fin: tail-fins of 2 equal, sharp lobes, and composed of 18 rays, besides small rays. Lateral line very obscure, above the centre, corresponding to the arch of the back. Scales large for size of fish, marked
with numerous minute dots at their base, visible mostly with the microscope. The native name of the fish is 'Tipree.'

Although the Tipree differs from Dr. Hamilton’s Cyprinus Ticto, in having one ray less in the ventral and caudal fins, and one more in the anal, and mention is not made of the occasional spot at the base of the first dorsal ray, I am nevertheless satisfied they are the same from the figure of the Ticto in Dr. Hamilton’s Plates.

Found in the Mota Mola river, at Poona.

Genus Cobitis, Lin.

Cobitis Rupelli.

Tab. LXIV. Fig 1.

A nearly cylindrical scaleless Cobitis, not much thicker than a large goose-quill; from 2 to 3 inches long; with 6 cirri; colour, including the fins, greenish-yellow, with the exception of the belly, which is white; the lateral line marked with short brown bars, and the rays of the dorsal and anal fins similarly barred; tail-fin chevroned with brown.

The head acuminated: eyes high up, and prominent; irides partly golden: dorsal fin of 13 rays, including a minute ray in front of the longest ray, higher and longer than any but the tail-fin; pectoral fins of 12 rays, the central ray the longest; ventral fins of 8 rays, situated behind a perpendicular from the first dorsal ray; anal fin of 8 rays, including the first double ray; tail-fin large, rather notched than forked, the lobes being small, of 19 rays, besides minute rays on the outer side of the longest rays. The head, although acuminated, has the snout rounded: it is unarmed, and there are small cirri at the corners of the mouth, and 4 small ones on the edge of the upper lip, the two intermediate ones being shorter than the exterior. The lateral line runs straight along the side of the fish. The native name is 'Mooreh.'

The Mooreh has a close affinity to the Cobitis Culturio of Dr. Hamilton, but it differs in the number of its rays supporting the fins, and slightly in the arrangement of its colours.

The Mooreh is a very beautiful little fish, is in great esteem for food, and is found in the Beema river, near the town of Taimbournee; in the Mota Mola river, near Poona, and probably in most of the other rivers of Dukhun.

Cobitis Mooreh.

A Cobitis, with the same name of 'Mooreh'; it differs from the preceding only in being of a smaller size, in having 12 rays in the dorsal, and 7 in the anal fin: the head is more obtusely pointed, and there are more dark blotches on it: the transverse dark marks on the body are not arranged along the lateral line and over the back, and alternating with each other: it differs, moreover, in having the tail wedge-shaped, and finally in having very minute scales. The fins have a very light orange tint.

Found in the Mota Mola river, at Poona.
**Fishes of the Dukhun.**

**Cobitis Maya.**

A *Cobitis*, with the same name of 'Mooreh': it differs only from the first in having a prickle under each eye, in having a blunter head, in having but 9 rays in the dorsal fin and 7 in the ventral fins, and in the tail being wedge-shaped, and it differs, moreover, in having excessively minute scales. The above fishes resemble each other so much in aspect, that it requires minute examination to satisfy the mind of their being of different species.

Found in the Mota Mola river, at Poona.

**Fam. Esocidae.**

**Genus Belone, Cuv.**

**Belone Graii.**

Tab. LXIII. Fig. 4.

A *Belone*, with the fin of the tail rounded and emarginate; with both jaws elongated into a quadrangular beak; with very minute scales; and with a dorsal of 16 rays, and anal of 16 rays.

Form long, thin, and cylindrical: length 9 1/2 inches: jaws subulate, almost linear, armed with teeth, those of the upper jaw alternating with those of the lower: jaws 2 inches long: fins all very small: pectoral fins of 10 rays; ventral fins of 6 rays; anal fin of 16 rays; dorsal, or fin above anal fin, and adjoining the tail, of 16 rays: tail 16 rays. Scales excessively delicate, small, thin and silvery: whole fish of a silvery colour; greenish upon the back: bones few: flesh very sweet and delicate: upper jaw a very little shorter than the lower; lower jaw slightly turned up at the tip: teeth large, distant, with many minute teeth between them.

Diffsers from *Esox Cancila* of Hamilton's 'Gangetic Fishes,' in having 1 ray more in the pectoral and tail-fins, and 1 ray less in the dorsal, and 2 in the anal fin, and in having minute scales. But a comparison of Dr. Hamilton's drawing with mine proves that they are very closely allied.

Found in the Mota Mola river, at Poona.

Although a freshwater fish, like its congener the *Belone vulgaris* of the European seas, it has its bones tinged greenish.

**Fam. Siluridae.**

**Genus Schilbe, Cuv.**

**Schilbe Pabo; Silurus Pabo, Buchanan Hamilton.**

A *Schilbe*, with the tail divided into 2 unequal lobes, both pointing downwards, with 4 cirri, 2 shorter than the head, and with from 68 to 70 rays in the anal fin.

Very high at the shoulders, and gradually narrowing to the tail: fish compressed and thin: both lobes of the tail pointing downwards: head suddenly narrowing, and flatten-
ing from the high shoulders; snout a little turned up, without scales; mouth wide and rounded; jaws set with numerous minute sharp teeth: 2 cirri on the upper lip, extending to the end of the pectorals, and 2 short capillary feelers on the chin: dorsal fin on the shoulders, near to the head, of 4 rays only; very small, with the first ray ending in a thread; membrane between them quite transparent: pectoral fins of 14 to 16 rays, first ray bony, and serrated posteriorly, and ending in a whalebone-like substance; ventral fins of 8 rays, very small, roundish, on a perpendicular from the last dorsal ray; anal fin commencing at the ventral fin, and continuing to the tail, of from 68 to 71 rays: tail deeply forked, of from 17 to 18 rays, besides 2 or 3 minute outer rays: the jaws red: a good deal of reddishness about the head and breast, with a fine play of metallic colours: back dark silver-grey, passing into silver-white on the belly: flesh sweet, but not firm: not bony. From 12 to 15 inches long, by 2½ to 3 inches high. In different parts of the country it is known by the name of ‘Googul,’ ‘Goolee,’ and ‘Purwa.’

Although the Googul has 1 ray in the dorsal, 2 in the pectoral, 2 in the ventral, and 2 in the anal fins, less than in the Silurus Pabo of Dr. Hamilton, from his drawing I am satisfied the two fish are identical. This fish is frequently confounded by fishermen in the different parts of the country with the Goolee, an Hypophthalmus.

**Silbee Boalis; Silurus Boalis, Buchanan Hamilton.**

Tab. LXIV. Fig. 2.

A Schilbe, with the fin of the tail divided into 2 unequal lobes; with 4 cirri, of which 2 extend to the middle of the fish; all the fins unarmed; dorsal of 5 rays, pectoral of 15; ventral fins very small, of 9 rays; anal fin of 84 rays.

This fish has the head broad and flat, with the tail cleft, and composed of 18 rays, one segment in the line of the body, the other striking downwards: both lobes small: no scales: breast has a broad reticulated appearance: upper jaw with 2 tentaculce, 6 inches in length: lower jaw with 2 cirri ⅔ths of an inch long: the back has a bluish silvery appearance: belly white. Attains the length of 3 feet, and weight of 4 seers. Differs only from the Silurus Boalis of Dr. Hamilton in having 1 ray less in the ventral and 2 in the anal fins. Flesh esteemed by the natives, but not pleasant to the European palate.

Found in the Mota Mola river, at Kowree, near Poona. Its Mahratta names are ‘Purras’ and ‘Worshoorah.’

This is probably No. 165 of Russell’s fishes, called ‘Wallagoo.’ In wanting the second dorsal fin this fish resembles the well-known Silurus glanis of Europe; but its vertically compressed body, independently of other differences, separate it from the genus Silurus; and yet, as it wants the serrated prickle in the dorsal, it is rather a Silurus than a Schilbe, particularly as it has only 4 instead of 8 cirri; but the number of cirri is certainly not a generic character.
Fishes of the Dukhun.

Genus Hypophthalmus.

Spix, in his Brazilian fishes, has separated this genus from the multitudinous Pine-
lodi: its chief characteristics are the form of the head and shoulders, the length of the
anal fin, and the extreme smallness of the second adipose dorsal, and the situation of
the eyes; but it approximates so closely to Cuvier's genus Schilbe, that the necessity for
its separation may be doubted.

Hypophthalmus Goongwaree.

Tab. LXIV. Fig. 3.

An Hypophthalmus, with 8 cirri, all longer than the head, but not extending to the middle of the fish; with
7 rays in the dorsal, and 52 in the anal fin.

Pectoral fins of 10 rays; first dorsal fin of 7 rays, and situated on the shoulders; the
first ray in the pectoral and first dorsal fins is a posteriorly serrated spine; second dorsal
fin very minute and fleshy, standing at an angle of 45°, small at its insertion, widening
at its extremity. Ventral fins of 6 rays; very small: anal fin of 52 rays, and extending
from the vent to the tail: tail deeply forked, of 18 rays; lobes large and sharp: vent
before the middle: mouth furnished with small teeth, and with 8 cirri or feelers, 4 on
the under jaw and 4 on the upper, all longer than the head, but none reaching to the
middle of the fish: head depressed: body very much compressed, elongated, without
scales, of a silvery hue, greenish along the back: eyes large, situated very low down,
and near to the mouth; dull. Lateral line straight from the snout to the fork of the
tail. Greatest size 28 inches long.

Found in the Mota Mola river, at Poona. Mahratta names 'Googlee' and 'Goongwaree.'

The Googlee has so much the aspect of the Pinelodus Vacha of Dr. Hamilton's draw-
ing, that I would consider them identical, but that the pectoral fins have 6 rays less, and
the anal 2 more; the posterior edge of the dorsal fin leans backward, and the posterior
edges of the tail-fin are straight, and the fish is without dots of any kind. In other re-
spects the two fishes correspond. Russell has not any of his Siluridae resembling the
Googlee.

This fish has the high shoulder and other characters of Schilbe, but having a second
dorsal fin, it belongs to the genus Hypophthalmus of Spix; but it may be well doubted
whether so slight a variation constitutes a generic difference. Cuvier has not made the
distinction. Vide Spix (Pl. IX. and XVII.).

Hypophthalmus Taakree.

Tab. LXIV. Fig. 4.

An Hypophthalmus, with 8 cirri, 2 of which reach to the ventral fins; 2 very minute cirri near the nostrils,
and 4 on the chin, nearly as long as the head; with the first dorsal and pectoral rays serrated on the
posterior edge, and with 8 rays in the dorsal and 50 in the anal fin.
An elongated, compressed fish: head flat: eyes so much on the edge or side of the head as to be seen in half their diameter from below: dorsal fin of 8 rays, first ray a double bone serrated behind, situated near the shoulders; second dorsal fin a spatulate membrane; pectoral fins of 12 rays, first ray a strong bone, sharply toothed on the posterior edge; ventral fins of 6 rays, situated a little behind a perpendicular dropped from the last ray of the first dorsal fin; anal fin of 50 rays, not reaching to the tail: tail deeply forked, of 28 rays, including 6 small rays beyond the longest ray on the under lobe, and 5 on the outside of the longest ray on the upper lobe; point of upper lobe as low as the line of the back, the tail being bent downwards from the end of the second dorsal and anal fins: mouth furnished with 8 tentaculae, of which the 2 smallest are situated close to the nostrils, 2 long ones (3½ inches long) are placed on each side of the upper lip, reaching to the end of the ventral fins, and 4 are on the under lip, arranged two and two, and they are nearly as long as the head: the snout nearly on a line with the level of the back, which is very slightly raised: belly more arched than the back. Length of the fish 9 inches; height 2 inches: back slate-colour, silvery on the sides and abdomen: neighbourhood of the eyes reddish. Bears some resemblance in form and colour to the Goongwarree, but grows to the size of a foot, the latter never exceeding 7 inches.

Found in the Beema river, near Pairgaon. The Mahratta name is 'Taakree.'

Neither Hamilton nor Russell have any fish identical with the Taakree.

**Genus Bagrus, Cuvier.**

**Bagrus Yarrelli.**

Tab. LXV. Fig. 1.

A *Bagrus*, with the first rays of the pectoral and dorsal fins terminating in long fleshy tendrils, and serrated behind; with 8 cirri, two of which are as long as the head, thick, fleshy, and being lateral elongations of the upper lip; other cirri very short; head broad, covered with a granulated bony plate; the fish olive-brown, marked with black blotches like a Dalmatian dog; second dorsal fleshy, triangular.

A remarkably flat and broad-headed fish: eyes very small and distant from the nose; pectoral fins of 13 rays, the outer ray a bone serrated behind, elongating into a fleshy thread; first dorsal fin of 8 rays, the first ray a very short bone, the second a prickle, terminating in a fleshy thread, extending beyond the membrane; second dorsal fin without rays, fleshy, triangular; ventral fins of 6 rays, situated behind a perpendicular from the last dorsal ray; anal fin immediately below the second dorsal fin, of 12 rays: tail deeply forked, of 17 rays, besides 8 minute rays outside the largest rays, the longest rays terminating in long fleshy fibres: mouth furnished on each side with two long, fleshy, thickish feelers, which appear to be lateral elongations of the upper lip: nostrils close to the base of the labial feelers, and each having at the mouth side a small, erect, fleshy fibre: lower jaw with 4 short feelers. Colour of the fish deep olive-brown, towards the belly yellowish brown, and marked with spots like a Dalmatian dog.
Length 18 inches, but attains to a very great magnitude, and requires, when caught, to be secured with cords. The fish is remarkably ugly: keeps always to the ground: teeth isolated, sharp and strong, prickle-like; not on tongue or palate.

The Kheerd has many features in common with the Pimelodus Cagarius of Dr. Hamilton, but some discrepancies compel me to consider them distinct. The discrepancies are in the granulated plate of the head, in the first pectoral ray being serrated posteriorly, in having one ray less in the anal fin, and in the spotted colour of the fish, instead of being marked in black blotches.

Found in the Mota Mola, at Poona. In different parts of the country it is known by the names of 'Kheerd,' 'Moolandah' and 'Guwch.'

Russell has not any fish resembling the Bagrus. The Silurus ascita of Bloch (Pl. XXXV. fig. 2.) approximates to the Bagrus.

I have named this fish after my friend Mr. Yarrell, who is so well known to ichthyologists, and to whom I am happy to make my acknowledgements for his judicious advice in the arrangement of my fishes.

**Bagrus Lonah.**

A Bagrus, with 8 small cirri; flat, granulated head; first dorsal fin of 7 rays, and pectoral of 10 rays, the first ray of which is furnished on the posterior edge with long sharp teeth; anal fin of 10 rays.

Head flat; snout round, furnished with 8 small tentacles, 2 on the upper lip, 2 on the nostrils, and 4 on the under lip: eyes small: pectoral fins of 10 rays, first ray a bone furnished on the posterior edge with long, sharp, distinct teeth; dorsal fin of 7 rays, first ray a bone; second dorsal fin a triangular fleshy excrescence; ventral fins of 6 rays, situated behind a perpendicular from the first dorsal fin; anal fin of 10 rays: tail forked, of 17 rays, besides 4 minute rays outside of each longest ray. reddish brown, maculated with blackish. Native name 'Lonah.'

**Genus Platystoma.**

Platystoma is a genus of Agassiz; in Spix and Agassiz 'Fishes of Brazil,' separated from the Pimelodi. Its principal features are the flat and elongated form of the mouth and head, and the peculiarly formed body; but it approximates very closely to the genus Sorubim of Spix.

**Genus Platystoma, Agassiz.**

**Platystoma Seenghala.**

Tab. LXV. Fig. 2.

A Platystoma, with the tail-fin crescent-shaped, lobes unequal; with 8 cirri, two of which only are longer than the head, reaching to two-thirds of the length of the fish; the first ray of the pectoral and ventral fins serrated behind.

Pectoral fins of 9 rays, first ray bony and serrated on the posterior edge; dorsal fin
of 8 rays, long, edge straight and sloping rapidly; ventral fins situated very far back, of 6 rays, first ray bony and serrated on the posterior edge; anal fin of 12 rays; second dorsal fin a long, thin, fleshy excrescence, terminating in a blunt point; tail crescent-shaped, approaching to forked, of 24 rays, including minute rays at the base of the longest and first ray; upper lobe the largest. Head remarkably flat and elongated; snout quite rounded and furnished with 8 cirri, 4 from the upper and 4 from the lower jaw; a bony plate on the head singularly marked with lines in regular forms; eyes far removed from the mouth. Fish long, somewhat roundish: colour, along the upper surface of the body, purplish grey, softening down to silvery on the lower surface: a chocolate spot at the posterior junction of the second dorsal fin with the body. Length \(8\frac{1}{2}\) inches; height \(1\frac{1}{4}\) inch; but grows to a great size: has a silvery appearance. Flesh heating, and not brought to the tables of Europeans. Two of the feelers of the upper jaw two-thirds of the length of the fish. This fish is remarkable for having the first ray of the ventral fins, as well as that of the pectoral, serrated posteriorly, and the first dorsal spine not serrated. Found in the Mota Mola river, at Poona. The Mahratta name is 'Seenghala.'

It is closely allied to the *Pimelodus Olor* of Hamilton. Russell has not any fish resembling it. Bloch's *Silurus fasciatus* (366) has the form of the *Seenghala*, and it is closely allied to species of the genus *Sorubim* of Spix (Tab. 13, 14 and 15.). The *Seenghala* would be a *Bagrus* of Cuvier.

**Genus Phractocephalus.**

*Phractocephalus* appears to be a very valid genus of Agassiz in the 'Brazilian Fishes.' Its chief features are the armature of the head, the elongated and pointed shoulder-blade, and the doubly-serrated, flat, bone-like first ray of the pectorals.

**Genus Phractocephalus, Agassiz. Pirarara of Spix.**

**Phractocephalus Kuturnee.**

Tab. LXV. Fig. 3.

A *Phractocephalus*, with 6 cirri, 2 of which only are longer than the head; the first pectoral spine serrated on both edges; the first dorsal spine on the posterior edge only; these two spines terminating in a filament; the shoulder-bone elongated into a point behind. Dorsal fin of 7 rays; pectoral of 9 rays; ventral fin small, of 7 rays; second dorsal replaced by a small adipose fin.

Fish oblong, subrotund, bluish, with a golden reflection along the back, silvery towards the abdomen. Mouth furnished with 6 cirri, 2 on the upper lip (the longest reaching as far as two-thirds of the length of the pectoral prickles), 2 on the under jaw, and 2 capillary cirri issuing from the nostrils: eyes remarkable for being covered with a case in which there is only a minute oblong aperture for the sight, the greatest diameter being horizontal. Dorsal fin of 7 rays, first ray a strong bone, \(1\frac{1}{4}\) inch long, serrated
slightly posteriorly and anteriorly, and terminating in a long flexible filament, each ray rapidly shortening from the first, and extending beyond the membrane; pectoral fins of 9 rays, the first ray a strong compressed bone, 1½ inch long, serrated anteriorly, and dentated with long, thin, sharp teeth posteriorly, and terminating in a long flexible filament; second dorsal fin membranous, small, oblong; ventral fins small, of 7 rays, situated considerably behind a perpendicular from the first dorsal ray; anal fin of 12 rays, the first half the length of the third, and thence rapidly shortening: tail forked, of 17 rays, exclusive of 7 minute rays on each side of the longest ray: greatest length 6 inches. The fish, although bony, is esteemed. Found in the Beema river, at Pairgaon, in great numbers. This fish has so much the character of the *Pimelodus viridescens* drawn in Dr. Hamilton’s ‘Fishes of the Ganges,’ that I should have considered them identical, did not the posterior and anterior serrated edges of the first pectoral and dorsal rays, and each of these rays terminating in a long filament, forbid it. It will be seen also, in a comparison of the drawings of the *Kuturnee* and *Pimelodus gagora* of Dr. Hamilton, that there is a close resemblance in their outlines; but the fishes are decidedly distinct. Russell has not any fish resembling it. The Mahratta name is ‘*Kuturnee.’

This genus of Agassiz would appear to differ from the genus *Doras* of Lacepède, in wanting the armature along the lateral line. *Vide* also *Pirarara bicolor* of Spix (Tab. 6).

**Phractocephalus Ichkeea.**

Tab. LXVII. Fig. 1.

*A Phractocephalus*, with 8 cirri, 2 of which, from the upper lip, extend to the end of the pectoral fins, the other 2 on the nostrils, very minute, with the 4 on the chin nearly as long as the head; with the first ray in the pectoral fins only serrated; with 8 rays in the dorsal, and 12 in the anal fins; with a sharp prolongation of the scapula.

A very pretty, minute, subcylindrical fish, 2 inches long: colour yellowish glossy silver, inclining to greenish on the back, and silvery on the belly; marked with dark bluish brown broad spots along the back, head, and at the base of the rays of the tail. Dorsal fin of 7 rays, outline concave, first ray a bone; second dorsal fin an elongated, erect, transparent membrane; pectoral fins of 10 rays, first ray a strong bone, serrated posteriorly; ventral fins of 6 rays, situated a good deal behind a perpendicular from the first dorsal ray; anal fin of 12 rays, outline concave: tail deeply forked, of more than 24 rays: head roundish; snout obtuse; eyes high, small, circular.

This fish has quite the outline of the *P. Tengana*, figured in Dr. Hamilton’s ‘Fishes of the Ganges,’ but 2 of its tendrils extend to the end of the pectoral fins, and the number of the rays differ in the fins; I am constrained, therefore, to consider it a new species. Found in the Beema river, near Pairgaon.

This fish presents some deviations from those generic characters which it is so difficult to fix in the inosculating transitions to be met without, throughout the family of the *Siluridae*. It has the remarkable spine-like shoulder-blade of the *Kuturnee* and *Gograh*;
and yet its first ray of the pectorals is only sawed posteriorly, and the first ray of the dorsals not serrated at all. The Mahratta name is 'Itchkeea.'

**Phractocephalus Gogra.**

Tab. LXVI. Fig. 1.

A *Phractocephalus*, with 4 shortish *cirri*; the plates of the shoulder elongated into acute, angular, broad spines, with a dorsal fin of 8 rays, first ray a bone serrated behind; pectoral fins of 10 rays, the first ray a broad compressed bone serrated on both edges; anal fin with 13 or 14 rays.

Subcylindrical, depressed head, remarkably flat and broad, and rounded; broader than any part of the body. A bony plate on each side of the thorax projecting into an excessively strong, flat, acute, angular, pointed spine \(\frac{2}{3}\)ths of the length of the head, but its edges are enveloped in the skin of the body. Mouth furnished with 4 *cirri*, one on each side of the upper lip and two on the under jaw, distant from the lip and distant from each other. Pectoral fins of 10 or 11 rays, first ray a broad compressed bone, serrated on both edges; dorsal fin of 8 rays, first ray serrated very minutely posteriorly; second dorsal fin an erect fleshy process, arched and projecting into a kind of lobe; ventral fins of 8 rays, situated a little behind a perpendicular let fall from the last dorsal ray; anal fin of 13 or 14 rays, including 4 or 5 minute rays in front of the longest ray: tail forked, of 17 rays, besides minute rays on the outside of the longest rays: flesh heating. Size of the fish described, 6 inches long; \(1\frac{2}{6}\)th inch high; width across the head \(1\frac{3}{6}\)th inch. Found in the Beema river, at Seedataik, and Mota Mola river, at Poona. It is a lurking fish, keeps near the ground and in dark places, and has the habits of a *Cottus*.

In different parts of the country it is known by the Mahratta names of 'Gograh,' 'Kheerurh,' and 'Puttar Chattah.'

**Genus Pimelodus, Lacepède.**

**Pimelodus Seengtee.**

Tab. LXVI. Fig. 2.

A *Pimelodus*, with the caudal fin divided into 2 unequal sharpish lobes, and having 8 *cirri*, 2 of which reach to the tail-fin, and 4 to the end of the head, and 2 are shorter than the head; the dorsal fin high and without spine, of 9 rays, 12 rays in the anal fin; the second dorsal adipose, and extending from the termination of the first dorsal to near the tail.

Mouth furnished with 8 *cirri*, 2 six inches long on each side of the upper lip, and turning backwards, 2 short capillary at the nostrils, and 4 on the under lip, arranged two and two, as long as the head. First dorsal fin of 8 rays—rays strong and large, first ray bony; second dorsal fin an erect membrane, commencing at the termination of the first dorsal fin, and continuing \(2\frac{1}{2}\) inches, in an arched form, low before and high behind, to the tail; pectoral fins of 10 rays, first ray a strong bone, strongly serrated posteriorly; ventral fins of 6 rays, situated on a perpendicular let fall from the last
dorsal ray; anal fin of 10 rays, besides 2 minute rays before the longest ray: tail deeply forked, of 17 rays, besides several minute rays outside the longest rays; upper lobe of the tail the longest: length of the fish 6 inches. Found in the Beema river, at Pairgaon. Differs from the *Pimelodus Carassius* of Dr. Hamilton in having one ray less in the pectoral fins, and one in the anal fin; in the absence of spots on the fins, and in other particulars. In the illustrations of Cuvier's 'Genera of Fish' by Guerin (Pl. LIII. fig. 1), a fish called *Porcus Bayad*, Geoff., has a close resemblance to the *Seengtee*; and in the notes to the 'Régne Animal' the *Porcus* is considered a *Bagrus*.

The Mahratta names for this fish are 'Seengtee' and 'Soorah.'

**Genus Ageneiosus**, Lacepède.

**Ageneiosus Childreni.**

Tab. LXVI. Fig. 3.

An *Ageneiosus*, without *cirri*; with the first ray of the dorsal and pectoral fins serrated on the anterior edge only; with 8 rays in the dorsal and 42 in the anal fin; with two sharp lobes to the tail, the upper being somewhat the smallest.

The form of the fish is somewhat lance-head shaped.

Pectoral fins of 12 rays, longest and outer ray serrated on the anterior edge; ventral fins of 6 rays, in the middle of the abdomen; first dorsal fin of 8 rays, the first ray bony and serrated on the anterior edge, situated a little behind the shoulders, its edge nearly perpendicular; second dorsal fin near the tail, without rays, fleshy, minute, oblong, standing at an angle of 45° to the back; anal fin of 42 rays, extending from near the ventrals to the tail; edge somewhat concave, first ray the longest: tail forked, of 30 rays: fish of a silvery appearance: deep or high, and somewhat compressed: shoulders high: snout flat; teeth sharp and distinct in both jaws; eyes far forward, at the sides of the head, longest axis of the pupil vertical: length of the fish 18 inches; depth 4½ inches; grows to a much larger size: flesh sweet and juicy, but not firm. A comparison of my drawing with the description of *Ageneiosus mino* of Dr. Hamilton's 'Fishes of the Ganges,' will show how many features there are in common between it and the *Parree*; but its height and compressed body, and the extent of the anal fin, at once fix the latter as a distinct species. Found in the Mota Mola river, at Poona. *Pimelodus Silorida* of Buchanan Hamilton (Tab. VII. fig. 50) is also an *Ageneiosus*.

*Ageneiosus Childreni* is known in the Deccan by the Mahratta names of 'Parree' and 'Sillun.' I have dedicated it to my friend Mr. Children, of the British Museum.

**Family Clupeidæ.**

**Genus Mystus; Notopterus**, Lacepède.

The genus *Mystus* of Buchanan Hamilton, as described p. 233, 'Fishes of the Ganges,' but not the *Mystus* of Cuvier: *Mystus radiis branchiosteges utrinque plus tribus; ventre carinato; prima ani longa cum caudali unita; dorso minopterygio.
Mystus Badgee.
Tab. LXVII. Fig. 2.

A Mystus, with not less than 105 rays in the anal fin, 7 or 8 in the dorsal; with the last gill-cover plate minutely crenated on its posterior edge, and with the anal fin terminating the body in a point; ventral fins none, or so minute as to escape observation.

Form of the fish broad lance-head shaped.

Posterior edge of the last gill-plate crenate; the lower ridge of the cheek-bone set with numerous minute square teeth. Dorsal fin of 7 or 8 small rays, branched, excepting the first, seated a little behind the centre of the back; pectoral fins of from 13 to 16 branched rays, small; anal fin extending from near the pectoral fins to the extremity of the fish, of 105 rays or more; ventral fins joined and surrounding the vent, of from 2 to 4 rays, but the fins are so minute as usually to escape observation: tail only in the continuation of the anal fin, and terminating in a point on the plane of the lateral line. Fish very much compressed. lance-head shaped, but deepest at the shoulders; length 11 inches; height 3 inches: vent before the extremity of the pectoral fins. A dark, irregular, lengthened, very smooth, shining cavity over each eye, besides two minute, oval, similar hollows further up the head. Scales very minute, steel-gray along the back, passing into white silvery at the belly: lateral line arched near the shoulders, thence straight to the tail: belly so compressed as to be comparatively knife-edged: the belly is grooved and minutely serrated on each edge from the throat to the vent: the back is rounded. The upper and lower jaws set with numerous minute teeth, scattered along the edge of the jaws; the tongue is set with many incurved teeth. Eyes circular, high up, near the snout; irides yellowish: fish very bony: flesh firm; not esteemed. Found in the Mota Mola river, at Poona, and in the Beema river, at Seedataik. In different parts of the Dukhun this fish is called by the Mahratta names of 'Challut,' 'Badgee,' and 'Putrah.'

This fish should constitute a new genus in Pisces of the order Apodes; for although Dr. Hamilton in his specific characters gives ventral fins with a definite number of rays, six or seven individuals were examined by me without my discovering them, and the fish from which the drawing was made was absolutely destitute of them. An eighth specimen, which I have preserved in spirits, has a minute fin surrounding the vent, but I cannot testify positively to the number of its rays, and I would rather look upon it as a defensive process for that organ. Of the three species of Mystus described by Dr. Hamilton, the Challut has a very considerable affinity to M. Kapirat, which Bonnaterre considered as a Gymnotus, and Lacepède a Notopterus; it nevertheless has specific differences. This is no doubt of the genus Notopterus of Lacepède; but as Buchanan Hamilton established the genus, I necessarily give his characters precedence.
Order Apodes.
Family Murénidæ.
Genus Anguilla, Cuvier.
Anguilla Elphinstoney.
Tab. LXVII. Fig. 3.

An Anguilla, with the lower jaw the longest; with the back, tail, and anal fins united, and with a broadish, flat head; body dark green, blotched with black; with 2 short tubular processes, one on each side of the upper jaw. Attains the length of 3 feet, and diameter of 3 inches.

Head wider than body; eyes very small and circular; irides yellowish: fish thick for the Eel family: the pectoral fins are small and with the longest rays in the centre; the dorsal fin commences behind the shoulders and continues to the tail; the rays in it are not very conspicuous from the thickness of the membrane; the anal fin commences from the centre of the fish, and continues to the tail, the dorsal and anal fins uniting in the tail. The skin of this fish, in a mature state, is remarkably beautiful, being of a dark green, maculated black; the spots being of irregular forms and running into each other occasionally. The breathing is by two small lunate spiracles close to the pectoral fins; the nostrils have two fleshy processes; the jaws and palate are set with minute teeth. A fish brought to me at Poona, measured three feet long by three inches in diameter—the fish being nearly cylindrical: flesh firm and sweet. The skin has a curious and beautiful appearance of minute plaited or basket-work. This fish has all the generic characters of the Anguilla of Shaw, and is an undoubted Eel; but with the exception of the absence of mention of spiracles by Dr. Hamilton, has a certain correspondence with his Murena maculata of Lacepède, which is, however, a sea-fish, with pointed head. It has the form of Chaukoo Parnoo, or Malgumarus (Murena Anguilla, Linn.) of Russell's 'Fishes of the Coromandel Coast,' but differs entirely in colour and in having cirri. I have dedicated this fine fish to the Honourable Mounestewart Elphinstone. Its Mahratta name is 'Aheer.'

In concluding my characters of the fishes of Dukhun (Deccan), I may be allowed to state that I have found the number of cirri, whether in the Siluridae or Cyprinidae, insufficient as a generic character; different species of the same genus varying in the number of their cirri.

Note.—Although the preceding details respecting the Fishes of the Dukhun were comprised in a report presented to the Court of Directors of the East India Company in June 1831, they were only communicated to the Zoological Society on the 27th of November, 1838, almost contemporaneously with a communication made to the Asiatic Society of Bengal on the Indian Cyprinidae, by John McClelland, Esq., Assistant-Surgeon in the Bengal
Army. The Asiatic Society of Bengal having taken precedence of the Zoological Society in the publication of Mr. McClelland’s voluminous, extensively illustrated, and able paper, the names of any of my new species of Cyprinidae, therefore, which are common to Mr. McClelland and myself, must give way to those fixed by Mr. McClelland.

London, 27th February, 1841.
XXVI. On the Osteology of the Marsupialia. By Richard Owen, Esq., F.R.S., Sc. Hunterian Professor of Anatomy at the Royal College of Surgeons.

Communicated October 9, 1838.

The species of the Marsupial Animals can never be clearly defined or satisfactorily recognized, until their osteological characters, and more especially those derivable from the structure of the cranium, are accurately described and delineated; and on this account the following anatomical essay seems not inappropriate for the pages of the Zoological Transactions. The experiments and observations which I had the opportunity of making some time ago¹, upon the generative œconomy of the Marsupials, led me to pay more particular attention to the organization of this singular and interesting group of animals; and I am induced to submit to the Society the result of my observations on the osseous system, both from its remarkable physiological modifications, and on account of its application to the zoology of the Marsupialia.

I have studied this part of the anatomy of the Marsupialia in the skeletons and skulls which are preserved in several museums in this country, as well as in the Museums of Comparative Anatomy at Paris and at Leyden; and although at first my object was simply to collect facts bearing upon the physiology, the affinities, and the specific characters of the individual under examination, I was soon led, by a comparison of my notes, to appreciate a more general diffusion of certain remarkable osteological conditions than could have been anticipated from the varieties of form and locomotion in the different members of the marsupial group.

As these general osteological conditions corroborate the inference which I have drawn from my investigations of the sanguiferous² and cerebral³ systems of the Marsupialia, as to their natural association in a distinct group, and as some of the peculiarities of the skeleton at the same time illustrate the affinity of this group to the oviparous type of the vertebrate structure, I am induced to premise the following general observations on the osteology of the Marsupials⁴ to the notices on the modifications of the skeleton in particular species and families, which I propose subsequently to communicate to the Society.

Of the Skull.—The form of the skull varies much in different marsupial animals, but it may be said in general terms to resemble an elongated cone, being terminated by a

³ Philosophical Transactions, 1837, p. 87.
⁴ This memoir was communicated and read before the Prospectus (Avril 1839) of M. De Blainville's 'Osteographic' had appeared.
vertical plane surface behind, and in most of the species converging towards a point anteriorly; it is also generally more depressed or flattened than in the placental Mammalia. The skull is remarkable in all the genera for the small proportion which is devoted to the protection of the brain, and for the great expansion of the nasal cavity immediately anterior to the cranial cavity.

In the stronger carnivorous species the exterior of the cranium is characterized by bony ridges and muscular impressions; but in Myrmecobius and in the smaller herbivorous species, as the Petaurists and Potoroos, the cranium presents a smooth rounded surface, as in Birds, corresponding with the smooth unconvoluted surface of the simple brain contained within.

The breadth of the skull, in relation to its length, is greatest in the Wombat¹ and Ursine Dasyure², in which it equals three-fourths of the length, and least in Perameles lagotis³, in which it is less than one half.

The occipital region, which is generally plane, and vertical in position, forms a right angle with the upper surface of the skull, from which it is separated by an occipital or lambdoidal crista. This is least developed in the Myrmecobius, Petaurists and Kangaroo, and most so in the Thylacinus and larger Opossums, in which, as also in the Koala, the crest curves slightly backwards, and thus changes the occipital plane into a concavity, well adapted for the insertion of the strong muscles from the neck and back. The upper surface of the skull presents great diversity of character, which relates to the different development of the temporal muscles, and the varieties of dentition in the different genera.

In the Wombat the coronal surface offers an almost flattened tract, bounded by two slightly elevated temporal ridges, which are upwards of an inch apart posteriorly, and slightly diverge, as they extend forwards to the anterior part of the orbit.

The skull of the Opossum presents the greatest contrast to that condition, for the sides of the cranium meet above at an acute angle, and send upwards from the line of their union a remarkably elevated sagittal crest, which, in mature skulls, is proportionally more developed than in any of the placental Carnivora, not even excepting the strong-jawed Hyæna.

The Thylacine and Dasyures, especially the Ursine Dasyure, exhibit the sagittal crest in a somewhat less degree of development. It is again smaller, but yet well marked, in the Koala and Perameles. The temporal ridges meet at the lambdoidal suture in the Phalangers and Hypsiprymnæ, but the size of the muscles in these does not require the development of a bony crest. In the Kangaroo the temporal ridges, which are very slightly raised, are separated by an interspace of the third of an inch. They are separated for a proportionally greater extent in the Petaurists; and in the smooth and convex upper surface of the skull of Pet. sciureus, Pet. pygmaeus, and of Myrmecobius, the impressions of the feeble temporal muscles almost cease to be discernible.

¹ Pl. LXXI. fig. 6. ² Pl. LXX. fig. 5. ³ Pl. LXXI. fig. 1.
The zygomatic arches are, however, complete in these, as well as in all the other genera; and are usually, indeed, strongly developed; but their variations do not indicate the nature of the food so clearly, or correspond with the differences of animal and vegetable diet in the same degree as in the placental Mammalia. No marsupial animal, for example, is devoid of incisors in the upper jaw, like the ordinary Ruminants of the placental series; and the more complete dental apparatus with which the herbivorous Kangaroos, Potoroos, Phalangers, &c., are provided, and which appears to be in relation to the scantier pasturage and the dry and rigid character of the herbage or foliage on which they browse, require a strong apparatus of bone and muscle for the action of the jaws, and the exercise of the terminal teeth. There are, however, sufficiently marked differences in this part of the marsupial skull; and the weakest zygomatic arches are those of the insectivorous Perameles\(^1\) and Acrobates, in which structure we may discern a correspondence with the edentate Anteaters of the placental series. Still the difference of development is greatly in favour of the marsupial Insectivora. The Hyspisprymni are next in the order of development of the zygomatic arches, which again are proportionally much stronger in the true Kangaroos. The length of the zygomata in relation to the entire skull, is greatest in the Koala\(^2\) and Wombat\(^3\). In the former animal they are remarkable for their depth, longitudinal extent, and straight and parallel course. In the latter they have a considerable curve outwards, so as greatly to diminish the resemblance which otherwise exists in the form of the skull between the Wombat and the herbivorous Rodentia of the placental series, as \textit{e. g.}, the Viseaccia.

In the carnivorous Marsupiata the outward curve of the zygomatic arch (which is greatest in the Thylacine and Ursine Dasyure\(^4\)) is also accompanied by a slight curve upwards; but this curvature is chiefly expressed by the concavity of the lower margin of the zygoma, and is by no means so well marked as in the placental Carnivora. It is remarkable that this upward curvature is greater in the slender zygomata of the Perameles than in the stronger zygomata of the Dasyures and Opossums. In the Koala and Phalangers there is also a slight tendency to the upward curvature. In the Wombat the outwardly-expanded arch is perfectly horizontal. In the Kangaroo the lower margin of the zygoma describes a slightly undulating curve, the middle part of which is convex downwards.

In many of the Marsupiata, as the Kangaroo, the Koala, the Phalangers, and the Opossums, the superior margin of the zygoma begins immediately to rise above the posterior origin of the arch. In the Wombat an external ridge of bone commences at the middle of the lower margin of the zygoma, and gradually extends outwards as it advances forwards, and, being joined by the upper margin of the zygoma, forms the lower boundary of the orbit, and ultimately curves downwards in front of the ant-orbital foramen, below which it bifurcates, and is lost. This ridge results, as it were, from the

\(^1\) Pl. LXXI. fig. 1. \(^2\) Pl. LXIX. figs. 1—3. \(^3\) Pl. LXXI. fig. 6. \(^4\) Pl. LXX. figg. 1 & 5.
flattening of the anterior part of the zygoma, which thus forms a smooth and slightly concave horizontal platform for the eyeball to rest upon.

The same structure obtains, but in a slighter degree, in the Koala. In the Kangaroo the anterior and inferior part of the zygoma is extended downwards, in the form of an inverted conical process, which reaches below the level of the grinding teeth. A much shorter and more obtuse process is observable in the corresponding situation in the Phalangers and Opossum. The relative length of the facial part of the skull, anterior to the zygomatic arches, varies remarkably in the different marsupial genera. In the Wombat it is as 6 to 19; in the Koala as 5 to 14; in the Phalangers it forms about one-third the length of the entire skull; in the carnivorous Dasyures and Opossums it is more than one-third. In Perameles, Macropus, and Hypsiprymnus murinus, Ill., the length of the skull anterior to the orbit is equal to the remaining posterior part; but in a species of Hypsiprymnus from Van Diemen's Land (Hypsiprymnus myosurus, Ogilb.), the facial part of the skull anterior to the orbit exceeds that of the remainder; and the arboreal Hypsiprymnus from New Guinea present a still greater length of muzzle. In most Marsupiata the skull gradually converges towards the anterior extremity; but in the Perameles lagotis\(^1\) the skull is remarkable for the sudden narrowing of the face anterior to the orbits, and the prolongation of the attenuated snout, preserving the same diameter for upwards of an inch before it finally tapers to the extremity of the nose. In the Koala the corresponding part of the skull is as remarkable for its shortness as it is in the Perameles lagotis for its length, but it is bounded laterally by parallel lines through its whole extent. Before concluding this account of the general form of the skull, I may observe that the Kangaroo resembles the placental Ruminantia, and some Rodentia, as the Viscacia, in the prolongation downwards of two long processes, corresponding in function with the mastoid, but developed from the ex-occipital bones. The same processes are developed in an almost equal degree in the Koala\(^2\), and, in the Wombat, co-exist with a corresponding development of the true mastoids. The ex-occipitals each send down a short obtuse process in the Potoroos, Perameles, Petaurists, Phalangers, Opossums, and Dasyures.

Of the Composition of the Cranium.—The occipital bone is developed, as in the placental Mammalia, from four centres, or elements,—the basilar below, the supra-occipital above, and the ex-occipitals at the sides; but these elements remain longer separate, and in some genera do not become, at any period of life, united by continuous ossification.

In the skull of an aged Virginian Opossum I found the supra-occipital still distinct from the ex-occipitals, and these not joined together, though anchylosed to the basilar element. In this marsupial animal they meet above the foramen occipitale, and complete its boundaries, as the corresponding superior vertebral laminae complete the medullary

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1. Pl. LXXI. fig. 1.
2. Pl. LXIX. figs. 1 & 3 a.
canal in the region of the spine. I have found the same structure and condition of the occipital bone of an adult Dasyurus Ursinus, and it is exhibited in the Plate of the cranium of this species given by M. Temminck 1.

In the skull of Perameles nasuta the ex-occipitals are separated by an interspace, so that a fissure is continued from the upper part of the foramen magnum to the supra-occipital element. The same structure may be observed in the Kangaroo, and is very remarkable in the young skulls of this species. I found this superior notch wide, and well marked, in Macropus Bennettii. In the Wombat the corresponding fissure is very wide, and the lower margin of the supra-occipital is notched, so that the shape of the foramen magnum somewhat resembles that of the trefoil leaf. I found the ex-occipital element 2 still unanchylosed with the basilar and supra-occipital elements in the cranium of a full-grown but not aged Wombat.

In the Koala, the Phalangers, Petaurus, Hypsiprymnus, and Dasyurus Maugei, the elements of the occipital bone present the usual state of bony confluence.

The temporal bone generally presents a permanent separation of the squamous, petrous and tympanic elements. I have observed this reptile-like condition of the bone in the mature skulls of an Ursine Dasyure, a Virginian Opossum, a Perameles, in different species of Potoroo and Kangaroo, in the Wombat, and in the Koala. So loose, indeed, is the connexion of the tympanic bone, that, without due care, it is very liable to be lost in preparing the skulls of the Marsupiata. In the Kangaroo and Wombat 3 it forms a complete bony tube, about half an inch in length, with an irregular exterior, and is wedged in between the mastoid and articular processes of the temporal bone. In the Potoroo the bony circle is incomplete at the upper part; in the Perameles and Dasyures the tympanic bone forms a semicircle, the posterior part being deficient, and the tympanic membrane being there attached to a descending process of the squamous element of the temporal. Here we have a near approach to the form of the tympanic bone in Birds; but we have a still closer resemblance to its condition both in Birds and Reptiles, in its want of union with the petrous element of the temporal bone. In the Rodent quadruped the tympanic, petrous and mastoid elements of the temporal bone are always anchylosed together; this condition is well shown in the skull of the Porcupine and Beaver, in which the mastoid element sends down a thick, obtuse process behind the petro-tympanic portion. It is to the expansion of the petro-tympanic, and not of the mastoid, portion of the temporal bone, that the enlargement of the tympanic cavity is due, in the Rodentia; and this expansion forms, in that order (as is well known), a large bulla ossea, which is situated anterior and internal to the mastoid process. In many of the Marsupiata, as the Dasyures, Petaurists, Perameles, Potoroos, and Koala, there is also a large bulla ossea for the purpose of increasing the extent of the auditory cavity; but, with one single exception—the Wombat, this bulla is not formed

1 Monographies de Mammalogie, Pl. VIII. 2 Pl. LXXI. fig. 6 a. 3 Pl. LXXI. fig. 6 b.
by the tympanic, or any other element of the temporal bone, but by the expansion of the base of the great ala of the sphenoid bone. It is only in the *Perameles lagotis*¹ that, in addition to the preceding bulla, I have observed an external dilatation of the petrous element of the temporal bone, which thus forms a second and smaller bulla on each side, behind the large bulla ossea formed by the sphenoid. In other Marsupiata the petrous bone is of small size, generally limited to the office of protecting the parts of the internal ear, and sometimes, as in the Koala, is barely visible at the exterior of the base of the skull. The petrous and mastoid elements are commonly ankylosed together. In the Kangaroos, Koala and Wombat, the petro-mastoid bone is of a larger size, and is visible in two situations on the outside of the skull, viz. at the usual place at the basis, where the petrous portion is wedged in between the basilar bone, ex-occipital and sphenoid; and again at the side of the cranium, where the mastoid portion appears between the squamous, ex-occipital and supra-occipital bones.

In the Wombat it sends outwards the strong compressed process which terminates the lateral boundaries of the occipital plane of the cranium. The auditory chamber of the ear is augmented in the Phalangers, the Koala, the Kangaroo and Potoroo, by a continuation of air-cells into the base or origin of the zygomatic process; but the extent of the bony air-chambers communicating with the *tympanum* is proportionally greatest in the Petaurists, or Flying Opossums, where, besides the sphenoid bulla, the mastoid element, and the whole of the zygomatic process of the temporal bone are expanded to form air-cells with very thin and smooth walls; thus presenting an interesting analogy in the structure of the *cranium* to the class of Birds. The direction of the bony canal of the organ of hearing corresponds, as in the placental Mammalia, with the habits of the species: the meatus auditorius is directed outwards and a little forwards in the carnivorous Dasyures; outwards, and a little backwards in the Perameles and Phalanger; outwards, backwards and upwards in the Kangaroos; and directly outwards in the Petaurists and Wombat; but the differences of direction are slightly marked.

The squamous element of the temporal bone generally reaches half way from the root of the zygoma to the sagittal ridge or suture; it is most developed in the Wombat, in which its superior margin describes a remarkably straight line. The zygomatic process of the temporal bone is in general compressed, and much extended in the vertical direction in the Opossum, Dasyure, Phalanger, Koala and Kangaroo. In the Wombat it curves outwards from the side of the head, in the form of a depressed and almost horizontal plate; it is then suddenly twisted into the vertical position, to be received in the notch of the malar portion of the arch. The cavity, corresponding to the sphenoidal bulla ossea in other Marsupials, is in this species excavated in the lower part of the squamous element of the temporal bone, at the inner side of the articular surface for the lower jaw. This articular surface, situated at the base of the zygomatic process,

¹ Pl. LXXI. fig. 1.
presents in the marsupial, as in the placential Mammalia, various forms, each manifesting a physiological relation to the structure of the teeth, and adapted to the required movements of the jaws in the various genera. In the herbivorous Kangaroo the glenoid cavity forms a broad and slightly convex surface, as in the Ruminants, affording freedom of rotation to the lower jaw in every direction. In the Phalangers and Potoroos the articular surface is quite plain. In the Perameles it is slightly convex from side to side, and concave from behind forwards. In the Wombat it is formed by a narrow ridge, convex antero-posteriorly, considerably extended laterally, and slightly concave in the transverse direction. This ridge is not bounded by any descending process posteriorly, so that the jaw is left free for the movements of protraction and retraction. But this structure is widely different from that which facilitates similar movements in the Rodentia: in these there is a longitudinal groove on each side, in which the condyle of the lower jaw plays backwards and forwards, but is impeded in its lateral movements; these, on the contrary, are freely allowed to the Wombat, and the oblique disposition of the lines of enamel upon the molar teeth corresponds with the various movements of which the lower jaw of the Wombat is thus susceptible. In the Koala the glenoid cavity is a transversely oblong depression, with a slight convex rising at the bottom, indicating rotatory movements of the jaw: in the carnivorous Dasypus it forms a concavity still more elongated transversely, less deep than in the placential Carnivora, but adapted, as in them, to a ginglymoid motion of the lower jaw. The joint differs in the absence of an inter-articular cartilage in the marsupial Carnivores. In all the genera, save the Wombat, retraction of the lower jaw is opposed by a descending process of the temporal bone immediately anterior to the meatus auditorius and tympanic bone. The glenoid cavity presents a characteristic structure in most of the Marsupialia. In all the species, the Petaurists excepted, the malar bone forms the outer part of the articular surface for the lower jaw; and in the Dasyurus Mangei, Dasyurus Ursinus, Perameles, Hypsiprymnus and Macropus, the sphenoid ala forms the inner boundary of the same surface; but it does not extend so far backwards in the Wombat or Koala.

The sphenoid bone has the same general form and relative position as in the ordinary Mammalia, but presents a similarity to that in the Ovipara in the persistence of the pterygoid processes as separate bones. It is only in the Koala that I have observed a complete obliteration of the suture joining its basilar element of the sphenoid with that of the occipital bone.

The chief peculiarity in the sphenoid bone is the dilatation of the root of the great ala already alluded to; this dilatation communicates with, and is filled with air from, the tympanum. It forms the hemispherical bulla ossea on each side of the basis cranii in the Dasypus and Phascogales, and the large semiovate bulla in the Myrmecobius; but in the Koala the bullae are still more developed, and are produced downwards to an

1 Pl. LXXI. fig. 6.
2 See the separate pterygoid of the Wombat, Pl. LXXI. fig. 6 c.
extent equal with the ex-occipital processes; they are somewhat compressed laterally, and instead of the smooth and polished surface which characterizes them in the preceding genera, terminate here in a rough ridge. The dilated air-chambers or bullae of the sphenoid are relatively smaller in the Phalangers and Potoroos than in the Dasyures, and they are incomplete posteriorly in the Kangaroo and Wombat. In the Brush Kangaroo the above process from the sphenoid joins the base of the large descending process of the ex-occipital. The pterygoid processes are relatively largest in the Kangaroo, Wombat and Koala, and present in each of these species distinct hamular processes. In the Potoroo, Kangaroo and Wombat the sphenoid ala combines with the pterygoid process to form a large and deep depression, opening externally. In the Kangaroo, Dasyures, Koala and Wombat, the great alae of the sphenoid articulate with the parietal bones, but by a very small portion in the two latter species; in the Perameles and Potoroos the sphenoid alae do not reach the parietals.

There is little to notice in the parietal bones, except the obliteration of the sagittal suture in those species in which a bony crista is developed in the corresponding place; they present a singularly flattened form in the Wombat, in an aged skull of which, and in a similar one in the Kangaroo, I observe a like obliteration of the sagittal suture. In the Kangaroo, Potoroo, Petaurus, Phalanger and Myrmecobius there is a triangular inter-parietal bone. The corresponding bone I find in three pieces in the skull of a Wombat.

The frontal bones are chiefly remarkable for their anterior expansion, and the great share which they take in the formation of the nasal cavity. In the Thylacine the part of the cranium occupied by the frontal sinuses exceeds in breadth the cerebral cavity, from which it is divided by a constriction.

The coronal suture presents in most of the Marsupials an irregular angular course, forming a notch in the frontals on each side, which receives a corresponding triangular process of the parietal bones: this form of the suture is least pronounced in the Myrmecobius and Acrobat. A process corresponding to the posterior frontal augments the bony boundary of the orbit in the Thylacine, the Ursine Dasyure, and, in a slighter degree, in the Virginian Opossum; it is relatively most developed in the skull of the Myrmecobius fasciatus, where the orbit is large; but the bony boundary of the orbit is not complete in any of the Marsupials. In the Myrmecobius there is a deep notch at the middle of the supra-orbital ridge.

I have found the frontal suture obliterated only in the Virginian Opossum and Petaurists; and in the latter it is remarkable that the other sutures of the head, as the lambdoidal and sagittal, continue distinct.

The lachrymal bones vary in their relative size in different Marsupialia. In the Koala they extend upon the face about a line beyond the anterior boundary of the orbit, and at this part they present a groove, with one large and two or three small perforations. In the Wombat their extent upon the face is slightly increased; it is proportionately
greater in the Kangaroos, Potoroos, Phalangers, and Dasyures, in which this part of the lachrymal bone presents two perforations, but it is close to the orbit. The Thylacine, as compared with the Wolf, presents a greater extent of the facial portion of the lachrymal bone, and thus indicates its inferior type. In the Myrmecobius the lachrymal bone exhibits its greatest relative development.

The malar bone is very strong, and of great extent, in all the Marsupiata. Least developed in the Perameles lagotis, it here presents a singular form, being bifurcate at both extremities: the processus zygomaticus maxillae superioris is wedged into the cleft of the anterior fork; the corresponding process of the temporal bone fills up the posterior space: the lower division of this bifurcation is the longest, and in all the Marsupiata enters into the composition of the articular surface for the lower jaw, except in the Petaurists, where it just falls short of this part. The anterior bifurcation of the malar bone is not present in the Marsupiata generally: the external malo-maxillary suture forms an oblique and almost straight line in the Wombat, Phalanger, Opossum, Dasyures, and Kangaroo. Owing to the inferior development of the zygomatic process of the superior maxillary in the Wombat, the malar bone is not suspended in the zygomatic arch in this Marsupial, as in the placental Rodentia. It is of relatively much larger size, and of a prismatic form, arising from the development of the oblique external ridge above described. In the Kangaroo, Potoroo, Great Petaurus, and Phalanger, it is traversed externally by a ridge, showing the extent of attachment of the masseter: in the Koala it extends along the bone, near the upper margin, and the surface below presents a well-marked excavation.

The nasal bones vary in their form and relative size in the different genera; they are longest and narrowest in the Perameles; shortest and broadest in the Koala. Their most characteristic structure is the expansion of the upper and posterior extremity, which is well marked in the Wombat, Myrmecobius, Petaurists, Phalangers, Opossums, and Dasyures.

In the Potoroos the anterior extremities of the nasal bones converge to a point, which projects beyond the intermaxillaries. In some Petaurists and the Perameles the corresponding points reach as far as the intermaxillaries, and in the skeleton of an old Perameles lagotis I found that the bony case of the nasal passages is further increased by the presence of two small rostral bones, resulting, as in the Hog, from ossification of the nasal cartilage.

The intermaxillary bones always contain teeth, and the ratio of their development corresponds with the bulk of the dental apparatus which they support. They are consequently largest in the Wombat, where they extend far upon the side of the face, and are articulated to a considerable proportion of the nasal bones, but do not, as in the placental Rodentia, reach the frontal, or divide the maxillary bone from the nasal. They present the next degree of inferior development in the Koala, and both in this species and in the Wombat bulge outwards, and thus remarkably increase the transverse
diameter of the osseous cavity of the nose. Neither in Hypsiprymnus nor Macropus do I find the incisive palatal foramina entirely in the intermaxillary bones, as described by the author of the text in Pander and D’Alton’s ‘Skeleti der Beutelthiere’; a small proportion of their bony circumference is due to the anterior extremity of the palatal process of the maxillaries; and the same structure obtains in the Wombat, Koala, and Opossums. In the Dasyures and Phalangers a greater proportion of the posterior boundary of these foramina is formed by the maxillaries; in the Petaurists they are entirely surrounded by the maxillaries, while in the Perameles the incisive foramina are wholly surrounded by the intermaxillary bones. They always present the form of two longitudinal fissures. The maxillary bones in the Wombat send up a long, narrow, irregular nasal process, which joins the frontal and nasal bones, separating them from the intermaxillaries; the part which projects into the temporal fossa, behind the orbit, presents two or three smooth tuberosities, formed by the thin plate of bone covering the pulps of the large curved posterior grinders. The corresponding part in the Perameles lagotis is perforated by numerous minute apertures, like a cribriform plate; and this structure is presented in a slighter degree in the Potoroo and Ursine Dasyure. The antorbital foramen does not present any marked variety of size, which is generally moderate. It is much closer to the orbit in the carnivorous Marsupiata than in the corresponding placental quadrupeds. It is relatively largest in the Ursine Dasyure. It presents the form of a vertical-oblique fissure in the Wombat. I have observed it double in the Kangaroo. The chief differences in the maxillary bones, independently of the teeth and their alveoli, are presented by the palatal processes, the modifications of which I shall consider in conjunction with those presented by the palatal processes of the palatal bones.

The perforations of the bony palate deserve particular attention; they are generally specific, and of consequence in the determination both of recent and fossil species.

In Phalangista Cookii¹, some of the Petaurists² and the great Kangaroo (Macropus Major), the bony palate is of great extent, and presents a smooth surface, concave in every direction towards the mouth; this is pierced by two small posterior palatine foramina, situated at the anterior external angles of the palatine bones, close to the transverse palato-maxillary sutures: behind these foramina in the Kangaroo, and pierced in the suture itself in some Petaurists, are a few small irregular perforations. The bony palate is also entire in the Hypsiprymnus ursinus.

In Macropus Bennettii³ there are four orifices at the posterior part of the bony palate: the two anterior ones are situated upon the palato-maxillary suture, of an ovate form, with the small end forwards; the two posterior foramina are of a less regular form, and smaller size.

In the Brush Kangaroo (Macropus Brunii, Cuv.) the posterior palatal foramina present the form of two large oval fissures, placed obliquely, and converging posteriorly. They

¹ Pl. LXXI. fig. 2. ² Ib. fig. 3. ³ Ib. fig. 5.
encroach upon the posterior border of the maxillary plate. Anterior to these vacancies there are two smaller foramina, and posterior to them are one or two similar foramina. In the Australian Potoroo¹, Wombat², and Koala³, the posterior palatal openings are large and oval, and situated entirely in the palatal bones; posterior, and external to these, there are two small perforations. In the Phalangers (Phal. Cookii excepted) the palatal openings are proportionally larger; they extend into the palatal process of the maxillaries, and the thin bridge of bone which divides the openings in the Potoroo, &c., is wanting; the two perforations at the posterior external angles of the palatine bones are also present. In the Virginian Opossum the bony palate presents eight distinct perforations, besides the incisive foramina: the palatal processes of the palatine bone extend as far forwards in the median line as the third molares; a long and narrow fissure extends for an equal distance (three lines) into the palatal processes both of the palatines and maxillaries. Behind these fissures, and nearer the median line, are two smaller oblong fissures; external, and a little posterior to these, are two similar fissures, situated in the palato-maxillary suture; lastly, there are two round perforations close to the posterior margin of the bony palate. In the Thylacine⁴ the two posterior palatal vacuities are an inch in length and half an inch in width, exposing to view the convolutions of the turbinated bones of the nasal cavity. In the Ursine Dasyure⁵ a large transversely oblong aperture is situated at the posterior part of the palatal processes of the maxillary bones, and encroaches a little upon the palatines; this aperture is partly, perhaps in young skulls wholly, bisected by a narrow longitudinal osseous bridge⁶. In Dasyurus macrourus⁷ two large ovate apertures, situated in the palato-maxillary sutures, are divided by a broad plate of bone; posterior to these are four similar but smaller apertures, which, being situated nearer the mesial line, are divided by a narrower osseous bridge; each posterior external angle of the bony palate is also perforated by an oval aperture. In the Viverrine Dasyure⁸ the two vacuities which cross the palato-maxillary suture are in the form of longitudinal fissures, corresponding in situation with the penultimate and antepenultimate grinders; the posterior part of the bony palate is perforated by several small apertures. Now there is no carnivorous quadruped, in the placental series, which has a bony palate characterized by perforations and vacuities of this kind. In the Dog, the Cat, and the Weasel tribe, the bony palate is only perforated by two small oblique canals, which open in or near the palato-maxillary suture. The very great interest which is attached to the fossil jaws of the Stonesfield Didelphys,—the only mammiferous remains hitherto discovered in the secondary formations, will justify the minuteness with which I have dwelt on characters that, inclusive of the teeth, serve to distinguish the cranium of the Opossum from that of any placental quadruped.

¹ Pl. LXXI. fig. 4. ² Ib. fig. 1. ³ Pl. LXIX. fig. 3. ⁴ Pl. LXX. fig. 1. ⁵ Pl. LXX. fig. 5. ⁶ The large aperture in the skull of the Dasyurus Ursinus, figured by M. Temminck, is the result of accidental injury to the bony palate.—Monographies de Mammalogie, Pl. VIII. ⁷ Pl. LXX. fig. 3. ⁸ Pl. LXX. fig. 2.
The structure of the bony palate in the Marsupiata is interesting in other respects. Since the defective condition of this part of the cranium is one of the characteristics of the skull of the Bird, it might be expected that some approximation would be made to that structure in the animals which form the transition between the placental and oviparous classes. We have already noticed the large vacuities which occur in the bony palate of nearly all the Marsupials; but this imperfectly ossified condition is most remarkable in the Acrobates and Perameles lagotis\(^1\). In the latter the bony roof of the mouth is wanting for a wide oval space, extending from the second spurious molars to the penultimate molars, exposing to view the vomer and convolutions of the inferior spongy bones in the nasal cavity. Behind this space there are six small perforations, two in a transverse line, midway between the great vacancy and the posterior margin of the bony palate, and four in a transverse line, close to that margin.

Cavity of the Cranium.—The parietes of the cranial cavity are remarkable for their thickness in some of the marsupial genera. In the Wombat the two tables of the parietal bones are separated posteriorly for the extent of more than half an inch, the interspace being filled with a coarse cellular diploë; the frontal bones are about two and a half lines thick. In the Ursine Dasyure the cranial bones have a similar texture and relative thickness. In the Koala the texture of the cranial bones is denser, and their thickness varies from two lines to half a line. In the Kangaroo the thickness varies considerably in different parts of the skull, but the parietes are generally so thin as to be diaphanous; which is the case with the smaller Marsupials, as the Potoroos and Phalangers. The union of the body of the second with that of the third cranial vertebra takes place in the Marsupiata, as in the placental Mammalia, at the sella turcica, which is overarched by the backward extension of the lesser alæ of the sphenoid. The optic foramina and the fissura lacera anteriores are all blended together, so that a wide opening leads outwards from each side of the sella. Immediately posterior, and external to this opening, are the foramina rotunda, from each of which, in the Kangaroo, a remarkable groove leads to the fossa Gasseriana, at the commencement of the foramen ovale; the same groove is indicated in a slighter degree in the Dasyures and Phalangers, but is almost obsolete in the Wombat and Koala. The carotid canals pierce the body of the sphenoid, as in the Bird, and terminate in the skull, very close together, behind the sella turcica, which is not bounded by a posterior clinoid process. The petro-tympanic bones form a large convex prominence on each side of the base of the cranial cavity in the Perameles lagotis; this prominence is hollow, contains air, and has very thin walls. The petrous bone in the Kangaroo, Koala and Phalanger, is impressed above the meatus auditorius by a deep, smooth, round pit, which lodges the lateral appendage of the cerebellum. The corresponding pit is shallower in the Dasyuri, and scarcely marked in the Wombat. The middle and posterior fissurae lacerae have the usual relative position,

\(^1\) Pl. LXXI. fig. 1.
but the latter are small. The condyles are perforated anteriorly by two foramina. The composition and form of the foramen magnum we have already spoken of. It is of great size, in relation to the capacity of the cranium; the aspect of its plane is backwards, and slightly downwards.

In the Kangaroo and Phalanger a thin ridge of bone extends for the distance of one or two lines into the periphery of the tentorial process of the dura mater, and two sharp spines are sent down into it from the upper part of the cranium in the Phalangista Vulpina. The tentorium is supported by a thick ridge of bone in the Thylacine; but it is not completely ossified in any of the Marsupiata; indeed, the Dasyures, the Koala, and the Wombat, have not the bony crista above described. There is no ossification of the falciform ligament, as in the Ornithorhynchus. The anterior depression, or olfactory division of the cavity of the cranium, as it may be termed, from its large size, is separated in a well-marked manner from the proper cerebral division of the cavity. It is relatively smallest in the Koala. In all the Marsupials it is bounded anteriorly by the cribiform plate of the ethmoid bone, which is converted into an osseous reticulation by the number and size of the olfactory apertures.

The cavity of the nose, from its great size, and the complication of the turbinated bones, forms an important part of the skull. It is divided by a complete bony septum to within one-fourth of the anterior aperture; the anterior margin of the septum is slightly concave in the Koala, describes a slightly convex line in the Wombat, Kangaroo and Phalanger, and a sigmoid flexure in the Dasyure. A longitudinal ridge projects downwards from the inside of each of the nasal bones, and is continued posteriorly into the superior turbinated bone; this bone extends into the dilated space anterior to the cranial cavity, which corresponds with the frontal sinuses. The convolutions of the middle spongy bone are extended chiefly in the axis of the skull; the processes of the anterior convoluted bone are arranged obliquely from below, upwards and forwards. They are extremely delicate and numerous in the Dasyures and Phalangers; they consist of thin laminae of bone, beautifully arranged on the convex surface of the os turbinatum, and placed vertically to that surface in the Potoroo; but the bone becomes very simple in the Kangaroo, Koala, and Wombat. The nasal cavity communicates freely with large maxillary sinuses, and finally terminates by wide apertures behind the bony palate. In the dry skull the nasal cavity communicates with the mouth, as before mentioned, by means of the various large vacuities in the palatal processes.

The lower jaw of the Marsupiata is a part of their osseous structure which claims more than ordinary attention, in consequence of the discussions to which the fossil specimens of this bone, discovered in the oolitic strata of Stonesfield, have given rise. These specimens, which are well known to the English reader by the figures of them published in the 'Bridgewater Treatise' of Dr. Buckland, and in the 'Elements of Geology' of Mr. Lyell, were regarded by Cuvier as appertaining to the marsupial series of Mammalia, and to be nearly allied to the genus Didelphys. This opinion of the great founder of
osteological science has been called in question by other naturalists, and has been more especially opposed by Prof. Blainville, who conceives it to be more probable that they belong to a genus of Saurian Reptiles than to the Didelphys, or any genus of insectivorous Mammals. I have examined the two specimens in the possession of Dr. Buckland, the specimen formerly in the collection of Mr. Broderip, and that which is preserved in the Museum at York. The simple structure of the lower jaw, each ramus of which consists of one piece of bone, the convex condyle, and the double fangs of the molar teeth, prove the mammiferous character of these remains; the size, elevation and form of the coronoid process of the lower jaw, the production of the angle of the jaw, with the development of the canines, and the pointed tubercular crowns of the molar teeth, indicate the carnivorous and insectivorous character of the species in question. The number of the incisors, eight in the lower jaw, and the structure and proportions of the molar teeth, approximate these small Insectivora most nearly to the smaller species of the modern genus Didelphys; but the number of the molars in one of the specimens exceeds that of any Insectivore, placental or marsupial, which was known at the period when Cuvier wrote on this fossil. Recently, however, a genus of insectivorous Mammal (Myrmecobius) has been discovered in Australia, presenting the modifications of the cranium which characterize the Marsupiata, and having nine tuberculate molars in each ramus of the lower jaw. Besides the osteological characters above alluded to, there is a character in the lower jaw of the marsupial animals, not peculiar to the genus Didelphys, which serves to distinguish it from that of the placental Mammalia. In the carnivorous Marsupials, as the Thylacine, the lower maxillary bone very nearly resembles in general form that of the corresponding placental species, as the Dog; a similar transverse condyle is placed low down near the angle of the jaw; the strong coronoid process rises high above it, and is slightly curved backwards; there is the same well-marked depression on the exterior of the ascending ramus for the firm implantation of the temporal muscle, and the lower boundary of this depression is formed by a strong ridge extended downwards and forwards from the outside of the condyle. But in the Dog, and other placental digitigrade Carnivora, a process, representing the angle of the jaw, extends directly backwards from the middle of the above ridge, which process gives fixation to the articulation of the jaw, and increases the power by which the masseter acts upon the jaw. Now although the same curved ridge of bone bounds the lower part of the external depression of the ascending ramus in all the Marsupiata, it does not in any of them send backwards, or in any other direction, a process corresponding to that just described in the Dog. The angle of the jaw is as if it were bent inwards in the form of a process, encroaching in various shapes and various degrees of development in the different marsupial genera upon the interspace of the rami of the lower jaw. In looking down upon the lower margin of the jaw, we see, therefore, in place of the

margin of a vertical plate of bone, a more or less flattened surface extended between the external ridge and the internal process, or inflected angle.

In the Opossums this internal angular process is triangular and trihedral, directed inwards, with the point slightly curved upwards. In the Dasyures it has a similar form, but the apex is extended into an obtuse process. In the Thylacine the base of the inflected angle is proportionally more extended; and a similar structure is presented by the jaw of the fossil Phascolothere. In the Perameles the angle of the jaw forms a still longer process; it is of a flattened form, extended obliquely inwards and backwards, and slightly curved upwards. In the Potoroos and Phalangers the process is broad, with the apex slightly developed;—it is bent inwards, and bounds the lower part of a wide and deep depression on the inside of the ascending ramus. In the Great Kangaroo the internal margin of this process is curved upwards, so as to augment the depth of the internal depression above mentioned. The internal angular process arrives at its maximum of development in the Wombat, so that the breadth of the base of the ascending ramus very nearly equals the height of the same. This broad base also inclines downwards and outwards from the inflected angle, and the same peculiarity occurs in the jaw of the fossil Phascolothere.

In the Koala the size of the process in question is also considerable, but it is compressed and directed backwards, with the obtuse apex only bending inwards; so that the characteristic flattening of the base of the ascending ramus is least marked in this species. There is no depression on the inner side of the ramus in the Koala, but the smooth surface is simply pierced near its middle by the dental artery. There is a corresponding perforation on the external surface of the ascending ramus, upon which we observe the external muscular depression bounded below by a broad angular ridge. In the Dasyure there is no external perforation corresponding with the dental canal on the inside of the ramus. The ramus is likewise entire in the Peteurists, Phalangers, Perameles and Opossums. In the Wombat the ascending ramus is directly perforated by a round aperture immediately posterior to the commencement of the dental canal: the corresponding aperture is of larger size in the Kangaroo; but in the Potoroos both the external and internal depressions of the ascending ramus lead to wide canals, or continuations of the depressions, which pass forwards in the substance of the horizontal ramus, and soon uniting into one passage, leave a vacant space in the intervening bony septum. This structure, if it had only existed in the jaw of a fossil Marsupial, would have supported an argument for its saurian nature, on account of a nearly allied structure in the jaw of the Crocodile. The posterior aperture of the dental canal is situated in the Potoroos and Wombat, as in the Stonesfield fossils, just behind the last molar tooth; and in the Wombat a vascular groove is continued from the foramen, along the

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1. Pl. LXXI. fig. 6 d.
2. Pl. LIX. fig. 4.
3. A bristle is represented as passing through this aperture on the left side of the lower jaw, in Pl. LXXI. fig. 6 d.
inner side of the ramus of the jaw, as in the same fossils. In the Thylacine and Ursine Dasyures, and in their fossil congener the Phascolothere, the condyle of the lower jaw is placed low down, on a level with the molar series: it is raised a little above that level in the Opossums, and ascends in proportion to the vegetable character of the diet.

In all those Marsupiata which have few or very small incisors, the horizontal rami of the jaw converge towards a point at the symphysis. The angle of convergence is most open in the Wombat, and the gradual diminution is most marked and direct. The internal surface of the symphysis menti is almost horizontal, and is convex from side to side in the interval between the molars and incisors. The suture becomes obliterated in aged skulls. It is also wholly obliterated in the skull of a Koala now before me: in all the other marsupial crania which I have examined, the rami of the lower jaw are not anchylosed at the symphysis; and in the Opossum, both the rami of the lower jaw and all the bones of the face are remarkable for the loose nature of their connection.

Of the Vertebral Column.—The vertebral column is divisible, in all the Marsupiata, into the usual classes of cervical, costal, lumbar, sacral and caudal vertebrae. The cervical vertebrae invariably present the usual number, seven, and the usual character of the perforation of the transverse process, or rather the presence of both upper and lower transverse processes, and the union of their outer extremities with a rudimental rib. I found the cervical ribs distinct and unanchylosed in the dentata of a mature Perameles lagotis. In the Dasyures, Opossums, Perameles and Phalangers, the seventh cervical vertebra has only the upper transverse process, and consequently wants the character of the perforation, as in many of the ordinary Mammalia. In the Petaurists, Koala, Wombat, Potoroos and Kangaroos, the seventh vertebra is perforated like the rest; but in the Kangaroo both the dentata and atlas have the transverse processes grooved merely by the vertebral arteries; and in the Koala and Wombat the atlas presents only the perforation on each side of the superior arch.

In Perameles and some other Marsupials, as the Cayopollin, an affinity to the Reptilia is manifested in the structure of the atlas, which exhibits a permanent separation of the superior laminae from the centre or body below. In the Koala and Wombat the body of the atlas remains permanently cartilaginous; at least this is its condition in an adult skeleton of each of these animals in the Hunterian Museum, in which the lower part of the vertebral ring is completed by dried gristly substance. In the Petaurists, Kangaroos and Potoroos, the atlas is completed below by an extension of ossification from the centres developed from the superior laminae into the cartilaginous nucleus representing the body; and the ring of the vertebrae is for a long time interrupted by a longitudinal fissure in the middle line, the breadth of which diminishes with age.

1 This fissure is represented in figures of the atlas of a Potoroo and Kangaroo, given by Pander and D'Alton (Beutelthiere, fig. c, Pl. III. and VII.); but in some of the skeletons of these Marsupials examined by me, I find the ring completed and the fissure obliterated.
In all the Marsupiata the spine of the dentata is well developed, both in the vertical and longitudinal directions, but most so in the Virginian and Crab-eating Opossums, where it increases in thickness posteriorly; in these species also the third, fourth and fifth cervical vertebrae have their spines remarkably long and thick, but progressively diminishing from the third, which equals in height and thickness, but not in longitudinal extent, the spine of the dentata. These spines are four-sided, and being closely impacted, one behind another, must add greatly to the strength, while they diminish the mobility of this part of the spine. I know of no other mammiferous genus which presents the same structure: in the Armadillos the corresponding spines are largely developed, but they are anchylosed together. In the Orang the cervical spines are remarkably developed in length, but have the ordinary, slender, subcylindrical, rounded form. Tyson, who describes and figures the above structure of the cervical vertebrae in the Opossum, conjectures that it is given to this arboreal animal in order that there might be no danger of its breaking its neck, should it happen to fall to the ground by chance or design. Unfortunately for this reasoning, however, the Phalanger, Petaurists, Koala, and other arboreal Marsupiata, whose arboreal habits render them equally liable to a fall, present the usual structure of the five posterior cervical vertebrae, the spines of which are all much less than that of the dentata, and in the Phalangers and Petaurists almost obsolete. I observe in the Phalangista Cookii that the superior flattened arches of the five last cervical vertebrae bear a ridge on each side of the spine, having the same direction and form, and nearly the same size. The spinous processes are wanting in the five last cervical vertebrae of the Phascogale.

The structure of the transverse processes of the cervical vertebrae, in the Opossum, is adapted to the strengthening and fixation of this part of the vertebral column; they are expanded nearly in the axis of the spine, but obliquely, so that the posterior part of one transverse process overlaps the anterior part of the succeeding. This structure is exhibited in a slightly degree in the cervical vertebrae of the Dasyures, Phalangers, and great Kangaroo. In the Petaurists, Potoroos, Wombat and Koala the direction and simpler form of the transverse processes allows of greater freedom of lateral motion. In the Koala and Wombat a short obtuse process is given off from the under part of the transverse process of the sixth cervical vertebra. In the Potoroos, Kangaroos, Petaurist, Phalangers, Opossums and Dasyures this process is remarkably expanded in the direction of the axis of the spine. In the Perameles corresponding processes are observed, progressively increasing in size, in the fourth, fifth and sixth cervical vertebrae.

The number of the dorsal vertebrae is greatest in the Wombat, where it is fifteen, corresponding with the number of pairs of ribs. In all the other genera they are thirteen.

In the Koala the length of the spine of the first dorsal hardly exceeds that of the last cervical, but in all other Marsupials the difference is considerable, the first dorsal
spine being much longer; those of the remaining dorsal vertebrae progressively diminish in length, and increase in breadth and thickness. They slope backwards towards the centre of motion, which in Mauge’s Dasyure is shown to be at the ninth dorsal vertebra, by the verticality of its spine, towards which both the preceding and succeeding spines incline. In the Perameles the centre of motion is at the eleventh dorsal vertebra; in the Potoroo and Kangaroo at the twelfth; in the Phalangers at the thirteenth vertebra. In the Phalangers, Opossums, Koala and Wombat the flexibility of the spine is much diminished, and the centre of motion is not defined by the convergence of the spinous process towards a single vertebra, but they all incline slightly backwards.

The lumbar vertebrae are four in number in the Wombat, seven in the Petaurists, and six in other Marsupiata,—the total number of true vertebrae being thus the same in all the genera1. The pressure to which the trunk of the Wombat must occasionally be subjected, in its extensive subterranean burrowings, is probably the condition of the development of the additional pairs of ribs in that species.

The anterior oblique processes, which begin to increase in length in the three posterior dorsal vertebrae, attain a great size in the lumbar vertebrae, and are locked into the interspace of the posterior oblique processes, which are double on each side, except in the Perameles, and in the last lumbar vertebrae of all the other genera. The transverse processes of the lumbar vertebrae progressively increase in length as the vertebra approach the sacrum; they are most developed in the Wombat, where they are directed obliquely forwards. In the Kangaroos, Potoroos and Perameles they are curved forwards and obliquely downwards. The length of these and of the anterior oblique processes is relatively least in the Petaurists, Phalangers and Opossums.

The number of vertebrae succeeding the lumbar, which are anchylosed together in the sacral region of the spine, amounts in the Wombat to seven; but if we regard those vertebrae only as sacral which join the osa innominata, then there are but three. In the Phalangers there are generally two sacral vertebrae, but in a small species from Tasmania (Phal. Cookii), the last lumbar assumes the character of the sacral vertebrae, both by anchylosis and a partial junction with the osa innominata. In the Kangaroos and Potoroos the impetus of the powerful binder extremities is transferred to two anchylosed vertebrae. In the Perameles there is only a single sacral vertebra, the spine of which is shorter and thicker than those of the lumbar vertebrae, and turned in the contrary direction, viz. backwards. In the Myrmecobius there are four sacral vertebrae by anchylosis, two of which join the ilia. In Mauge’s Dasyure two sacral vertebrae are anchylosed; but it is to the expanded transverse processes of the anterior one only that the innominata are joined. The same kind of union exists in the Viverine Dasyure, but three vertebrae are anchylosed together in this species. In the Phalangers and Petaurists there are two sacral vertebrae. In Petaurus Taguanoides and Pet. macrour-

1 In Phalangiota Cookii the sixth lumbar vertebra is joined by a part of its transverse process to the osa innominata.
rus three are anchylosed together, although two only join the ilium. In the Wombat the transverse processes of the numerous anchylosed vertebrae are remarkable for their length: those of the first four are directed outwards, and are confluent at their extremities; the remaining ones are turned in a slight degree backwards, and very nearly reach the tuberosities of the ischia, behind which they gradually diminish in size, and disappear in the three last caudal vertebrae.

The transition from the sacral to the caudal vertebrae is very obscure in the Wombat; if we limit the sacral to the three which join the ilium, then there remain twelve vertebrae for the tail. The spinal canal is complete in all but the last three, which consist only of the body. There are no inferior spines; and as only the six posterior vertebrae, which progressively diminish in length, extend beyond the posterior aperture of the pelvis, the tail is scarcely visible in the living animal. In the Koala the tail is also very short. In the Chaeropus it would seem to be wanting. In one species of Perameles I find eighteen caudal vertebrae, in another twenty-three.

In two species of Potoroo there are twenty-four caudal vertebrae, but the relative length of the tail differs in these by one-third, in consequence of the different length of the bodies of the vertebrae. In the Hypsiprymnus ursinus there are more than twenty-six caudal vertebrae. In the great Kangaroo there are twenty-two caudal vertebrae; in Bennett’s Kangaroo there are twenty-four caudal vertebrae. In the Phalangista Vulpina there are twenty-one caudal vertebrae. In the Petaurus macrourus I find twenty-eight caudal vertebrae; in Pet. Tuguanoides there are twenty-nine, while in the Pet. sciureus there are but twenty. In both these species the bodies of the middle caudal vertebrae are remarkably long and slender. In the Dasyurus Maugei I find twenty caudal vertebrae.

In the Didelphys cancrivora there are thirty-one, in the Virginian Opossum there are twenty-two caudal vertebrae: in the latter species the spinal canal is continued along the first six; beyond these the superior spinous processes cease to be developed, and the body gives off above only the two anterior and two posterior oblique processes, which are rudimental, and no longer subservient to the mutual articulation of the vertebrae. The transverse processes are single on the first five caudal vertebrae, and are nearly the breadth of the body, but diminish in length from the second caudal, in which they are generally the longest. In the other vertebrae a short, obtuse, transverse process is developed at both extremities of the body, on either side, so that the dilated articular surfaces of the posterior caudal vertebrae present a quadrate figure.

In most of the Marsupials which have a long tail this appendage is subject to pressure on some part of the under surface. In the Kangaroo this must obviously take place to a considerable degree when the tail is used as a fifth extremity to aid in supporting or propelling the body. In the Potoroos and Perameles the tail also transmits to the ground part of the superincumbent pressure of the body by its under surface, when the animal is erect; but it is not used as a crutch, in locomotion, as in the Kangaroos. In the
Phalangers and Opossums the tail is prehensile, and the vessels situated at the under surface are liable to compression when the animal hangs suspended by the tail. To protect these vessels, therefore, as well as to afford additional attachment to the muscles which execute the various movements for which the tail is adapted in the above-mentioned Marsupialia, V-shaped bones, or inferior arches (haemapophyses), are developed, of various forms and sizes, and are placed opposite the articulations of the vertebrae, a situation which is analogous to that of the superior arches in the sacral region of the spine in Birds, and in the dorsal region of the spine in the Chelonian Reptiles. The two crura of the subvertebral arch embrace and defend the blood-vessels, and the spinous process, continued from their point of union, presents a variety of forms in different genera.

In Cook's Phalanger I find the haemapophyses commence between the second and third caudal vertebrae, increase in length to the fourth, and then progressively diminish to the end of the tail, the penultimate and antepenultimate presenting a permanent separation of the lateral moieties, and an absence of the spine. In the Virginian and Vulpine Opossum and Phalangers they are simple; about a quarter of an inch in length where longest, directed obliquely forwards, and diminish in size as they approach the extremity of the tail. In the Potoroos the extremity of the long anterior spines is dilated and produced both backwards and forwards; the posterior smaller ones become expanded laterally, and give off similar but shorter processes from each side, whereby the base of support is extended.

In the Great Kangaroo the spine of the first subvertebral arch only is simple and elongated; the extremities of the others are expanded, and in some jut out into four obtuse processes, two at the sides and two at the anterior and posterior surfaces. In a carefully-prepared skeleton of Macropus Bennettii I found these inferior spines wanting between the last nine vertebrae of the tail. In the Petaurists, Phascolagales and Dasyures, where the tail acts as a balancing-pole, or serves, from the long and thick hair with which it is clothed, as a portable blanket to keep the nose and extremities warm during sleep, the subvertebral arches are also present, but in less number, and of smaller relative size; they are here principally subservient to the attachment of muscles, their more mechanical office of defending the caudal vessels from pressure not being required.

Of the Thorax.—Of the ribs, which, with the exception of the Wombat and Petaurists, are thirteen pairs, the first is the shortest, and, except in some of the Petaurists, the broadest. In the Pet. macourous the fifth, sixth or seventh are the broadest; and the ribs generally have, both in this species and in Pet. sciureus, a more compressed form than in the other Marsupials; but this character does not exist in Petaurus Taguanoides. In the Great Kangaroo they are very slender and rounded, except at the sternal extremities, which are flattened for the attachment of the cartilages. In this species and the Bush Kangaroo the seven anterior pairs of ribs articulate directly with the sternum. The cartilages of the six false pairs are long and bent towards the sternum, but do not
join it, nor are they confluent, but have a gliding motion one over the other. In the Opossum there are seven pairs of true ribs, and six which may be regarded as costae notae. In the Petaurists six pairs out of the twelve, and in the Wombat six pairs only out of the fifteen reach the sternum.

The sternum consists of a succession of elongated bones, generally six in number, but in the Petaurus Taguanoides five, and in the Wombat four. The first bone, or manubrium sterni, is the largest, and presents in many species a triangular shape, from the expansion of its anterior part, and sometimes a rhomboidal figure. A strong keel or longitudinal process is given off in many species from the middle of its inferior or outer surface; the side next the cavity of the chest is smooth and slightly concave. In the Wombat, Phalangers and others, the keel is produced anteriorly into a strong process, against the sides of which the clavicles abut. The first pair of ribs join the produced anterior angles of the manubrium. In the Dasyures, Opossums, Phalangers and Petaurists the manubrium is compressed and elongated, and the clavicles are joined to a process continued from its anterior extremity. The small clavicles of the Kangaroo have a similar connection.

The cartilages of the true ribs (which frequently become ossified in old Marsupials) are articulated, as usual, to the interspaces of the sternal bones; the last of these bones supports a broad flat cartilage.

Of the Pectoral Extremities.—The clavicles are present in all the Marsupials excepting the Perameles, and probably also the Charopus. In the claviculate species they are relatively strongest and longest in the burrowing Wombat, weakest and shortest in the Great Kangaroo. In the latter they are simply curved, with the convexity forwards, and measure only two inches in length. In the Wombat they are upwards of three inches in length, and have a double curvature; they are expanded and obliquely truncate at the sternal extremity, where the articular surface presents a remarkably deep notch; they become compressed as they approach the acromion, to which they are attached by an extended narrow articular surface. In the Koala the clavicles are also very strong, but more compressed than in the Wombat, bent outwards in their whole extent, and the convex margin formed, not by a continuous curve, but by three almost straight lines with intervening angles, progressively diminishing in extent to the outermost line, which forms the articular surface with the acromion. In the Myrmecobius the clavicles are subcompressed, and more curved at the acromial than at the sternal end. In most of the other Marsupials the clavicle is a simple, compressed, elongated bone, with one general outward curvature.

The scapula varies in form in the different Marsupiata. In the Petaurists it forms a scalene triangle, with the glenoid cavity at the convergence of the two longest sides. In the Wombat it presents a remarkably regular oblong quadrate figure, the neck being produced from the lower half of the anterior margin, and the outer surface being traversed diagonally by the spine—which, in this species, gradually rises to a full
inch above the plane of the scapula, and terminates in a long, narrow, compressed acromion, arching over the neck to meet the clavicle.

In the Koala the superior costa does not run parallel with the inferior, but recedes from it as it advances forwards, and then passes down, forming an obtuse angle, and with a gentle concave curvature, to the neck of the scapula; a small process extends from the middle of this curvature. In the Potoroos the upper costa is at first parallel with the lower, but this parallel part is much shorter; the remainder describes a sigmoid flexure as it approaches the neck of the scapula. In the Great Kangaroo, the Perameles, Phalangers, Opossums and Dasyures, the whole upper costa of the scapula describes a sigmoid curve, the convex posterior portion of which varies as to its degree and extent.

The sub-scapular surface is remakable in the Perameles for its flatness, but presents a shallow groove near the inferior costa. In most other Marsupials it is more or less convex and undulating.

In the Great Kangaroo the supra-spinal fossa is of less extent than the space below the spine, and the spine is inclined upwards. In the Perameles and Dasyures the proportions of the supra- and infra-spinal surfaces are reversed, and the whole spine is bent downwards over the infra-spinal surface. In the Potoroos and Phalangers the acromion is, as it were, bent downwards, so as to present a flattened surface to the observer; in the Potoroos and Opossums this appearance is produced by a true expansion of the acromion. In the Perameles the coracoid process is merely represented by a slight production of the superior part of the glenoid cavity. In the Kangaroos and Potoroos it forms a protuberance on the upper part of the head of the scapula. In the other Marsupiata it assumes the character of a distinct process from the same part, and attains its greatest development in the Wombat and Koala, in the latter of which it is forcibly curved downwards and inwards.

The humerus in the Dasyures and Thylacine resembles that of the Dog-tribe in the imperforate condition of the inner condyle, but differs in the more marked development of the muscular ridges, especially of that which extends upwards from the outer condyle for the origin of the great supinator muscle; this ridge is terminated abruptly by the smooth tract for the passage of the musculo-spiral nerve. In all the other genera of Marsupials that I have examined the internal condyle of the humerus is perforated. It is so in the Petaurus macrourus and Pet. Taguanoides, but in the Petaurus sciureus the foramen is represented by a deep notch; in the Phalangista Cookii both foramen and notch are wanting. The ridge above the external condyle is much developed in the Petaurus macrourus and sciureus, and notched at its upper part; but this notch does not exist in Pet. Taguanoides. I find similar differences in the development of the supinator or outer ridge in the genus Perameles. In the P. nasuta it is bounded above by a groove; in a smaller species it is less developed and less defined. In the Kangaroos, Potoroos, Wombat and Koala the outer condyloid ridge extends in the form of a
hooked process above the groove of the radial nerve. In all these, and especially in
the Wombat, the deltoid process of the humerus is strongly developed: it is continued
from the external tuberosity down the upper half of the humerus; except in the Petau-
rists, where, from the greater relative length of the humerus, it is limited to the upper
third. The interspace of the condyles is occasionally perforated, as in the Perameles
lagotis and Wombat. The articular surfaces at both extremities of the humerus have the
usual form; but it may be observed, that in some Marsupials, as the Koala, at the distal
articulation the external convexity for the radius has a greater relative extent than
usual, and the ulnar concavity is less deep.

The bones of the fore-arm present little to detain our notice. They are always distinct
and well developed, and their adaptation to pronation and supination is complete. The
prehensile faculty and ungulcate structure of the anterior extremities appear to have
been indispensable to animals where various manipulations were required in the
economy of the marsupial pouch. When, therefore, such an animal is destined, like
the Ruminant, to range the wilderness in quest of pasturage, the requisite powers of
the anterior members are retained and secured to it by an enormous development of
the hinder extremities, to which the function of locomotion is restricted.

We find, therefore, that the bones of the fore-arm of the Kangaroo differ little from
those of the burrowing Wombat, the climbing Koala, or the carnivorous Dasyure, save
in relative size. They present the greatest proportional strength in the Wombat,
and the greatest proportional length and slenderness in the Petaurists, or Flying Opos-
sums, in which the radius and ulna are in close contact through a great portion of their
extent, and thus lend a firmer support to the outstretched dermal parachute. They are
also long and slender in the Koala. In general the radius and ulna run nearly parallel,
and the inter-osseous space is very trifling; it is widest in the Potoroos. The olecranon
is well developed in all the Marsupials. In the Pet. Taguanoides it is expanded, and
truncate at the upper extremity; in the Virginian Opossum and Petaurists we find it
more bent forwards upon the rest of the ulna, than in the other Marsupials. In the
Wombat, where the acromion is the strongest, and rises an inch and a half above the
articular cavity of the ulna, it is extended in the axis of the bone. The distal end of
the radius in this animal is articulated to a broad bone representing the os scaphoides
and os lunare. The ulna, which in the same animal converges towards a point at its
distal end, has that point received in a depression formed by the cuneiform and pisiform
bones; these are bound together by strong ligaments, and the pisiform then extends
downwards and backwards for two-thirds of an inch. The second row of the carpus
consists of five bones. The trapezium supports the inner digit, and has a small sesamoid
bone articulated to its radial surface. The trapezoides is articulated to the index digit,
and is wedged between the scapho-lunar bone and os magnum; this forms an oblique
articular surface for the middle digit. But the largest of the second series of carpal
bones is the cuneiform, which sends downwards an obtuse rounded process, and receives

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the articular surface of the fifth and the outer half of that of the fourth digit, the remainder of which abuts against the oblique proximal extremity of the middle metatarsal bone.

The five metatarsal bones are all thick and short, but chiefly so the outermost.

The innermost digit has two phalanges, the remainder three. The unguial phalanx of all the digits is conical, curved, convex above, expanded at the base, and simple at the opposite extremity. In the Perameles the unguial phalanx of the three middle digits of the hand, and of the two outer digits of the foot, are split at the extremity by a longitudinal fissure commencing at the upper part of the base. This structure, which characterizes the unguial phalanges in the placental Anteaters, has not been hitherto met with in other marsupial genera.

The terminal phalanges of the Koala are large, much compressed, and curved. The concave articular surface is not situated, as in the Cats, on the lower part of the proximal end, but, as in the Sloth, at the upper. The claws which they support are long.

In the Great Kangaroo the first row of the carpus is composed, as in the Wombat, of three bones, but the apex of the ulna rotates in a cavity formed exclusively by the cuneiform. There are four bones in the second row, of which the unciform is by far the largest, and supports a part of the middle, as well as the two outer digits. In the Potoroos I find but three bones in the distal series of the carpus, the trapezoides being wanting, and its place in one species being occupied by the proximal end of the second metacarpal bone, which articulates with the os magnum. In the Perameles there are four bones in the second carpal row, although the hand is less perfect in this than in any other marsupial genus, Charopus excepted, the three middle toes only being fully developed. In the Petaurists the carpus is chiefly remarkable for the length of the os pisiforme. It would be tedious to dwell on the minor differences observable in the bony structure of the hand in other Marsupials; I shall therefore only observe, that though the inner digit is not situated like a thumb, yet that the fingers enjoy much lateral motion, and that those at the outer can be opposed to those at the inner side, so as to grasp an object and perform in a secondary degree the function of a hand. In the Koala the two inner digits are more decidedly opposed to the three outer ones than in any other climbing Marsupial. But some of the Phalangers, as the Ph. Cookii and Ph. gliriformis of Bell, present in a slighter degree the same disposition of the fingers, by which two out of the five have the opposable properties of a thumb. A similar disposition of the fingers may be observed in the Dormouse when it climbs, and it probably may not be uncommon in other placental Mammals of similar habits, and which have long, slender, and freely moveable fingers. As a permanent disposition of the digits, the opposition of three to two is most conspicuous in the prehensile extremities of the Chamaeleon.

1 It would be interesting to examine the skeleton of the Charopus with reference to this structure.
OF THE MARSUPIALIA.

Of the Pelvic Extremities.—The pelvis in the mature Marsupial is composed of the os sacrum, the two osa innominata, and the characteristic supplemental bones attached to the pubis, called by Tyson the osa marsupialia, or Janitores Marsupii.

We seek in vain for any relationship between the size of the pelvis and that of the new-born young, the minuteness of which is so characteristic of the present tribe of animals. The diameters both of the area and the apertures of the pelvic canal are always considerable, but more especially so in those Marsupialia which have the hinder extremities disproportionately large; as also in the Wombat, where the pelvis is remarkable for its width. The pelvis is relatively smallest in the Petaurists. The anterior bony arches formed by the osa pubis and the ischia are always complete, and the interspace between these arches is divided, as in other Mammalia, into the two obturator foramina by an osseous bridge continued from the pubis to the ischium, on each side of the symphysis.

In the Kangaroos, Potoroos, Phalangers and Opossums, the ilia offer an elongated prismatic form; they are straight in the Opossum, but gently curved outwards in the other marsupial genera. In the Dasyures there is a longitudinal groove, widening upwards, in place of the angle at the middle of the exterior surface of the ilium.

The ilia in the Petaurists are simply compressed from side to side. They are broader and flatter in the Perameles, and their plane is turned outwards. But the most remarkable form of the ilia is seen in the Wombat, in which they are considerably bent outwards at their anterior extremity.

In the Kangaroos and Potoroos the eye is arrested by a strong process, given off from near the middle of the ilio-pubic ridge; and this process may be observed less developed in the other Marsupialia.

The tuberosity of the ischia inclines outwards in a very slight degree in the Dasyures, Opossums, Phalangers, Petaurists, and Perameles; in a greater degree in the Kangaroos and Potoroos; and gives off a distinct and strong obtuse process in the Wombat, which not only extends outwards, but is curved forwards. In the Potoroos the symphysis of the ischia, or the lower part of what is commonly called the symphysis pubis, is produced anteriorly. The length of this symphysis, and the straight line formed by the lower margin of the ischia, is a characteristic structure of the pelvis in most of the Marsupials.

The marsupial bones are elongated, flattened, and more or less curved, expanded at the proximal extremity, which sometimes, as in the Wombat, is articulated to the pubis by two points; they are relatively longest, straightest, and most slender in the Perameles; flattest, broadest, and most curved in the Koala, and shortest in the Myrmecobius', where they do not exceed half an inch in length. They are always so long that

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1 The presence of these characteristic bones in the skeleton of the Myrmecobius exposes the fallacy of the doubts of its marsupial character entertained by some naturalists, as M. Gervais, who had not confidence in the marsupial modifications of the cranium pointed out in Mr. Waterhouse's original description of this genus.
the cremaster muscle winds round them in its passage to the testicle or mammary gland.

The osteogenesis of the marsupial pelvis derives some extrinsic interest from the not-yet-forgotten speculations which have been broached regarding the analogies of the marsupial bones. These have been conjectured to exist in many of the placental Mammalia, with a certain latitude of altered place and form, disguised, e.g. as the bone of the penis in the Carnivora, &c., or appearing as the supplemental ossicles of the acetabulum, which exist in the young of many of the Rodentia. In the os innominatum of an immature Potoroo it will be seen that the curved prismatic ilium contributes to form by the outer part of its base the upper or anterior third of the acetabulum; the rest of the circumference of this cavity is completed by the ischium and pubis, excepting a small part of the under or mesial margin, which is formed by a distinct ossicle or epiphysis of the ilium, analogous to that described by Geoffroy St. Hilaire as the rudimental marsupial bone in the Rabbit. Now here there is a coexisting marsupial bone; but besides the five separate bones just mentioned, there is a sixth distinct triangular ossicle, which is wedged into the posterior interpace of the ischio-pubic symphysis. How easy were it to suggest that this single symmetrical bone may be the representative of the os penis, removed from the glans to the root of the intromittent organ! I regard it as a mere epiphysis of the ischium. The circumference of the acetabulum is always interrupted by a deep notch opposite the obturator foramen, which is traversed by a ligamentous bridge, and gives passage to the vessels of the Harderian gland lodged in the wide and deep acetabular fossa.

The femur is a straight, or nearly straight, long cylindrical bone, having a hemispherical head, supported on a very short neck, especially in the Petaurists, and situated here almost in the axis of the shaft, above and between the two trochanters, which are nearly of equal size. In the Kangaroos and Potoroos the head of the thigh-bone is turned more inwards, and the outer or great trochanter rises above it. In other Marsupials the great trochanter is less developed. In all the species a strong ridge is continued downwards, to a short distance from the trochanter; and this ridge is so produced at the lower part in the Wombat, as almost to merit the name of a third trochanter.

In the Wombat and Koala there is no depression for a ligamentum teres.

The shaft of the bone presents no lineæ asperesa. The canal for the nutrient artery commences at the upper third and posterior part of the bone in the Koala, and extends downwards, contrariwise to that in most other Mammalia. At the distal extremity of the femur the external condyle is the largest, the internal rather the longest. The intermediate anterior groove for the patella is well marked in the Perameles, where the patella is fully developed, but is broad and very shallow in the Phalangeres and Dasyures, where the tendon of the rectus muscle is merely thickened, or offers only a few irregular specks of ossification; and the corresponding surface in the Petaurists, Wombat and
Koala, is almost plane from side to side. I find distinct but small bony patella in the Macropus Bennetii.

In the knee-joint, besides the two crucial ligaments continued from the posterior angles or cresses of the semilunar cartilages,—one to the outer side of the inner condyle, the other to the interspace of the condyles,—there is a strong ligament which passes from the anterior part of the tibial protuberance backwards, to the inner side of the fibular condyle; and a second continued from the same point, along the outer margin of the outer semilunar cartilage, to the head of the tibia.

The tibia presents the usual disposition of the articular surface for the condyles of the femur; but in some genera, as the Wombat and Koala, the outer articular surface is continuous with that for the head of the fibula. In the Kangaroos and Potoroos the anterior part of the head is much produced, and in the young animal its ossification commences by a centre distinct from the ordinary proximal epiphysis of the bone. A strong ridge is continued down from this protuberance for about one-sixth the length of the tibia. In the Koala a strong tuberosity projects from the anterior part of the tibia at the junction of the upper with the middle third. In this species and in the Wombat, as also in the Opossums, Dasyures, Phalangers and Petaurists, the shaft of the tibia is somewhat compressed and twisted; but in the Kangaroos, Potoroos and Perameles, the tibia is prismatic above and subcylindrical below. The internal malleolus is very slightly produced in any Marsupial, but most so in the Wombat.

The fibula is complete, and forms the external malleolus in all the Marsupials. In one species of Hypsiprymnus, and in one species of Perameles (Per. lagotis), it is firmly united to the lower part of the tibia, though the line of separation be manifest externally. In a second species of each of the above genera it is in close contact with the corresponding part of the tibia, but can be easily separated from that bone.

In the Great Kangaroo the fibula is also a distinct bone throughout, but it is remarkably thinned and concave at its lower half, so as to be adapted to the convexity of the tibia, with which it is in close contact and attachment. In each of those genera, therefore, in which locomotion is principally performed by the hinder extremities, we perceive that their osseous structure is so modified as to ensure a due degree of fixity and strength; while in the other marsupial genera, as Phascolarctos, Phascolomys, Phalangista, Petaurus, Didelphys and Dasyurus, the tibia and fibula are so loosely connected together, and with the tarsus, that the foot enjoys a movement of rotation analogous to the pronation and supination of the hand; and in the Petaurists, Phalangers, Opossums, and Koala, the inner toe is so placed and organized as to perform the office of an opposable thumb, whence these Marsupials have been termed Pedimana, or foot-handed. It is to this prehensile power that the modifications of the fibula chiefly relate. In the Wombat, Koala, Petaurists and Phalangers, it expands to nearly an equal size with the tibia at the distal extremity, and takes a large share in the formation of the tarsal joint; but the articular surface is slightly convex, while that of the tibia is...
slightly concave. The proximal extremity of the fibula is also much enlarged, but compressed, obliquely truncated, and giving off two tuberosities from its exterior surface; to the superior of these a large sesamoid bone is articulated: I have observed the same sesamoid attached to the upper end of the fibula in a Dasyurus macrourus. Temminck figures it in the Didelphys urrsina and Didelphys Philander.

I find the following structure of the tarsus in the Wombat. The astragalus is connected, as usual, with the tibia, fibula, calcaneum and scaphoides. The upper articular surface for the tibia is, as usual, concavo-convex, the internal surface for the inner malleolus flattened, and at right angles with the preceding; but the outer articular surface presents a triangular flattened form, and instead of being bent down parallel with the inner articular surface, slopes away at a very open angle from the upper surface, and receives the articular surface of the fibula so as to sustain its vertical pressure. A very small proportion of the outer part of the inferior surface of the astragalus rests upon the calcaneum; a greater part of the superincumbent pressure is transmitted by a transversely-extended convex anterior surface to the scaphoid and cuboid bones. This form of the astragalus is also characteristic of the Koala, Petaurists, Dasyures, and the Pedimanous Marsupials. In the Kangaroos, Potoroos and Perameles, which have the pedes saltatorii, the fibular articular surface of the astragalus is bent down, as usual, at nearly right angles with the upper tibial surface. The calcaneum presents a ridge on the outer surface, which serves to sustain the pressure of the external malleolus, which is not articulated to the side of the astragalus. The internal surface, which joins the astragalus, is continuous with the anterior and slightly concave surface which articulates with the cuboides. The posterior part of the bone is compressed; it projects backwards for nearly an inch, and is slightly bent downwards and inwards. This part is relatively shorter in the Koala, Phalangers, Opossums and Petaurists, but is as strongly developed in the Dasyures as in the Wombat. In the Dasyurus macrourus I observe a small sesamoid bone wedged in between the astragalus, tibia and fibula, at the back part of the ankle-joint. In the Petaurus Taguanoides there is a supplemental tarsal bone wedged in between the naviculare and cuboides on the plantar surface. In the Wombat the scaphoid, cuboid, and three cuneiform bones have the ordinary uses and relative positions.

The analogy of the carpal and tarsal bones is very clearly illustrated in this animal. The anchylosed naviculare and lunare of the hand correspond with the astragalus and naviculare of the foot, transferring the pressure of the facile majus upon the three innermost bones of the second series. The long, backward projecting, pisiform bone of the wrist closely resembles the posterior process of the os calcis; the articular portion or body of the os calcis corresponds with the cuneiform bone of the carpus; the large carpal unciniform represents the tarsal cuboides, and performs the same function, supporting the two outer digits; the three cuneiform bones of the tarsus are obviously analogous to the trapezium, trapezoides, and os magnum. The internal cuneiform bone is the largest of the three in the Wombat, although it supports the smallest of the toes: it is of course
Phaselus fuscescens
Fig 1 Thylacinus. 2–3 Dasyurus.
more developed in the Pedimaneous Marsupials, where it supports a large and opposable thumb. In the Wombat the metatarsals progressively increase in length and breadth from the innermost to the fourth; the fifth or outermost metatarsal is somewhat shorter, but twice as thick, and it sends off a strong obtuse process from the outside of its proximal end. The innermost metatarsal supports only a single phalanx; the rest are succeeded by three phalanges each, progressively increasing in thickness to the outermost; the ungual phalanges are elongated, gently curved downwards, and gradually diminish to a point.

In the Myrmecobius the tibial or innermost toe is represented by a short, rudimental, metatarsal bone, concealed under the skin.

In the Dasyures the innermost toe has two phalanges, but it is the most slender, and does not exceed in length the metatarsal bone of the second toe. In the Peturists it is rather shorter than the other digits, but is the strongest; and in Petaurus Taguanoides the terminal phalanges are singularly flattened and expanded; the toes are set wide apart in this genus. In the Opossums and Phalangers the innermost metatarsal bone is directed inwards, apart from the rest, and, together with the first phalanx, is broad and flat. The second phalanx in the Opossum supports a claw, but in the Phalangers is short, transverse, unarmed, and almost obsolete.

In all the preceding genera there are two small sesamoid bones on the under side of the joints of the toes, both in the fore and hind feet.

The commencement of a degeneration of the foot, which is peculiar to, and highly characteristic of, the marsupial animals, may be discerned, in the Peturists, in the slender condition of the second and third toes, as compared with the first, fourth, and fifth. In the Phalangers this diminution of size of the second and third toes, counting from the hallux, is more marked; they are also both of the same length, and have no individual motion, being united together in the same sheath of integument as far as the ungual phalanges, whence the name of Phalangista applied to this genus. In the saltatorial genera of Marsupialia the degradation of the corresponding toes is extreme; but though reduced to almost filamentary slenderness, they retain the usual number of phalanges, the terminal ones being armed with claws, which appear as appendages at the inner side of the foot, for the purpose of scratching the skin and dressing the fur. The removal of the innermost toe, corresponding with our great toe, and the hallux of the Pedimana, commences in the Perameles. In one species I find the metatarsal bone of this toe supports only a single rudimental phalanx, which reaches to the end of the next metatarsal bone, and the internal cuneiform bone is elongated. In another species the internal toe is as long as the abortive second and third toes, and has two phalanges, the last of which is divided by the longitudinal fissure characteristic of the ungual phalanges in this genus. In the Perameles lagotis the innermost toe is represented by a rudimental metatarsal bone, about one-third the length of the adjoining metatarsal. In the Poeophagous Marsupials no rudiment of the innermost toe exists. The
power of the foot is concentrated in all these genera on the two outer toes, but especially the fourth, which in the Great Kangaroo is upwards of a foot in length, including the metatarsal bone and the claw, which latter resembles an elongated hoof, but is threesided and sharp-pointed, like a bayonet. It is with this formidable weapon that the Kangaroo stabs and rips open the abdomen of its assailant; it will hold a powerful dog firmly during the contest with the anterior extremities, and firmly supporting itself behind upon its powerful tail, deliver its thrusts with the whole force of the hinder extremities.

The cuboid bone, which supports the two outer metatarsals in the Poephaga, is proportionally developed. The internal cuneiform bone is present, though the toe which is usually articulated to it is wanting; it is also the largest of the three, and assists in supporting the second metatarsal; it is joined with the navicular and external cuneiform, the small middle cuneiform occupying the space between the external and internal wedge-bones and the proximal extremities of the two abortive metatarsals. The great or fourth metatarsal is straight, and somewhat flattened; the external one is compressed and slightly bent outwards; the toe which this supports is armed with a claw similar to the large one, but the unguial phalanx does not reach to the end of the second phalanx of the fourth toe, and the whole digit is proportionally weaker.

PLATE LXVIII.

Side-view of the skeleton of the Wombat (Phascolomys Wombat).

PLATE LXIX.

Views of skull and lower jaw of the Koala (Phascolarctos fuscus).

PLATE LXX.

Fig. 1. Base of the skull of the Thylacinus Harrisii.
2. Base of skull of Dasyurus viverrinus.
3. ——— Dasyurus Maugei.
4. ——— Dasyurus macrourus.
5. ——— Dasyurus Ursinus.

PLATE LXXI.

Fig. 1. Base of the skull of Perameles lagotis.
2. ——— Phalangista Cookii.
3. ——— Petaurus breviceps.
4. ——— Hypsiprymnus Hunteri.
5. ——— Macropus Bennetii.
6 a. Exoccipital bone.
6 b. Tympanic bone.
6 c. Pterygoid bone.
6 d. Inferior maxillary bone.
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Plate 1. *Coturnix erythrohyncha* to face page 24

2. *Coturnix Argoondah*

3. *Coturnix Pentah*

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RED LION COURT, FLEET STREET.