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THIS BOOK PRESENTED BY

John M. Russell
THE ELEMENTS OF BOTANY:
CONTAINING
The HISTORY of the SCIENCE:
WITH
Accurate Definitions of all the Terms of Art,
exemplified in Eleven COPPER-PLATES;
The THEORY of VEGETABLES;
The scientific Arrangement of Plants,
and NAMES used in Botany;
Rules concerning the general History,
Virtues, and Uses of Plants.
Being a Translation of the Philosophia Botanica,
and other Treatises of the celebrated LINNAEUS.
TO WHICH IS ADDED,
AN APPENDIX,
Wherein are described some Plants lately found in
Norfolk and Suffolk, illustrated with three additional COPPER-PLATES, all taken from the Life.

By HUGH ROSE, Apothecary.

LONDON:
Printed for T. Cadell, opposite Catharine-
Street in the Strand; and M. Hingeston,
near Temple-Bar. MDCCCLXXV.
LINNAEUS'S PREFACE TO THE BOTANIC READER.

Several years ago I comprized in a few aphorisms or short sentences the theory and institutions of botany under the name of Fundamenta Botanica, or the Fundamentals of Botany; the explanation of which aphorisms, by examples, observations, and demonstrations, distinct and accurate definitions of the parts of plants and terms of art, I have intituled Botanic Philosophy (Philosophia Botanica), because in them were contained the principles and precepts of the science.

Of this Botanic Philosophy I have some time since published different parts; upon the first part or chapter of the Fundamenta Botanica, a book called Bibliotheca Botanica, the 3d edition, was published in 1751, containing 220 pages; on the second another called Classis Plantarum, the 2d edition, in 1747, contains 656 pages; on the fifth a treatise called Sponsalia Plantarum, or the Nuptials of Plants; on the seventh, A 2 eighth,
LINNAEUS's PREFACE

eighth, ninth, and tenth, a book called Critica Botanica, or Botanic Criticisms, published in 1737, 270 pages, in 8vo; on the twelfth, a tract under the name of Vires Plantarum, or the Virtues of Plants. The remaining chapters, viz. the third, fourth, sixth, and eleventh, I had long resolved to publish, together with those mentioned above, in one work, enlarged with new examples, observations, and demonstrations, under the title of Botanic Philosophy, and for this purpose I had made large collections. In the mean time, being frightened with the prospect of what still remained to be said on this subject, I began to be weary of such a laborious undertaking, and had put it off to a more seasonable opportunity; while my time, daily engrossed with cares both public and private, or taken up in the business of my profession, and travels undertaken on account of natural history, slipped so fast away, that I began to despair of the success of such a work.

In the mean time my Bookseller urging the necessity of a new edition of the Fundamenta Botanica, all the copies of the former being sold off, my Pupils at the same time earnestly intreating me to add the parts of plants and terms of art properly defined, in the same way I used to deliver them in my lectures; to this their request were added, the exhortations of some of my friends, eminent,
TO THE BOTANIC READER. v
eminent in botany, that I would explain the terms of art, and give definitions of the parts of plants: in order to satisfy both, I began to reduce my collections into an abridgement for publication. But no sooner had I set about this work, than a severe fit of the gout so broke my strength of body and mind, that it was stopped as soon as begun.

Having now in some measure recovered my strength, I here present the reader with an abridgement of the Botanic Philosophy. The book, though small at present, as containing only the outlines or rudiments of botany, published for the sake of my pupils, I intend, if health and leisure should permit, shall make its appearance, one time or other, with large additions.

Being now busied in collecting the species of plants, I earnestly beg and intreat all the most eminent botanists in Europe to send me compleat specimens of such scarce plants as they have duplicates of, or of those I have not hitherto mentioned, that I may refer them to their proper genera, with their adequate specific differences; and it shall be my care, in return, under every such species in this work, publicly to testify my gratitude to those who have favoured me with such specimens.

Upps, Sept. 16, 1750. CHA. LINNEE."
OUR author's design, in this compendious treatise, is to give us the outlines of botany. The first two chapters contain a brief account of the rise and progress, the fate, changes, and discoveries in botany; the times when, and the places where, cultivated; its improvements, and all the methods used by the moderns in the disposition and distribution of plants. As the whole of practical botany consists in definition, disposition, and denomination, Linnaeus proceeds in the third and fourth chapters to lay down accurate descriptions and definitions of all the parts of plants. In the fifth chapter, where he treats of the sexes and generation of plants, we have almost everything relating to the theory of vegetables. In the sixth, seventh, and eighth chapters, he treats of the other two parts of practical botany, to wit, disposition and denomination, or the disposing and naming, i.e. the arrangement of plants and names used in botany, both classic, generic, and specific. In the four last chapters he treats of the varieties, synonyms,
nyms, general history, medicinal virtues, and other uses of plants, whether esculent or õconomical.

The compleat history of any plant should contain the following particulars:

1. The class and order of each systematic writer to which it does belong; and also the natural order, tribe, or family. This part of the subject is discussed in Chap. II.

2. The generic name of the plant. This is handled in Chap. VII; and,

3. The etymology or derivation of this name, in Chap. VII.

4. The generic characters, in Chap. VI.

5. The specific difference of this from others of the same genus, in Chap. VIII.

6. The synonymous names (in Chap. X.) of all the different writers who have treated on the plant, Chap. I.

7. The several varieties of the plant, in Chap. IX.

8. The description of all its external parts, in Chap. III, IV, V, and XI.

9. An accurate figure of the plant, in Chap. XI.

10. The place of growth, soil, and culture. See Chap. XI.

11. The times of leafing, flowering, fruiting. See also Chap. XI.

12. The medicinal virtues and õconomical uses. See Chap. XII.
In treating of the medicinal virtues, we ought to describe the manner of gathering and curing, or preparing the plant;—the origin of its use;—the inventor or discoverer if known, with the time when, and the place where, first discovered;—select passages of the poets or others may and ought to be illustrated;—historical traditions, pleasant and entertaining, mentioned;—the parts in use;—the marks by which to know its goodness;—the qualities, as far as they are deducible from the fructification, natural order, smell, taste, colour, and place of growth;—experiments on the subject;—its chemical analysis;—its real medicinal virtues, its good and bad effects, in what diseases useful, in what hurtful;—its preparations, what compounds it enters; its doses, and manner of giving; and lastly, its succedanea.

In treating of the economical uses of any plant, we should also describe the manner and time of gathering or felling, curing or preparing, method of using, origin, inventor, historical traditions, select passages, &c. And thus we see, that every chapter of this treatise is extremely useful, and that all of them together constitute the fundamental parts of botany.

And as the whole of this useful Treatise has not hitherto appeared in an English dress,
dressed, the Translator humbly hopes that the present publication, in which he has endeavoured throughout, without taking too great liberties, to give the true sense and meaning of his author, may be of general use to those that are fond of this study or fashionable amusement, and meet with a favourable reception from the public. He also flatters himself that the errors and mistakes, which may be found in the following sheets, are not very great, and therefore begs the candid reader would look upon them with an indulgent eye.

ERRATA.

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THE ELEMENTS OF BOTANY.

PART I.

INTRODUCTION.

SECT. I.

ALL things that fall under our notice in this our earth, are the four simple elements, earth, water, air, fire; and natural bodies, which are compounded of the four elements.

SECT. II.

The natural bodies are commonly divided into the three great kingdoms of nature, the fossil, vegetable, and animal. To describe and demonstrate the properties of the four elements, is the business of natural philosophy; and to describe the subjects of the three great kingdoms of nature, is properly the business of natural history.
The subjects of the fossil kingdom (though they are the most simple and inorganical bodies) have notwithstanding a certain sort of growth. The vegetables have not only an increase of growth, but, being besides organized bodies, and having a regular propulsion of fluids through their proper vessels, are also endued with life. Animals, the most perfect in the scale of natural bodies, besides growth and life, are endued with senses.

That branch of natural history which teaches the right knowledge of vegetables, and their application to the most beneficial uses, is called botany; of the fundamental principles of which we intend to treat in the same order with Linnaeus, who divides his Philosophia Botanica, or Rudiments of Botany into the twelve following chapters, viz.

1. Bibliotheca. Of the various authors and books written on botany.
2. Systemata. The different botanic systems.
3. Plantæ. The different parts of plants, and their terms explained.
4. Fructification. The different parts of fructification.
5. Sexus
Chap. I. OF BOTANY.

5. Sexus. The sexes and generation of plants.
6. Characteres. The characters of the genera, classes and orders.
7. Nomina. The generic names:
8. Differentia. The specific names or differences.
10. Synonyma. The synonymous names.
11. Adumbrationes. The history or compleat description of plants.

CHAP. I. The Botanic Library.

SECT. V.

This first chapter contains an account of the various authors, and their books which have been written on the subject of botany.

SECT. VI.

The authors (phytologi) who have written on plants, may be called either true botanists (botanici), or only lovers of botany (botanophil). The chief botanists since the revival of learning (for we shall have occasion under section ninth to speak of the antients) are the following. In the 15th century Gaza and Barbarus: In the 16th century Brunfelsius, Tragus, Cordus, Ruellius, Gesner, Fuschius, Matthiolus, Dodonæus,
THE ELEMENTS Part I.


In the 18th century, Sherard, Rudbeck, Jussieu, Boerhaave, Kempfer, Feuillee, Knautius, Bradley, Isnard, Vaillant, Blair, Pontedera, Ruppius, Dillenius, Montius, Buxbaumius, Tillius, Martyn, Michelius, Catesby, Geofroy, Cellius, Linnaeus, Haller, Miller, Burman, Ludwig, Amman, Gronovius, Royen, Gesner, Gmelin, Wackendorf, Lechius, Kalmius, and Hasselquist, with many others; besides the several societies which have been established in different parts of Europe, as in Germany, England, France; at Upsal, Peterburg, Norimberg, Stockholm, &c. by whom many of the chief discoveries and improvements have been made.
Chap. I. OF BOTANY.

SECT. VII.

The true botanists are of two sorts, collectors or methodical writers.

SECT. VIII.

The collectors, whose chief care has been about the number of species, are the following, viz.

SECT. IX.

1. The most antient and original writers (patres) among the Greeks, Romans, and Arabians, from Hippocrates and Theophrastus, down to the revival of learning in the 15th century, who may be said to have laid the foundation, and to have taught the first rudiments, of botany; the knowledge of which the Greeks received from the Egyptians, and they from the Chaldeans; the Romans not till after the defeat of Pompey; the Goths in the fourth, and the Lombards in the fifth century; the Arabians in the sixth and seventh centuries, and among them it was cultivated till the middle of the twelfth century. From thence to the middle of the 15th century, when learning began to be restored in Europe, there are a few obscure writers. All those writers are very deficient in the description of plants, for they seldom give any description, and what few they have left us are very incompleat and imperfect.

B 3 The
The Greek writers are, Hippocrates, who flourished in the 5th century before the Christian era; Aristotle in the 4th; Theophrastus in the 3d, Basillus, Nicander, Xenophon in the 2d century, Apuleius, Dioscorides, Rufus, Galen, Oribasius, Æthius, Alexander Trallian, Paulus Ægineta, Myrepus, and Actuarius. Hippocrates has mentioned in his works only the names and medicinal virtues of about 234 plants. Aristotle, who flourished in the 4th century before the Christian era, has mentioned a few plants. Theophrastus, the father of botany, who flourished in the 3d century before Christ, has given us the names of about 500 plants, chiefly without descriptions; and those he has left are very short and imperfect. Dioscorides, who lived in the time of Nero, mentions about 600 plants in all, 410 of which are briefly described by him; of all the others he has given nothing but their names and virtues. Galen, who flourished at Rome about the year of Christ 133, has treated on the virtues of about 450 plants, in his 6th, 7th, and 8th books of simple medicines, besides many other plants which are mentioned in different parts of his works. Oribasius, Æthius, Alexander Trallian, and Paulus Ægineta, who flourished in the 4th, 5th, 6th, and 7th centuries, added little or nothing
thing to what had been advanced by their predecessors, but borrowed all from Galen, either in the very words of that writer, or even more briefly expressed.

The Roman or Latin writers are Cato, who lived about 149 years before Christ; Varro, in the reign of Augustus Caesar. In both these writers on agriculture we find somewhat concerning plants. Virgil, and Antonius Musa, both in the reign of Augustus. The first wrote four books on husbandry, in which he mentions a great many plants. Musa, a physician, wrote a book, which goes under his name, on betony, and the virtues of that plant. Columella, in the time of Claudius, wrote on agriculture; he wrote also a poem in the most pure and elegant Latin, called Hortulus, or his little garden. Pliny lived from the reign of Tiberius to that of Titus: he treats of plants from the 12th to the 27th book of his natural history, and has mentioned above 1000 plants. Palladius, in the time of Antonius Pius, wrote on husbandry.

The Arabian writers are Serapio, Rhazes, Avicenna, Avenzoar, Abenguecit, Abenbitar, Averrhoes; all between the 9th and 12th centuries. They added many things to what the Greeks had formerly advanced on this subject, and indeed a great many of
the medicines now used in the shops were introduced by the Arabians, and wholly unknown to the Greeks.

And lastly, the following obscure and barbarous writers, viz. Nicolaus Myreptus, Hildegardis, Platearius, Matthæus Sylvaticus, Arnoldus de Villa Nova, Jacobus de Dondis, Petrus Crescenticis, Joannes Cuba, Quiritius, Joannes de Bosco, Paulus Suardus, all lived between the beginning of the 12th, and middle of the 15th century; during which time ignorance in the arts and sciences prevailed almost over the whole world, till, at last, about the close of the 15th century, the works of Theophrastus, Dioscorides, and others, were translated by Theodorus Gaza, and Hermolaus Barbarus, out of the original Greek, into the Latin; and learning began to revive in Europe.

sect. x.

2. The second order of the collectors are the commentators (commentatores), who, either by translating, commenting upon, or restoring the true reading of the antients, have thereby elucidated or cleared up their writings; as Bodæus à Stapel on Theophrastus, Dalechampius and Gronovius on Pliny, Matthiolus and Gesner on Dioscorides.
SECT. XI.

3. Those who have given cuts or figures of the plants (iconiographi) on wood, copper, or other plates, as Gerard, Parkinson, Morison, Plukenet, Petiver, Dillenius, &c.; though an hortus focus, properly made and methodically disposed, is far preferable to any cuts, and absolutely necessary to every botanist.

SECT. XII.

4. The next sort of collectors are those who have given us descriptions or histories of the vegetable kingdom (descriptores), either in whole or in part, as Dodonæus, Gerard, Parkinson, Bauhin, Ray, Morison, Dillenius, Scheuchzer, &c.

SECT. XIII.

5. Next follow those who have written whole treatises on one single plant (monographi), or one genus, as Kempfer on tea, Boerhaave on the protea, Dillenius on the mesembryanthemum, Haller on allium, Breynius on ginseng, Bradley on succulent plants, Linnaeus on the betula nana, ficus, passiflora, senega, and several others in his Amoenitates Acad.

SECT. XIV.

6. Again some have treated on the most scarce and rare plants (curiosi); as Gmelin on
THE ELEMENTS. Part I.

on the plants of Siberia, Linnaeus on the Lapland plants, Læselius on the Prussian, Ray on the English, Amman on the Russian, Haller on the Swiss plants, Dillenius, in his Hortus Elthamensis, on the Indian plants; as also Plukenet in his Phytography; with a great many others too tedious to mention.

SECT. XV.

7. In the next place we may reckon those who have given catalogues of all the plants (adonides) that were cultivated in particular gardens, public or private; as Magnolius's garden of Montpelier, Herman's Leyden garden, Volkamerus's Norimberg garden, Haller's Gottingen garden, Linnaeus's Upsal garden; with many others.

SECT. XVI.

8. Others have collected all the indigenous or spontaneous plants (floriflæ) or natives, as we may properly call them, of some particular country, kingdom, province, or district; as Gmelin in his Flora Sibirica, Amman in his Flora Ruthenica, Haller in his Flora Helvetica, Ray in his Flora Anglica, Ruppius in his Flora Jenensis, Linnaeus in his Flora Suecica, &c.
Chap. I. OF BOTANY.

SECT. XVII.

9. Lastly, others have traveled into far distant countries on purpose to collect the foreign plants; as Scheuchzer's travels through the Alps, Pona's plants of Mount Baldus, Ray's travels and voyages, Tournefort's voyage to the Levant, Shaw's travels into Africa, &c. Alpinus to Egypt, Kempfer to Japan, Margravius and Piso to Brazil, Feuillee to Peru, Hernandez to Mexico, Cornutus to Canada, Rheede to Malabar, Rumphius to Amboyna, Sloane to Jamaica, Plumier to North America, &c.

SECT. XVIII.

The methodical writers (methodici), see N° 7, whose business was chiefly the regular disposition and denomination, or ordering and naming the plants, are of several sorts or orders; and

SECT. XIX.

1. Philosophers (philosophi) or theoretical botanists; and of them,

SECT. XX.

1. Some have written orations or declamations (oratores) in praise of botany, or a few general observations concerning the utility of the science, &c. see the Amaen. Acad.
SECT. XXI.

2. Some in the controversial way (eristic) have written in defence of certain systems; as Tournefort's Elements, Colet's Critical Letters, Ray's Sylloge and Rivinus' Letters to Ray, Linnaeus' Methodus Plantarum, and Sigelbeck's Criticism on the same, &c.

SECT. XXII.

3. Some have laid down the laws and principles of vegetation, (physiologi) and the doctrine of the sexes of plants; as Millington in 1676, Camerarius's Epistle, Vaillant's Discourse, Wahlbom in his Sponsalia Plantarum, or Nuptials of Plants.

SECT. XXIII.

4. Others have laid down certain rules and aphorisms on the fundamentals of botany; as Linnaeus in his Fundamenta Botanica, Ludwigius in his Botanical Aphorisms, &c.

SECT. XXIV.

2. The second order of methodical writers (see No 18.) are the systematics (systematici), who have disposed the plants into certain classes, and are either the orthodox or heterodox, that is to say, the true systematics, or the false.
Chap. I. OF BOTANY. 13

SECT. XXV.

The false systems, not being founded on the fructification, have ranged the plants, some in an alphabetical manner (alphabetarii), others according to the structure of their roots (rhizotomi), others according to the different species of their leaves (phyllophili), or the habit or external appearance of plants (physiognomi), or their time of flowering (chronici), their places of growth (topophili), their medicinal uses (empirici), or lastly, according to the order laid down in the several dispensatories (seplasiarii).

SECT. XXVI.

The true systematics (orthodoxi), who have always built their several methods on the fructification, are either universal, taking in the whole compass of vegetables; or partial, comprehending only a small part.

SECT. XXVII.

The universal systems have been formed either on the several parts of

SECT. XXVIII.

The fruit, (fructifæ) viz. the pericarpium, seed or receptacle; as Cæsalpinus, Morison, Ray, Knautius, Herman, and Boerhaave; or on the
Corollæ or petals of the flower (corollæ), as Rivinus, and Tournefort, &c. or on the

Calyx or flower-cup (calycis), as Magnolius and Linnaeus, in the year 1737; as we shall afterwards see in chap. II.; or, lastly, on the

Sexes of plants (sexualis), as that of Linnaeus, first published in 1735, and now universally allowed to be the best.

Of the partial systems (partiales), which have been generally of one class only; the chief are the following, together with the authors who have treated on them.

The compound flowers by Vaillant in 1718, and Pontedera in 1720.

The umbelliferous plants by Morison in 1672, and Artedi in 1735.

The grasses by Ray in 1703, by Monti in 1719, Scheuchzer in 1719, by Michelius in
Chap. I. OF BOTANY.

in 1729, and Linnaeus in 1737, in his Genera Plantarum.

SECT. XXXVI.
The mosses by Dillenius, professor of botany at Oxford, in 1741.

SECT. XXXVII.
The funguses by Dillenius, then physician at Giffein in Germany, in 1719, and Michelius in 1729.

SECT. XXXVIII.
The third sort of methodical writers (see No 18.) are called nomenclators, and are those who have written any thing concerning the names of plants; of whom

SECT. XXXIX.
1. Some have collected all the synonymous names (synonominis) given by different authors to plants, as Caspar Bauhin in his Pinax.

SECT. XL.
Some have written critical dissertations (critici) on the generic and specific names of plants, as Linnaeus in his Critica Botanica.

SECT. XLI.
Others have endeavoured to find out the etymology (etymologici), or original derivation
viation of such names, as Falugiui in his Prosopopeia.

SECT. XLII.

Others have made collections (lexicography) of the different names of plants used in different languages, as Menzelius in his Lexicon Polyglotton.

SECT. XLIII.

The lovers of botany (botanophili, No 4.) are those who have written various observations on plants in general, though not properly belonging to botany as a science; as, for instance,

SECT. XLIV.

1. On the internal structure of plants, (anatomici) as Malpighi, Grew, Hales.

SECT. XLV.

2. On the culture of plants (hortulanii), as Miller, Bradley, and others on husbandry and gardening.

SECT. XLVI.

3. On the medicinal virtues and uses of plants, which some have endeavoured to deduce from
Aftrology (αστρολογία), that is to say, from the influence of the stars, as Bode-stein; others from the similitude (σημειότοτες) between the part of the plant and the part injured or diseased, as Pappen; others from

Chemistr:y (χημεία), that is to say, from a chemical analysis of the plants, as Geo-froy, Tournéfort, &c.

Others from observation and experience (οbservatōres), as Herman, Boerhaave, Lin-naeus in his Materia Medica, Haller; or from mechanical and physiological principles.

Others have endeavoured to ascertain the virtues of esculent plants from smell and taste (diēτετική), as Quercetan, Nonnius, Behren, Lifter.

And lastly, others have distinguished the virtues of medicinal plants according to the natural classes (βοτανο-συστηματική) to which they belonged, as Camerarius in his Con-
venientia Plantarum, and Hasselquist in his Tract called Vires Plantarum, in the Aene.

sect. llii.

Of the fourth and last species of the lovers of botany (see No 43.) we shall reckon those who have written various observations on the manifold uses of plants in common life, as Linnaeus in his Flora Oeconomica, his Pan Suecicus, his Iter Olandicum, Gothicum, Westrogothicum, Scanicum; or those who have written the lives of famous botanists; or those who have explained the scripture plants, as Celsius in his Hierobotanicon; or lastly, the botanic works of several excellent poets, as Macer, Strabus, Rapin, Nevianus, Pectorius, Santolinus, Falugiis, and Cowley.

chap. ii. systems of botany.

sect. liii.

to the true systematics, and to them only, all the clearness and perspicuity, as well as certainty of botany as a science, is owing: they are the following, together with their systems.

sect. liv.

Caesalpinus founds his system on the fruit. He is the first true systematic writer;
Chap. II. OF BOTANY.

ter; distributing his classes according to the situation of the corculum or germ of the seed and receptacle.

1. *Arbores Corculo ex Apice Seminis.* Trees with the germ on the point of the seed.
2. *----- Corculo ex Basi Seminis.* Trees with the germ on the base of the seed.
3. *Herbae Monospermae.* Herbs having one seed only.
4. *----- Dispermae.* Herbs having two seeds.
5. *----- Tetraspermae.* Herbs having four seeds.
6. *----- Polyspermae.* Herbs having many seeds.
7. *----- Monococceae.* Herbs having one grain or kernel.
8. *----- Monocapsulæ.* Herbs having one capsule.
9. *----- Bicapsulæ.* Herbs having two capsules.
10. *----- Fibrosæ.* Herbs having fibrous roots.
11. *----- Bulbosæ.* Herbs having bulbous roots.
12. *----- Cichoraceæ.* Herbs having fuc-cory or endive-like flowers.
13. *----- Flore Communi.* Herbs having a common flower.
14. *----- Pluribus Folliculis.* Herbs having several follicles or feed-bags.

C 2

15. *Herbae*

SECT. LV.

Morison founds his system on the fruit, the *corollæ*, and habit of the plants.
5. *— Leguminosæ*. Herbs leguminous or papilionaceous.
6. *— Siliquose*. Herbs podded.
7. *— Tricapsulares*. Herbs tricapsular, or with three capsules.
8. *— a numero Capsularum dicæ*. Herbs with 4, 5, &c. capsules.
9. *— Corymbiferæ*. Herbs corymbiferous.
10. *— Lactescentes f. pappose*. Herbs having a milky juice, or downy tops.
11. *— Culmiferae*. Herbs culmiferous, as grasses.
12. *— Umbelliferæ*. Herbs umbelliferous.
13. *— Tricocca*. Herbs having three kernels.
15. *— Multicapsulares*. Herbs having many capsules.

16. *Herbæ*
Chap. II. OF BOTANY.


17. — *Capillares*. Herbs called capillary plants, as the fern kind.

18. — *Heteroclítæ*. Herbs anomalous or irregular.

SECT. LVI.

Herman builds his system on the fruit, classing the plants according as they have naked seed or seed vessels, in the following manner.

1. *Herbae Gymnomonospermae simplices*. One naked seed, and a simple flower.

2. — *compositæ*. One naked seed, and a compound flower.

3. — *Gymnodisperma stellatae*. Two naked seeds, and stellated or star-shaped.

4. — *umbellatae*. Two naked seeds, and umbelliferous.

5. — *Gymnotetrasperma asperifol*. Four naked seeds, and rough leaves.

6. — *verticillat*. Four naked seeds, and verticillated or whorl-shaped.

7. — *Gymnopolyispermae*. Many naked seeds.

8. — *Angiospermae*, bulbosa tricapsul. Having seed vessels, bulbous and tricapsular.

9. *Herbae*


12. Quadrivasculare. Four feed vessels.


14. Siliquose. Podded, which are always tetrapetalous.

15. Leguminose. Leguminous and papilionaceous.


19. Apetale Calyculate. Without petals, but having a calyx.

20. Glumose f. flamineae. Without petals, chaffy or stamineous.

21. Nudeae f. muscosae. Without petals, calyx, chaff, or stamina, i. e. a naked anthera, as the mosses.


23. Carnose umbilicate. Trees with a fleshy fruit, umbilicate or naval-shaped.

24. Arbor
Chap. II. OF BOTANY.

25. — Fructu Sicco. Trees with a dry fruit.

SECT. LVII.

Christopher Knautius takes Ray's method inverted, as follows.

2. — Monopetala. Monopetalous, 1 petal.
3. — Tetrarpetala regulars. Tetrapetalous and regular, 4 petals.
4. ——— irregulares. Tetrapetalous and irregular.
5. — Pentapetala. Pentapetalous, or 5 petals.
6. — Hexapetala. Hexapetalous, or 6 petals.
7. — Polypetala. Polypetalous, or many petals.
8. — Multicapsulare. Multicapsular, or many capsules.
10. — Solidae. Solid, or not downy.
12. — Apetalae. Without petals.
13. — Stamineae. Stamineous, without petals or calyx.
15. Herbae
Boerhaave blends Herman's system with that of Ray and Tournefort, in the following manner.

1. *Herbe Submarinae*. Herbs submarine, or sea plants.
2. — *Terrestres*. Imperfect land plants.
3. — *Capillares*. Capillary plants, or the fern kind.
4. — *Gymnoploypermae*. Many naked seeds.
5. — *Gymnotetraspermae verticillatae*. Four naked seeds, and verticillated.
6. — *Asperifolii*. Four naked seeds, and rough leaves.
7. — *Tetrapetala*. Four naked seeds, and four petals.
8. — *Monangiæ*. Having one seed vessel.
9. — *Diangiæ*. Two seed vessels.
10. — *Triangiæ*. Three seed vessels.
11. — *Tetramangiæ*. Four seed vessels.
12. — *Penticangiæ*. Five seed vessels.
13. — *Polyangiæ*. Many seed vessels.
14. — *Gymnodispermae umbellatae*. Two naked seeds, and umbelliferous.
15. *Herbe*
Chap. II. OF BOTANY.

15. Herbae Gymnodisperma fiellatae. Two naked seeds, and star-shaped.
16. — Gymnomonospermae simplices. One naked seed, and a simple flower.
17. — — — — — — — — planipetala. One naked seed, and comp. fl. semi-flosculos.
18. — — — — — — radiatae. One naked seed, and comp. fl. radiated.
20. — — — — — — capitatae. One naked seed, and comp. fl. flosculos.
23. — Apetalae. Without petals.
24. — Monocotyledones Braeteatae. One cotyledon, and having petals.
25. — — — — — Apetalae. One cotyledon, and without petals.
27. — Multifiliqueae. Many podded.
29. — — — — — Tetrapietae cruciformes. Tetrapetalous and cruciform.
30. — — Leguminoseae. Leguminous.
31. — — Apetalae. Having no petals.
34. — — Rosaceae. Rosaceous flowers.

sect.
I. Ray's first method or system is taken chiefly from the fruit, as in the following table.

2. Frutices. Shrubs.
4. — *Flore carentes.* Having no flower.
5. — *Capillares.* Capillary plants.
6. — *Stamineæ.* Staminoes, having only the stamina.
7. — *Gymnomonospermae.* One naked seed.
8. — *Umbellatae.* Umbelliferous.
9. — *Verticillatae.* Verticillated, annular or ring-shaped.
10. — *Asperisfoliæ.* Rough leafed.
11. — *Stellatae.* Stellated or star-shaped.
12. — *Pomiseræ.* Apple-bearing herbs.
15. — *Monopetala uniformes.* Monopetalous uniform or regular.
16. — — — — *difformes.* Monopetalous irregular, or different forms.
17. — *Tetrapetala siliquose.* Tetrapetalous, large pods.
18. — — — — *siliquose.* Tetrapetalous, small pods.
19. — *Papilionaceæ.* Papilionaceous.
Chap. II. OF BOTANY.

20. Herbeae Pentapetalæ. Pentapetalous, or five petals.
25. — Bulbosis affines. Plants near akin to the bulbous.

II. Ray's method amended is taken from the fruit and corolla, as may be seen in the following table.

1. Herbae Submarinae. Submarine plants or sea plants.
2. — Fungi. Funguses.
5. — Apetalae. Without petals.
6. — Planipetalæ. Comp. fl. semi-florescuous, or half florets.
8. — Corymbsiferæ. Comp. fl. corymbiferous.
9. — Capitatae. Comp. fl. florescuous, or whole florets.
10. Monospermeæ. One seed.
12. — Stellatae. Stellate, or star-shaped.
14. Herbeæ
15. — *Polyspermae.* Many seeds.
17. — *Baccisperae.* Berry-bearing herbs.
18. — *Multisiliquae.* Many pods.
19. — *Monopetalae.* Monopetalous, or one petal.
20. — *Ditripetalae.* Two and three petals.
21. — *Siliquose et siliculose.* Great and small, or long and short pods.
22. — *Leguminosae.* Leguminous plants.
23. — *Pentapetalae.* Pentapetalous, or five petals.
25. — *Stamineae.* Stamineous, i.e. having only the stamina.
26. — *Anomala.* Herbs of an uncertain family.
27. *Arbores Arundinaceae.* The palms.
29. — *Fruetum umbilicato.* Trees with an umbilicated fruit.
30. — *Fruetum non umbilicato.* Trees with fruit not umbilicated.
31. — *Fruetum ficco.* Trees with a dry fruit.
32. — *Fruetum siliquoso.* Trees with podded fruit.

*Arbores*
33. *Arbores Anomala*. Trees anomalous or irregular.

**SECT. LX.**

Camellus attempted to dispose the plants according to the valves of the *pericarpium*, thus,

*Pericarpia Afora*. Pericarpium without valves.

--- *Uni fora*. with one valve.

--- *Bifora*. with two valves.

--- *Trifora*. with three valves.

--- *Tetra fora*. with four valves.

--- *Pent a fora*. with five valves.

--- *Hexa fora, &c.* with six valves, &c.

**SECT. LXI.**

Rivinus forms his system on the regularity and number of the petals, taking in also the fruit, which is of three sorts, viz., either 1. naked, or having 2. a dry, or 3. a fleshy *pericarpium*.

Ruppius afterwards improved Rivinus's system in the compound flowers.

1. *Regulares*

2. —— *Dipetala*. —— Dipetalous, or 2 petals.

3. —— *Tripetala*. —— Tripetalous, or 3 petals.

4. —— *Tetrapetala*. —— Tetrapetalous, or 4 petals.

5. —— *Pentapetala*. —— Pentapetalous, or 5 petals.

6. —— *Hexapetala*. —— Hexapetalous, or 6 petals.

7. —— *Polypetala*. —— Polypetalous, or many petals.

8. *Irregulares Monopetala*. Irregular. Monopetalous, or 1 petal.

9. —— *Dipetala*. —— Dipetalous, or 2 petals.

10. —— *Tripetala*. —— Tripetalous, or 3 petals.

11. —— *Tetrapetala*. —— Tetrapetalous, or 4 petals.

12. —— *Pentapetala*. —— Pentapetalous, or 5 petals.

13. —— *Hexapetala*. —— Hexapetalous, or 6 petals.

14. —— *Polypetala*. —— Polypetalous, or many petals.

15. *Composite ex flore regulari*. Comp. fl. of regular florets.

16. —— *regulari et irregulari*. Comp. fl. of regular and irregular florets.

17. *Composite*
Chap. II. OF BOTANY.

17. *Compositae ex flore irregulari.* Comp. fl. of irregular florets only.

18. *Incompletae Imperfectae.* Incompleat or imperfect plants.

**SECT. LXII.**

Knautius (Christiaii) inverted Rivinus's system, preferring number to regularity. He maintained also that there were no flowers without petals, nor any naked seeds.

1. *Monopetali Uniformes.* Monopetalous, uniform or regular.

2. ——— *Difformes.* Monopetalous, difform or irregular.

3. ——— *aggregati uniformes.* Monopetalous, comp. uniform or regular.

4. ——— ——— *Difformes.* Monopetalous, comp. difform or irregular.

5. ——— ——— *Uniformi-difformes.* Monopetalous, comp. uniform and difform together.


7. ——— *Difformes.* Dipetalous, difform or irregular.

8. *Tripetali Uniformes.* Tripetalous, uniform or regular.

9. ——— *Difformes.* Tripetalous, difform or irregular.

10. *Tetrapetali*
10. *Tetrapetalii Uniformes.* Tetrapetalous; uniform or regular.
11. ——— *Difformes.* Tetrapetalous; dfform or irregular.
12. *Pentapetalii Uniformes.* Pentapetalous; uniform or regular.
13. ——— *Difformes.* Pentapetalous; dfform or irregular.
14. *Hexapetalii Uniformes.* Hexapetalous; uniform or regular.
15. ——— *Difformes.* Hexapetalous; dfform or irregular.
16. *Polypetalii Uniformes.* Polypetalous; uniform or regular.
17. ——— *Difformes.* Polypetalous; dfform or irregular.

**SECT. LXIII.**

Ludwigius united Rivinus’s method with that of Linnaeus, thus,

*Monantherae,* mono-stylis. One anthera and one stye.

*Diantherae,* di-stylis. Two antherae, two styles.

*Triantarherae,* tri-stylis. Three antherae, three styles.

*Pentantarherae,* tetra-stylis. Five antherae, four styles.

*Decantarherae,* &c. poly-stylis, &c. Ten antherae, &c. many styles, &c.

Thus taking his classes from the antherae, and the orders of his classes from the styles.
Tournefort's system is formed on the regularity and figure of the petals, together with the two-fold situation of the receptacle of the flower. His orders on the pistillum or calyx.

**Herbae. Herbs.**


3. *Simplices monopetalae labiatae.* Simple flowers monopetalous, labiate or lip’d.

4. *Simplices monopetalae anomalae.* Simple flowers monopetalous, anomalous or irregular.

5. *Simplices polypetalae cruciformes.* Simple flowers polypetalous, cruciform or cross-shaped.


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11. Simplices polypetalaæ anomalaæ. Simple flowers polypetalous, anomalous or irregular.

12. Compositæ flosculosaæ. Compound flowers flocculous, tubular or whole florets.

13. —— Semiflosculosaæ. Compound flowers semi-flocculous, flat or half florets.

14. —— Radiataæ. Compound flowers radiated, like the spokes of a wheel.


16. Ananthæ spermatophoræ. No flower, but bearing seed.

17. Ananthæ & asperæ vulgo. No flower nor seed in the vulgar estimation.


18. Arbores, Apetalæ stamineæ. No petals, but bare stamina.

19. —— Apetalæ amentaceæ. No petals, bearing catkins.

20. —— Monopetalæ. Monopetalous.


22. —— Papilionaceæ. Papilionaceous.

SECT. LXV.

Pontedera's system is a compound of Tournefort and Rivinus's systems.

1. Incertæ. Uncertain to which class they belong.

2. Floribus deftitaæ. Having no flowers.

3. Gemmis

4. Anomala. Anomalous or irregular.

5. Labiata. Labiated.


15. Liliacea. Liliaceous.


17. Cruciformes. Cruciform, or cross-shaped.


19. Filamentoseae. Staminate, or naked stamina.


22. Gemmiferae


27. —— Rosaceae. Bearing buds, rosaceous.

SECT. LXVI.

Magnoliæ's system is formed on the calyx and fruit.

Herbæ. Herbs.

1. Calyx externo includente florem ignotum. Calyx external, including a flower unknown.

5. Calyx externo includente florem flamineum. Calyx external, including a flower flamineous.

4. Calyx externo includente florem monopetalum. Calyx external, including a flower monopetalous.

3. Calyx externo includente florem polypetalum. Calyx external, including a flower polypetalous.

2. Calyx externo includente florem compositum. Calyx external, including a flower compound.

6. Herbæ

7. —— Calyce externo sustinente florem polypetal. Calyx external, supporting a flower polypetalous.

8. —— Calyce interno tantum. Calyx internal only, which is the corolla.

9. —— Calyce externo internoque flore monopetal. Calyx external and internal, flower monopetalous.

10. —— Calyce externo internoque flore di-tripetal. Calyx external and internal, flower with two and three petals.

11. —— Calyce externo internoque flore tetrapetal. Calyx external and internal, tetrapetalous.

12. —— Calyce externo internoque flore polypetal. Calyx external and internal, polypetalous.

Arbores. Trees.

13. Calyce externo tantum. Calyx external only.

14. —— interno tantum. Calyx internal only.

15. —— externo internoque simul. Calyx external and internal both.

Sect. LXXVII.

Linnaeus formed in 1737 a system from the calyx, as follows.

1. Spathacei. Spathaceous, like a sheath or hose.

2. Glumofl. Glumose, or chaffy.

3. Amentacei. Amentaceous, or catkins.

4. Umbellati.
7. Floribundi. Flowering; the petals and stamina are inserted into the flower-cup.
8. Coronati. Crowned, or crown-shaped with a radius.
10. Difformes. Difform, or different shapes.
11. Caduci. Caducous, which fall off, or shed their leaves.
13. ———— uniformes polypetali. Not caducous, uniform and polypetalous.
15. ———— difformes polypetali. Not caducous, difform and polypetalous.
17. Apetali. Apetalous, or a bare calyx without petals.
18. Nudi. Naked, or no petals nor calyx.

SECT. LXVIII.

Linnaeus's sexual system is formed on the number, proportion, figure, and situation of the stamina and pistilla, which he calls the male and female parts of vegetables. It consists
Chap. II. OF BOTANY. 39

consists of 25 classes, which are taken from the flamina, or rather the antheræ; and the orders of the first 13 classes from the pistillæ, as monogynia, digynia, trigynia, tetragynia, &c. that is, 1, 2, 3, 4 pistillæ, &c. The orders of the last 12 classes are characterized from other parts of the fructification, &c. six or seven of his classes are natural, and have been most of them assumed by all the systematic authors. These are the 14th, which contains the labiated and personated flowers of Tournefort; the 15th, the tetrapetalous and cruciform of Tournefort; the 16th, the mucilaginous monopetalous of Tournefort; the 17th, the papilionaceous or leguminous plants of Tournefort; the 19th, the compound flowers which make three of Tournefort’s classes, viz. the flosculous, semiflosculous, and radiated; the 24th, the ananthous and aspermous of Tournefort; the 25th, is the first of Royen.

Characters of the Classes.

1. Monandria. One fertile stamen, i.e. having the anthera.

2. Diandria. Two fertile, or fruitful flamina.


4. Tetrandria. Four ditto, all of an equal length, by which this is distinguished from the 14th class.

5. Pent-
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<thead>
<tr>
<th>Clasfes</th>
<th>Characters of the Clafles</th>
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<tbody>
<tr>
<td>5. Pentandria</td>
<td>Five ditto.</td>
</tr>
<tr>
<td>6. Hexandria</td>
<td>Six ditto, all of an equal length, by which this is distinguished from the 15th clas.</td>
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<tr>
<td>7. Heptandria</td>
<td>Seven ditto.</td>
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<tr>
<td>8. Octandria</td>
<td>Eight ditto.</td>
</tr>
<tr>
<td>10. Decandria</td>
<td>Ten ditto.</td>
</tr>
<tr>
<td>11. Dodecandria</td>
<td>From 11 to 19 stamina inclusive.</td>
</tr>
<tr>
<td>12. Icosandria</td>
<td>Twenty stamina and upwards, sometimes fewer, which are fixed to the inner side of the corolla or calyx, and not to the receptacle; and the corolla is fastened to the inner side of the calyx, which is concave and monophylous, or consists of one leaf.</td>
</tr>
<tr>
<td>13. Polyandria</td>
<td>From 15 to 1000 stamina, which are fastened to the receptacle. It differs from the Icosandria in the calyx, and the insertion of the stamina and corolla.</td>
</tr>
<tr>
<td>14. Didynamia</td>
<td></td>
</tr>
</tbody>
</table>
Chap. II. OF BOTANY.

Claffes. Characters of the Claffes.

14. Didynamia. Four fiamina. The two next to one another shorter than the other two, one style and an uneven corolla.

15. Tetradyfamia. Six fiamina tapering and erect; the two opposite fiamina are as long as the calyx, the other four a little longer, but shorter than the corolla, four even petals.

16. Monadelphia. A Perianthium, not caducous, often double, five petals. The filaments are all joined below into one parcel, but not above, the external are shortest.

17. Diadelphia. The filaments are joined below into two parcels; the lower has nine. A perianthium monophyllous, campanulated, caducous; the cor. always papilionaceous and uneven.

18. Polya-
18. Polyadelphica. The filaments of the flamina are united below into three or more distinct parcels.

19. Syngenesia. The flamina are joined by their antherae (rarely by their filaments) in the form of a cylinder.

20. Gynandria. The flamina grow upon the style, or on the receptacle elongate, in the form of a style; which in that case supports both the flamina and pistilla.

21. Monacia. Male and female flowers in distinct cups on the same plant. All these are called androgynous plants.

22. Diacia. Male and female flowers on different plants of the same species.

23. Polygarnia. Male, female, and hermaphrodite flowers distinct in the same species,
Chap. II. OF BOTANY.

Classes. Characters of the Classes.

species, and sometimes on the same plant. All the plants of this class are called polygamous.

24. Cryptogamia. The fructification either wholly escapes our notice, or the flowers are hid within the fruit.

25. Palmae. Palms, which have always a simple stem, not branched, the top frondose, the fructification on a spadix, which is originally contained within a spathe or sheath. The flowers of all the palm kind are always tri-petalous.

Monoclinia, i. e. the first 20 classes have the male and female parts both in the same calyx; or in other words they are all hermaphrodite flowers. The 21st, 22d, 23d classes are diclinia, i. e. they have the male and female organs in distinct flowers.

Obf. The Dodecandria and Polyandria, in my opinion, are not sufficiently distingushed.

Obf. on class 22, Diæcia. There are many flowers which have the male and fe-
male organs on different plants of the same species, which are put under other classes, and could not be reckoned under the Diæcia, because all the species of those genera are not distinct sexes, as for example, the carex dioica, valeriana dioica, morus nigra, phylica dioica, rhamnus alaternus, salix pentandra, rumex acetosæ, laurus nobilis, acer rubrum, lycnis dioica, cucabulus otites, phytolacca dioica, rubus chamæmorbus, clematis dioica, thalictrum dioicum, napæa dioica, gnaphalium dioicum, &c. Vide Syft. Nat. 642, &c.

See Tab. I. where the classes and their characters are represented on a beautiful copper-plate.

SECT. LXIX.

Haller in 1740, Royen in 1742, and Wackendorf in 1747, have each of them endeavoured to find out a natural method, or nature's system, in the cotyledons, the calyx, the sex, and other parts and circumstances of plants.

Royen's natural method is as follows.
2. Lilia. Lilies.
8. Tricoceæ.
8. Tricoccæ. Three kernels or grains.
9. Incompletae. Incomplete or imperfect.
10. Fructifloraæ. That bear the flower upon the fruit, or above the germ.
11. Calycifloraæ. That bear the flower within the calyx, or below the germ.
13. Siliquoseæ. Siliquole, or podded.
15. Leguminoseæ. Leguminous plants or pulse.
16. Oligantheraæ. Stamina, fewer than the divisions of the corolla.
17. Diploantheraæ. Stamina, double the number of the divisions of the corolla.
18. Polyantheraæ. Many more antheraæ than the divisions of the corolla.
20. Lithophyta. Hard or stony plants.

Haller's natural method.
1. Fungi. Funguses.
5. Gramina. Grasses.
7. Monocotyledones Petaloideæ. One cotyledon or lobe, with petals.
8. Polysemones.
8. *Polysteliones*. Many more *stamina* than petals.
9. *Diplosteliones*. Double the number of *stamina* to the petals.
10. *Isosteliones*. Equal number of *stamina* and petals.
12. *Staminibus sesquialteris*. Half as many *stamina* than petals.

Wackendorf's natural method.

2. *Homoioidiperianthae*. Plants with seed vessels. The *stamina* and petals equal to the divisions of the calyx.
3. *Anomoioidiperianthae*. Plants with seed vessels. The *stamina* and petals not equal to the divisions of the calyx.
4. *Pollaplostemonopetalae*. The *stamina* much more numerous than the petals.
5. *Anisostemonopetalae*. The *stamina* and petals unequal in length.
6. *Cylindrobasisteliones*. Filaments united in a cylinder below the *antherae*, distinct at top, as in the monadelphia.

7. *Dima*
Chap. II. OF BOTANY.

7. Dimacrofrustemonæ. Four stamina, two long, and two short.

8. Tetramacrofrustemonæ. Six stamina, four long, and two short.

9. Distemonopleantherae. Filaments united in two parcels below, as in Diadelphia.

10. Eleutherantherae. Aggregate flowers properly so called, as Dipsacus.

11. Cylindrantherae. Compound flowers properly so called, as in Syngenesia.


16. Calycinae. Visible flowers which have a calyx, and a single cotyledon, as Fucus.

17. Spathaceæ. Spathaceous plants.


Thus have we mentioned all the universal methods of classing plants, made use of by the true or orthodox systematics before the middle of this century.

We shall next speak of the partial systems, which have been generally of one class only.

SECT. LXX.

Vailliant has distributed the compound flowers according to the calyx, receptacle,
and coronula, or little crown of the seed, thus,


— Corymbiferi. Compound flowers corymbiferous.

— Gichoreacei. Compound flowers semisflocculous or half florets.

— Dipsacei. Compound flowers where each floret has a proper calyx.

Orders. Calyx simplex. Calyx simple.

— imbricatus. Calyx imbricated.

— calyculatus. Calyx included within another calyx.

— Receptaculum nudum. Receptacle naked or bare.

— Receptaculum paleaceum. Receptacle chaffy.

— Receptaculum pilosum. Receptacle hairy.


SECT. LXXI.

The umbelliferous plants were classed by Morison according to the figure of the seeds, but by Artedius according to the involucra into three classes, thus,
Involucrum universale et partiale. Universal and partial involucrum.

partiale tantum. Partial involucrum only.

nullum. No involucrum.

SECT. LXXII.

Ray, Montius, and Scheuchzer have disposed the grasses according to their affinity with the different sorts of corn, &c. Michelius according to the glume or chaff, simple or compound; and Linnaeus according to the sexes.

Ray, Montius, and Scheuchzer's genera of grasses are:

Spicata Triticæa. Spiked like wheat.
Hordeacea. Spiked like barley.
Secalina. Spiked like rye.
Loliacea. Spiked like darnel.
Panicea. Spiked like panic.
Phalaroidea. Spiked like canary-grass.
Alopecuroidea. Spiked like fox-tail.
Typhoidea. Spiked like cats-tail.
Myosuroidea. Spiked like mouse-tail.
Echinata. Spiked rough or bristly.
Cristata. Spiked and crested.
Aromata. Spiked aromatic grasses.
Daityloidea. Spiked fingered.

E Paniculata
THE ELEMENTS Part I.

Paniculata Simplicia mutica. Panicle simple and beardless.

— Simp. ariflata. Panicle simple and bearded.

— Composita. Panicle compound.

Affines Linagrostis. Gras$\text{-}$like plants, Linagrostis, cotton grass.

— juncoides. Grass$\text{-}$like plants, \{junc-

— juncus. \{junc-

coids,\} rushes.

— Canna. Grass$\text{-}$like plants. Canna, Indian-fl. reed.

— Scirpus. Grass$\text{-}$like plants, \{Scir-

— Cyperus. \{Cype-
pus,\} rushes.

— Cyperoides. Cyperoides, or carexes.

SECT. LXXIII.

Dillenius has with the most amazing dili-
gence discovered, and compleatly described and figured, the mosses; his principal distinction of which is with or without a calypttra.

SECT. LXXIV.

Dillenius has ranked the algae according to their texture, and Michelius according to their flowers.
As to the funguses, Dillenius has distinguished them according to their tops or caps, which are underneath folded, porous, or echinated; and Michelius according to their fructification.

As to the lithophyta, or stony plants, as they have been called, such as corallines, &c. which were of old reckoned of the fossil or mineral kingdom, Marsilius put them under the vegetables, but Peysonellus restored them to their right place, to which they certainly belong, the animal kingdom.

Besides all the above-mentioned systems or methods of distributing the plants deduced from the fructification, and which may therefore be called artificial, there is a natural method, or nature's system, which we ought diligently to endeavour to find out. Some detached fragments of this we shall here subjoin. And that this system of nature is no chimera, as some may imagine, will appear, as from other considerations, so in particular from hence, that all plants, of what order soever, shew an affinity to some others to which they are nearly
nearly allied. In the mean time, till the whole of nature's method is compleatly discovered (which is much to be wished), we must be content to make use of the best artificial systems now in use.

**Natural Orders*.  

1. *Palmae*. Palms, and some genera that agree with them in habit; *cocos*, *phœnix*, *fritioïtes*, &c.

2. *Piperitæ*. Pepper, and some other that resemble it in habit, structure, and sensible qualities; *piper*, *arum*, &c.

3. *Calamariae*. Reed-like plants. In these the leaf is entire at the base, they have no joints nor petals; *scirpus*, *schænus*.

4. *Gramina*. Grasses; *triticum*, *secale*.

5. *Tripetaloidea*. Plants with three petals; *calamus*, *juncus*.

6. *Enfatae*. Plants with sword-shaped leaves; *iris*, *gladiolus*.

7. *Orchideæ*. Orchises, and those that resemble them in habits, powers, and sensible qualities; *orchis*, *satyrium*.

8. *Scitamineæ*. Aromatic plants, and some others which afford agreeable fruit, and agree in habit; *musa*, *coslus*, *amomum*.

* See Mr. Milne's Botan. Dist. To the sensible and ingenious writings of that gentleman, I acknowledge myself indebted for many things, particularly for his accurate definitions.
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9. Spathaceae. Spathaceous plants, whose flowers are contained within a spatha or sheath; narcissus, galanthus, amaryllis.

10. Coronariae. Plants of the garland or lily tribe; lilium, tulipa, hemerocallis, fritillaria, hyacinthus, ornithogalum.

11. Sarmentosae. Plants with climbing stems and branches; tamus, smilax, aristrolochia.

12. Holoraceae. Pot herbs, plants for the table, and other domestic uses; blitum, spinacia, atriplex, beta.


15. Inundatae. Plants which grow in the water; potamogeton, ruppia, myriophyllum, ceratophyllum, hippuris.

16. Calyciflorea. Plants with the stamens inserted into the calyx, have no corolla, and their fruit is a pulpy drupa or bacca; osyris, trophis, hippocphae, eleagnus.

17. Calycanthemae. Plants with the corolla and stamens inserted into the calyx; epilobium, oenothera, glaux.

18. Bicornes. Plants with horned antherae; kalmia, ledum, azalea, rhododendrum, erica, vaccinium, arbutus, andromeda, pyrola, epigea.

19. **Hesperideae.** Plants in habit like the myrtle; *eugenia, psidium, myrtus, caryophyllus, philadelphus.*

20. **Rotaceae.** Plants with one flat wheel-shaped petal, and no tube; *trientalis, centunculus, anagallis, lysimachia, phlox, gentiana, sertoria.*

21. **Preciae.** Early flowering plants, as *primula,* and some others that agree in habit; *androjaec, diapensia, dodecatheon, cortusa, cyclamen, menyanthes, botonia, samolus.*

22. **Caryophylleae.** Plants of the pink or carnation tribe, and others nearly allied to them; *dianthus, saponaria, silene, cucubalus, lychnis, cerasifium, holosteum.*

23. **Tribilatae.** Plants with three seeds, each marked with a scar; *melia, acer, aesculus, staphylea, sapindus.*

24. **Corydalis.** Plants with hooded or helmet-shaped flowers; *melianthus, epimedium, fumaria, utricularia, pinguicula.*

25. **Putamineae.** Plants whose fruit is covered with a hard woody shell; *cleome, capparis, moriflora.*

26. **Multifilique.** Plants which have many seed vessels; *Paonia, aquilegia,aconitum, delphinium, dictamnus, ruta, nigella, trollius, belleborus, caltha, ranunculus, adonis, anemone, thalictrum.*

27. **Rhoeadeae.** Plants of the poppy tribe, or resembling them in habit; *arge-mone,*
Chap. II. OF BOTANY.

mone, chelidonium, papaver, sanguinaria, podophyllum.

28. Lurideæ. Plants of an ominous appearance, hurtful or noxious; verbascum, digitalis, nicotiana, atropa, hyoscyamus, datura, capsicum, solanum.


30. Contortæ. Plants with a monopetalous corolla, twisted or bent towards one side; genipa, vinca, nerium, periploca, apo- cynum, cynancum, asclepias, stapelia.

31. Vepreculae. Plants that resemble the daphne, dirca, gnidia, passerina, thesium.

32. Papilionaceæ. Plants that have papilionaceous flowers, i.e. somewhat resembling a butterfly in shape, of which number are all the leguminous plants; pisum, vicia, ervum, cicer, orobus, lupinus, arrachis, medicago, trifolium, lotus.

33. Lomentaceæ. Plants which afford a fine dye, with others like them in habit; caesalpinia, haematoxylon, cajia, mimosa, hymenæa, polygala.

34. Cucurbitaceæ. Plants resembling the gourd in figure, habit, virtues, and sensible qualities; anguria, elaterium, cucurbita, cucumis, momordica, passiflora.

35. Senticoseæ. Briars, brambles, and others which resemble them in external appear-
appearance; alchimilla, agrimonia, dryas, geum, tormentilla, fragaria, rubus, rofa.

36. Pomaceae. Plants with a pulpy succulent fruit of the apple, berry, and cherry kind; ribes, forbus, crataegus, mespilus, pyrus, punica, prunus, amygdalus.

37. Columniferae. Plants whose stamina and pistilla have the appearance of a column or pillar in the middle of the flower; malva, alcea, althaea, lavatera, hybiscus.

38. Tricoccæ. Plants with a single three-cornered capsule, having three cells, each containing one seed; euphorbia, croton, jatropha, ricinus, mercurialis, buxus.


40. Personatae. Plants with a marked flower; the ringentes of Rivinus, chelone, antirrhinum, rhinanthus, pedicularis, euphrasia, melampyrum, orobanche, acanthus.

41. Asperifoliae. Rough-leafed plants; the didynamia angiospermia of Linnaeus, symphytum, borrago, echium, asperugo, lithospermum.

42. Verticillatae. Verticillate plants, they have four naked seeds, and flowers growing in whorls; the labiatae of Tournefort, and didynamia gymnospermia of Linnaeus, thy-
mus, melissa, origanum, hyssopus, lavendula salvia, mentha, nepeta, teucrium.

43. Dumosæ. Plants which are thick-\,, with irregular branches, and bushy; \,: rhamnus, ceanothus, ilex, viburnum, celastrus, caffeine, euonymus.

44. Sepiariæ. Woody plants proper for hedges; Jasminum, ligustrum, phillyrae, olea, fraxinus, syringa.

45. Umbellatae. Umbelliferous plants; eryngium, sanicula, daucus, angelica, pastina-\,, hum, fison, coriandrum, cicuta, anethum, cuminum.

46. Hederaceæ. Plants resembling the ivy; panax, hedera, vitis, cissus.

47. Stellatae. Starry plants, with two naked seeds, and leaves round the stem in form of a star; \,: serardia, asperula, gallium, valantia, rubia, cornus.

48. Aggregatae. Aggregate flowers, consisting of a number of florets, which have each a proper and a common calyx; statice, globularia, diplus, scabiosa, knautia, circeæ, lonicera, linnæa, viscum.

49. Compositæ. Compound flowers; arct-\,, carduus, cnicus, cichorium, lapsana, leontodon, lactuca, gnaphalium, tanacetum, matricaria, inula, tuffilago, \,: aster, helenium, othonna, bidens, helianthus, melampodium, ta-\,, getes, zinnia, amellus, artemisia, seriphium, filago, xanthium.

50. Amentaceæ.
50. Amentaceae. Plants bearing catkins; salix, populus, platanus, fagus, juglans, corylus, betula, myrica.

51. Coniferae. Cone-bearing plants; pinus, cupressus, thuja, juniperus, taxus.

52. Coadunatæ. Plants with numerous seed vessels, joined together to form a single round or conical fruit; annona, uvaria, magnolia, liriodendron.

53. Scabridæ. Plants with rugged or bristly leaves; ficus, parietaria, urtica, morus, ulmus, cannabis, humulus.

54. Miscellaneæ. Miscellaneous plants; reseda, poterium, lemma, coriaria, empetrum, amaranthus, nymphæa, swietenia, telephium.

55. Filices. Ferns; ophioglossum, osmunda, adiantum, asplenium, polypodium, pilularia, isoetes.

56. Musci. Mosses; lycopodium, fontinalis, sphagnum, phascum, mnium, splachnum, polytrichum, bryum, hyllum.

57. Algae. Flags; marchantia, jungermannia, anthoceros, targinia, lichen, blasia, riccia, tremella, ulva, fucus, chara, conferva.

58. Fungi. Funguses; agaricus, boletus, hydnum, phallus, clathrus, elvela, clavaria, peziza, lycoperdon, byfhus, mucor.

59. Dubii ordinis. Doubtful genera; amyris, berberis, cuscuta, dioïna, empetrum, fuschia, galax, hydrophylhum, illicium, limonia, mangifera, nepenthes, ophioxyloyn, plantago, randia, xantalum, trapa, ximenia, &c.
As to all the other genera under this last number, which are near one hundred and twenty, it is uncertain of what order they are.

In the above table I have added only a few examples to each number, referring the reader to the Genera Plantarum, Edit. vi. for the other genera contained under each number.

CHAP. III. Of the Parts of Plants.

After this long but necessary digression concerning the authors on botany, and the several botanic systems, we shall now resume our subject.

SECT. LXXVIII.

A vegetable (see N° 4.) is an organical body, which draws the matter of its nourishment and growth by pores or vessels placed on its external surface; and consequently it may be aptly enough called an inverted animal. As to the component parts of vegetables they consist of three sorts of vessels (with their contained fluids, sap and air), to wit, 1. The sap vessels, in which the circulation, or rather propulsion, is carried on. 2. Small reservoirs, wherein the sap is lodged; and lastly, very small vessels, air vessels, or tracheae, by which they draw and retain the air.
Vegetables may be divided into the three following tribes, viz. 1. Monocotyledones; 2. Dicotyledones; and 3. Acotyledones. The first have only one seminal leaf, valve, or lobe; and therefore the leaves they put forth, at their first springing out of the ground, are entirely similar to the succeeding ones. This tribe comprehends the three families of 1. palms, 2. grasses, and 3. bulbous plants of the lily kind, &c. The second tribe have two seminal leaves, and comprehend the two numerous families of, 4. herbs, and, 5. trees. The third tribe have no seminal leaves or lobes; they comprehend the four families of, 6. ferns, 7. mosses, 8. algae or flags, and, 9. funguses.

1. The palms have a simple stem, not branched; the top is frondose, i.e. shaped like the fern kind, the fructification is on a spadix, which is originally contained within a spathe or sheath. The flowers are always tripetalous.

2. Grasses have the most simple leaves, an articulated or jointed stalk and tubular, their calyx is glumose or chaffy, each calyx containing one seed only.

3. Bulbous plants of the liliaceous kind; as allium, narcissus, ornithogalum, hyacinthus, crocus, iris, &c.

4. Herbs, and

5. Trees: these need no definition.

6. Ferns
6. Ferns have, properly speaking, no stem, but consist of what botanists call frons, which is a composition of leaf and stem. Ferns also for the most part have their seeds on the backside of the leaf.

7. Mosses have an anthera without any filament supporting it, remote from the female flower; have no pistillum; their seeds have no cotyledons or lobes, nor any coat or tunic.

8. Algae have their root, leaf, and stem, all in one.

9. Fungusese are plants seemingly imperfect, low, having neither flower, leaf, colour, nor texture, analogous to others; of a quick growth, and short duration.

The component parts of trees, the most perfect vegetables, are, 1. The outer bark, cortex; 2. the inner bark, liber; 3. the blea or white sap, alburnum; 4. the fibres, filaments, or woody parts, lignum; and 5. the pith, medulla. By the inner bark of trees is caused their increasing growth or thickness, by the addition of a new covering or ring of wood, every year. Hence the principal part of trees is that portion of the bark which is joined to the wood, or the inner bark, by whose assistance trees perpetuate life, their trunks become thicker, and their germination or budding, as well as fruitfulness, succeed. Of trees, some are gemmi-
gemmiparous, and others not. Those growing in warm climates are mostly destitute of buds, and those in cold climates are for the most part furnished with buds. Hence it is, that trees which are natives of the warmer climates cannot be naturalized to our cold northern climes, because of their want of buds. " All trees, says Alfton, " whether they do or do not bear gems or " buds, are furnished with a true bark, " with a liber or inner bark, and with an " alburnum, which is that sappy part of " trees betwixt the inner bark and wood, " or the external soft part commonly called " ed the white sap; and these are the prin- " cipal parts of them. Consequently we " may infer, that such plants, whose stems " are not annual, but endure for some " years, and are not covered with a true " bark, but only with a cuticle or film, " may be styled shrubs or undershrubs, or " numbered with herbs." Though Lin- " neus says, that nature has put no limits or " distinction betwixt trees and shrubs; for, " says he, it cannot consist, as has been com- " monly thought, in having or not having " buds, since many trees in hot countries, as " we said before, are entirely destitute of " buds. Buds are the rudiments of leaves " and flowers, or both, and also of young " shoots. Perennial herbs have gems or eyes, " as
as they are commonly called, on their roots, and some roots there are which consist of a great many little bulbs; all these are analogous to the buds on trees. So then perennial plants have a double set of flowers at one and the same time, as one may say, the bulbs, or eyes and buds containing the rudiments of the next succeeding flowers in embryo. Another distinction of trees is into the evergreens and deciduous, that is, those which shed their leaves every autumn. Herbs are annual, biennial, or perennial; the perennial are of two sorts; evergreens, as the lavender, rosemary, &c. or caducous, which die down to the root every year. Another general division of vegetables may be into exotic and indigenous plants. Exotics or foreign plants are of four sorts; 1. the Tropical, which are never exposed to the air of our climate, but kept within stoves all the year round; 2. the African or succulent plants, which in the summer will bear being exposed abroad in the day-time; 3. the Tame (*manueta*), which in the summer will bear being set abroad day and night; 4. the Naturalized, which will bear our winters, as rue, lavender, &c. Indigenous plants or natives, which grow spontaneously with us, are distinguished according to their place of growth into marsh, wood, mountain, sea, river, plants, &c.
The three principal parts of vegetables are; 1. the root; 2. the herb, or main body of the plant; and 3. the fructification. Of the two first only we shall treat in this Chapter, and of the fructification in the following.

The root which draws nourishment for the supply and production of the whole plant and its fructification, consists of the stock (caudex) and radicle.

A. The radicle is that fibrous part of the root in which the descending stock terminates, and by which the root draws nourishment for the support of the whole plant.

B. The descending stock gradually strikes downward into the ground, and puts forth radicles. From its various structure it has been distinguished by botanists into,

1. The perpendicular root, when it runs in a straight line downwards.
2. The horizontal root, which runs transversely under the earth. Iris.
3. The simple root (see f. 129.) which is not subdivided.
4. The branched root (see f. 130.) which is divided into lateral branches.
5. The tapering root (see f. 129.) which is oblong, thick at the upper end, and gradually
dually smaller to the other extremity; as in Daucus, pafinaca.

6. The tuberous root (see f. 128.), which consists of a bundle of roundish knobs. As in paeonia, hemerocallis, helianthus, solanum, filipendula.

7. The creeping root (see f. 131.), which runs out to a great length, putting forth small roots here and there as it creeps along.

8. The fibrous root, which consists only of small fibres.

9. The stumped root, whose lower extremity is not tapering to a point, but stumped, or as it were bitten off. As in scabiosa, plantago, valeriana.

C.

The ascending stock gradually raises itself above ground, often supplying the place of a trunk, and produces the main body of the plant. It is for this reason that all trees and shrubs may be considered as roots above ground; and therefore a tree turned upside down, will produce leaves from the descending stock, and roots from the ascending.

SECT. LXXXI.

The second part of the vegetable is the herb or main body of the plant, which rises from the root, and is terminated by the fructification. It consists of the trunk, F the
the leaves, the fulcra, props or supports, and the hybernacula or winter quarters: the trunk, whose use is to multiply the herb, leads immediately from the root to the fructification; the leaves transpire and draw the air, as the lungs in animals, and also afford shade; the fulcra or props serve as supports to the plant, which however seldom perishes, though deprived of those fulcra; the hybernacula or winter quarters, to wit, the bulbs and buds, contain the herb or plant, as it were, in miniature.

SECT. LXXXII.

The trunk, which produces the leaves and fructification, is of seven sorts, viz. the caulis, culmus, scapus, pedunculus, petiolus, frons, and stipes.

A.

The caulis or stem is the proper trunk of the herb, and produces leaves and fructification.

a. Simple stems are extended in a continued direction to the top, without deviation, and are the following:

1. The entire stem is most simple, having scarce any branches.

2. The naked stem is without leaves, as in the euphorbia, caestus, Stapelia, ephedra, cuscata.

3. The leafy stem, which is furnished with leaves.

4. The
4. The bending stem is turned according to the joints in different directions, as in ptelea; to the left, or according to the motion of the sun, as it is commonly called, as in hamulus, helxine, lonicera, tamus; to the right, or contrary to the sun's motion, as in convolvulus, basella, phaseolus, cynanche, euphorbia, eupatorium.

5. The twining stem (fig. 115.), mounts in a spiral line upon the branch or stem of another plant.

6. The reclining stem, which bends like a bow towards the earth, as in the ficus.

7. The procumbent stem, which lies flat on the ground.

8. The creeping stem (fig. 112.), which lying on the ground puts forth small roots here and there, as in the hedera, bignonia.

9. The long and slender or twig-like stem (sormentosus, see f. 131.), is also creeping, and almost naked or without leaves.

10. The parasitic stem is that which grows on some other plant, and not out of the ground; as the epidendrum, viscum, tilandsia.

11. The round stem is cylindrical.

12. The two-edged stem has two angles opposite to one another, as in the fisyrinchium.

13. The two, three, four, five, and many edged stems are all species of the foregoing.

F 2 14. The
14. The *three-cornered* stem has three plain sides, and three angles.

15. The *triangular, quadrangular, quincangular, and multangular* stems, which have two, three, four, five, or many angles.

16. The *furrowed* stem is marked with broad and deep channels through its whole length.

17. The *striated* or streaked stem is fluted or marked with very small parallel channels through the whole length.

18. The *smooth* stem, which has a smooth or even surface.

19. The *hairy* stem, which is covered with soft hairs; as in *rhus, tomex*.

20. The *rough* stem is covered with rough projecting points.

21. The *bristy* stem is spread over with stiff bristles; as in *brassica erucastrum*.

**Simple branching Stems.**

22. The *ascending* stem, where the branches come out horizontally, and then gradually turn upwards.

23. The *spreading* stem, where the branches are spread out wide, as in the common water germander.

24. The *dichotomous* stem, where the branches are put forth in two rows, or from two sides of the stem only.

25. The
25. The brachiate stem sends out its branches in opposite pairs, each pair crossing the other. (See f. 117.)

26. The most branched stem abounds with branches disposed without any regular order.

27. The propped stem is supported by the branches which descend to the earth; as in ficus, rhizophora, mangrove.

28. The proliferous stem, which throws out its branches from the center of the apex; as in the pinus.

Compound Stems.

b. 29. The forked stem is when the division is always made in two parts; as in the cerasium dichotomum. (See f. 116.)

30. The subdivided stem is divided into branches without any order.

31. The jointed stem has joints or knots at certain distances; as in salicornia.

B.

The culmus, straw or haulm, is that sort of stem which is proper to grasses and corn, bearing the leaves and fructification thereof. Besides many of the distinctions given for the caulis, it admits also of some peculiar to itself, as,

32. The straw without knots or joints.

33. The jointed straw or haulm. (See f. 114.)

34. The squamose or scaly straw. (See f. 111.)

F 3  C. The
C.

The *scapus* or stalk is an universal trunk, bearing the fructification only, and not the leaves; as in *narcissus, pyrola, convallaria, hyacinthus*. (See f. 113.)

D.

The *peduncle* or footstalk of the flower is a partial trunk, bearing the fructification only, but not the leaves.

When branched or divided, each of the divisions is called *pedicellus*, or a little flower-stalk. Flower-stalks are distinguished from the place of the plant where they grow, into,

1. The *radical* flower-stalk, when they proceed immediately from the root.
2. The *cauline* flower-stalk, which proceeds from the stem.
3. The *branch* peduncle, which proceeds from the branches.
4. The *axillary* or bosom flower-stalk, which comes out between the leaf and stem, or between the branch and stem.
5. The *terminal* flower-stalk, which comes from the extremity of the branch or stem.
6. The *solitary* peduncle, when there is only one in the same place.
7. The *scattered* peduncles, when a great many grow together without any order.

Again, flower-stalks are distinguished from the different modes in which flowers are borne and connected on them, into,

8. The
8. The uniflorous, biflorous, triflorous, or multiflorous peduncle, that is, which bear one, two, three, or many flowers.

9. The fasciculus, a bunch or bundle, where the peduncles are erect, parallel, placed close to one another, and all of the same height, as in sweet william, dianthus barbatus, Pl. 10. f. 164.

10. The capitulum, a little head, where many flowers are collected into a head at the extremity of a peduncle, as in globe amaranthus, gomphrena, f. 171.

11. The spike where the sessile flowers are placed alternately upon both sides of a simple common flower-stalk (f. 165.). A spike is said to be single rowed (spica secunda), when the flowers are all turned one way, as in dactylis cynosuroides; or double rowed (spica difficba), when the flowers look to both sides, or stand two ways.

12. The Corymbus, where the lesser flower-stalks of unequal lengths are produced along the common peduncle on both sides, and rise to the same height, so as to form a flat or even surface at top, as in spiraea opulifolia, gold of pleasure, &c. (see f. 163. Pl. 10.)

13. The panicle where the fructifications are dispersed upon foot-stalks variously subdivided (f. 170.), as in oats, &c. A panicle is said to be diffuse, when the partial foot-stalks diverge, and the fructifications
THE ELEMENTS Part I.

hang loose; as in the *poa aquatica*, or straight and narrow; when the foot-stalks approach near to one another, as in *fesjuca ovina*, *aira cerulea*.

14. The *thyrsus* is a panicle contracted into an oval or egg-shaped form, resembling the cone of a pine; as in *lilac, butter-burr*, f. 168.

15. The *racemus* or cluster, consists of a common peduncle, having short lateral branches, all of equal lengths, proceeding from it; as in the *vitis, ribes*, f. 166.

16. The *verticillus* or whorl, where the flowers are produced in rings at each joint of the stem, with very short foot-stalks, as in *mint, horehound*, &c. See f. 169.

E.

The *petiolus* or foot-stalk of the leaf is a species of trunk which bears the leaf, but not the fructification. It happens sometimes, though very rarely, that the fructification and leaf are both produced on the same foot-stalk; as in *turnera*, Syrian mallow.

F.

The *frons* is a species of trunk consisting of a branch and leaf, and frequently the flower and fruit all blended together. It belongs properly to the *ferns* and *palms*, f. 108.

G.

The *stipes* is the base or lower part of a *frons* and *fungus*, and is only proper to the *palms*, *ferns*, and *fungi*.
Chap. III. OF BOTANY.

SECT. LXXXII.

Leaves are either simple, compound, or determinate, which last term respects their disposition upon the plant.

A.

Simple leaves are those which have only a single leaf on a foot-stalk. Simple leaves differ in respect to circumference, angles, sinuses, extremity, margin, surface, and substance.

a. As to their circumference simple leaves are either,

1. Round (orbiculatum), as in *rumex digynus*, fig. 1.
2. Roundish (subrotundum), see f. 2.
3. Egg-shaped (ovatum), as in *vaccinium myrtillus*, f. 3.
4. Oval (ovale) as in the rose, f. 4.
5. Parabolic or half oval (paraboticum), f. 110.
7. Wedge-shaped (cuneiforme), as in *apium graveolens*, f. 45.
8. Oblong (oblongum), as in forrel, &c. f. 5.

b. In respect to their angles simple leaves are,

10. Linear or equally broad every where (lineare); as in rosemary, pine, grafts, f. 7.

11. Chaffy
11. Chaffy and evergreen (*acerosum*), as in *pinus, abies, juniperus, taxus*, f. 102.
12. Awl-shaped, or tapering to a point (*subulatum*), as in *arenaria saxatilis sedum rubescens*, &c. See f. 8.
15. Deltoid, shaped like a delta (*deltae*), as in *populus nigra*, f. 58.
16. Round (*rotundum*), which has no angles.

C. Sinuses are deep cuts or openings in the disk of the leaf.
18. Heart-shaped (*cordatum*), as in lime-tree, f. 10.
19. Moon-shaped (*lunulatum*), f. 11, as in moonwort.
20. Arrow-shaped (*sagittatum*), f. 13, as in field-bindweed.
21. Spear-shaped (*baulatum*), f. 15, as in *dulcamara, scutellaria baellifolia*.
22. Fiddle-shaped (*panduriforme*), f. 15, nearly resembles it.
23. Parted or cut halfway down (*fissum*), f. 16.
24. Lobed or divided almost to the midrib (*lobatum*). From the number of divisions in this and the foregoing, the leaves are
are termed, *bifida*, *trifida*, *quadrifida*, *quinquifida*, *multifida*, or *biloba*, *triloba*, *quadriloba*, *quinqueloba*, i.e. divided into two, three, four, five, or many segments or lobes.

25. Hand-shaped (*palmatum*), f. 22. as in *palma Christi*, *rheum palmatum*.

26. Pinnatifid, cut like wings (*pinnatifidum*), f. 23.

27. Shaped like a lyre (*lyratum*), f. 76.


29. Sinuated, having sinuses (*sinuatum*), f. 25.

30. Divided to the base (*partitum*), f. 28. From the number of divisions they are termed *bipartitum*, *tripartitum*, *quadripartitum*, *quinquepartitum*, *multipartitum*, i.e. having two, three, four, five, or many divisions.

31. Entire (*integrum*), having no division or sinus.

d. The extremity or tip of simple leaves is either,

32. Stumped (*truncatum*), as in the tulip tree.

33. Bitten (*premorsum*), f. 18.

34. Blunted (*reutum*), f. 46.

35. Notched (*emarginatum*), at the tip, f. 45.

36. Obtuse or blunt (*obtusum*), f. 40.

37. Acute or sharp-pointed (*acutum*), f. 41.

38. Tapering
38. Tapering to a point (acuminatum), f. 42.

39. Obtuse with a point (obtusum cum acuminine), f. 43.

39. Terminated with tendrils (cirrhosum), f. 43. as in superb lily, &c.

e. The margin or brim of a simple leaf is either,

40. Prickly (spinosum), as in holly.

41. Unarmed (inerme), without prickles, opposed to the former.

42. Toothed or indented (dentatum), f. 30. as in dandelion.

43. Sawed or ferrate (serratum), f. 31, as in vaccinimum myrtillus.

43. Notched (crenatum), f. 38, as in primula farinosa.

Notches blunt, f. 36. notches sharp, f. 35. notches double, f. 33.

44. Serpentine edged, f. 29, repandum.

45. Griffly or cartilaginous (cartilagineum), f. 34.

46. Fringed or ciliate (ciliatum), f. 50, as in erica ciliaris.

47. Torn or ragged (lacerum), the various segments of the margin of different forms.

48. Gnawed (erosum), f. 21, is a sinuated leaf, f. 25, with other very small obtuse sinuses on its margin.

49. Very entire (integerrimum), f. 42.

f. The
The surface, upper or under of a simple leaf is either,

50. Clammy (viscidum), as in senecio viscosus.

51. Cottony (tomentosum), as in cerastium tomentosum, f. 48. verbasicum hapsus.

52. Wooly (lanatum), as in salvia, sideritis, ledum villosum, and some geraniums.

53. Hairy (pilosum), f. 47. as in cortusa, and juncus pilosus.

54. Bristly (bispidum), f. 49. as in turritis hirsuta.

55. Rough with knots (scabrum), as in some of the fig marygolds.

56. Prickly (aculeatum), as in some of the thistles.

57. Streaked with parallel lines (striatum).

58. Blistered (papillosum), see f. 54. as in some of the fig marygolds.

59. Dotted, or covered with transparent points (punetatum), as in St. John's-wort.

60. Glittering or shining (nitetum), as in ferula Canadensis, angelica Canadensis.

61. Plaited (plicatum), as in ladies-mantle, f. 37.

62. Waved (undulatum), as in rheum undulatum.

63. Curled (crispum), f. 39. as in brassica crispa; all curled leaves are monsters.

64. Wrinkled (rugosum), as in sage, f. 51.

65. Hollow
65. Hollow or concave (concavum).
66. Veined (venosum), when the veins are branched, as in laurus nobilis, &c. f. 52.
67. Ribbed (nervosum), when the vessels are not branched, as in plantain, f. 53.
68. Beautifully coloured (coloratum), as in amaranthus tricolor.
69. Smooth (glabrum).
70. Cylindrical (teres), f. 62. as in allium vineale, and allium oleraceum.
    Semicylindrical (semicylindraceum), half a cylinder, as in chenopodium maritimum.
71. Tubular, or hollow like a pipe, (tubulosum), as in the onion.
72. Fleshly (carnosum), as in all the succulent plants.
73. Compressed (compressum), when the leaf is thicker than the breadth of the disk.
74. Plane, even or level (planum), of an equal thickness throughout.
75. Humped or bunched (gibbum), convex on both sides, f. 76.
76. Depressed (depressum), when the disk is lower than the sides.
77. Convex (convexum), when the disk is higher than the sides.
78. Channelled (canaliculatum), f. 61, sunk almost to a semicylinder.
79. Sword-shaped (enfiforme), as in iris, gladiolus.
80. Shaped
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80. Shaped like a Persian scymitar (acinaciforme), f. 56, as in some of the fig marygold.

81. Tongue-shaped (linguisforme), f. 55, as in some of the fig marygold.

82. Hatchet-shaped (dolabriforme), f. 57, as in some of the fig marygold.

83. Two edged (anceps), as in the sisyrinchium.

84. Three cornered (triquetrum), f. 59, with three angles and three flat sides.

85. Furrowed (sulcatum), f. 60, with longitudinal ridges and channels.

86. Keel-shaped (carinatum) on the under surface, as in crinum Asiaticum.

87. Membranaceous (membranaceum), thin like films.

B.

Leaves are called compound when there are two or more upon one foot-stalk. Such leaves are either once or twice, or more than twice compounded.

b. 88. A compound leaf, properly so called, is, when a single foot-stalk supports more than one leaf.

89. It is called jointed when one leaf grows out of the extremity of the other, see f. 107. as in the prickly pear.

90. Fingered, when a single foot-stalk has several small leaves connected to its extremity, f. 66. as in horse-chesnut, lupin, fetterwort; and these fingered leaves are said to be,
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91. Binatum, compounded of two, see f. 63. or
92. Ternatum, compounded of three, see f. 64, 65. or
93. Quinatum, compounded of five, or
94. Pinnatum, when a single foot-stalk has a great many small leaves attached along its sides; and these pinnated leaves either end with
An odd one, as in f. 68, or with
A tendril, as in f. 72, or with neither, and then they end
Abruptly, as in f. 69, or the pinnae or small leaves are
Opposite to one another on the mid-rib, or they are
Alternately placed, as in f. 70, or they are
Interrupted, i.e. with every other leaf smaller, as in f. 71. or
Jointed, when the common foot-stalk is so, as in f. 75, or
Decurrent, when the lobes run down along the mid-rib, as in f. 74.
95. Conjugate is a pinnate leaf, consisting only of two lobes, f. 73.
i. In a leaf twice compounded, the common foot-stalk bears other lesser or partial foot-stalks.
96. A decompound leaf, when a foot-stalk once divided connects several lesser leaves.
97. Bigemi-
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97. Bigeminate leaf, when a forked foot-stalk connects four small leaves on its extremities.

98. Double-three-leaved (biteminatum or duplicato-ternatum), when each of the lateral foot-stalks supports three leaves, f. 77.
as in barrenwort.

99. Bipinnate or doubly pinnate, f. 78.
a double winged leaf.

100. Foot-shaped (pedatum), when the foot-stalk divides at top into two parts, on the inside of which the lobes are supported, as in passion-flower, arum, &c. see f. 67.

k. More than twice compounded leaves.

101. A more than twice compounded leaf, when the lateral foot-stalks are subdivided into other partial foot-stalks, which last bear the lobes or lesser leaves.

102. Triple-three-leaved (triternatum or triplicato-ternatum), as in f. 79. where double-three-leaved are inserted into a common foot-stalk.

103. Triple-winged (tripinnatum or triplicato-pinatum) as in f. 80. where double-winged leaves are inserted into a common foot-stalk.

C.

As to the determination or disposition of leaves, we are to consider their place, situation, insertion, and direction.

l. Place.

104. A seed leaf (folium seminale) is a production
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production of the cotyledons or lobes of the seed, see f. 91.

105. A radical or root leaf (folium radi-
cale), or bottom leaf, comes immediately from the root.

106. A stem leaf (folium caulinum) proceeds from the stem or stalk of the plant, see f. 90.

107. A branch leaf (folium rameum) is seated upon the branch, see f. 89.

108. An axillary leaf (folium axillare) proceeds from the bosom or armpit of a branch.

109. A flower leaf (folium florale) is placed at the coming out of the flower, see f. 88.

m. Situation.

110. Leaves are called starry or whorled (stellata or verticillata), when more than two leaves surround the stem in rings or whorls, see f. 106.

111. These are called terna, quaterna, quina, sena, &c. i.e. three, four, five, six, according to the number of leaves which compose the star or whorl; as in nerium, brabeium, hippuris, sedum verticillatum, gal-
lium spurium.

112. Opposite leaves, i.e. facing one another, where each pair is crossed by that immediately above or below it; as in myr-
tle, jessamy, and rocket, &c. see f. 82-87.

113. Alternate,
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113. Alternate, when they come out singly, and are ranged gradually upon both sides of the stem; as in antirrhinum, cymbalaria, see f. 103.

114. Scattered (sparfa), when disposed plentifully round the stem without any regular order; as in several species of the lily.

115. Crowded (conferta), when they come out in such quantities as to cover the branches, leaving scarcely any space between them; as in toadflax, antirrhinum, monspessulanum, see f. 102.

116. Laid over each other like tiles or fish-scales (imbricata), as in some species of faxifrage, see f. 101.

117. Placed in bundles (fasciculata), when many leaves proceed from the same point; as in the larch, and some pines, see f. 100.

118. Ranged along two sides of the branches only (disticha), as in the fir-tree.

n. Insertion.

119. A target-shaped leaf (petatum) has the foot-stalk inserted into the center of the lower disk or surface; as in water-lily, palma Christi, Indian cress, and geranium peltatum, see f. 99.

120. A leaf furnished with a foot-stalk is called folium petiolatum, see f. 98.

121. A leaf furnished with no foot-stalk is called folium sessile, see f. 97.
122. A running leaf (fol. decurrens) runs downwards along the stem beyond its base; as in thistle, verbascom, and globe flower, see f. 96.

123. A leaf is said to embrace the stem (fol. amplexicaule), when by its base it entirely surrounds it transversely; as in moth mullein, and black henbane, see f. 95. When such a leaf half surrounds the stem, it is called (semiamplexicaule).

124. A perforated leaf (perfoliataum) is, when the stem penetrates the leaf above its base; as in the round-leafed bupleurum, see f. 94.

125. Two opposite leaves grown together into one at their base are called folia connata, as in lonicera, eupatorium, see f. 93.

126. A glove-like leaf (fol. vaginans) has the base formed into a tube, which embraces the stalk like a sheath; as in corn, grass, and some of the lilies, see f. 92.

127. Adversum, a leaf whose upper disk is turned to the meridian, and its margin or edge to the sky; as in amomum.

128. An oblique leaf (obliquum), when the base looks to the sky, and the tip to the horizon; as in ruscus, fritillaria, and protea.

129. Bent inwards (inflexum), when they are turned upwards towards the plant, see f. 87.

130. Laid
130. Laid close to the stem (adpressum).
131. Upright (erectum), is nearly perpendicular, see f. 86.
132. Spreading (patens), when they recede from the stem, see f. 85.
133. Horizontal (horizontale or patentifsimum), when they form right angles with the stem, see. f. 84.
134. Reclined (reclinatum or reflexum), when they are bent downwards, so that the tip is lower than the base, see f. 83.
135. Rolled back (revolutum), when the tip is rolled downwards, f. 82.
136. Hanging down (dependens), when they point with the tips to the earth.
137. A rooting leaf (radicans) is one, which being planted strikes root, as in aloe.
138. A floating leaf (natans), lies on the surface of the water, as in water-lily and pondweed.
139. A sink leaf (demersum) is one which lies below the surface of the water.

N. B. There are above forty more species of leaves in Elmgren's Termini Botanici in the Aænitates Academicae, Vol. VI.

SECT. LXXXIV.

Fulcra (see N° 81.), the props or supports of the plant, are the seven following, viz. stipula, braætea, spina, aculeus, cirrhus, glandula, pilus.

G 3 1. Stipula
1. **Stipula** is a scale or small leaf on each side the base of the foot-stalks of the flowers and leaves, though in the *Amen. Ac.*, it is confined to the foot-stalks of the leaves only. These *stipulae* may be seen in the tamarind tree, *cassia*, rose, honey flower, *tulip* tree, apricot, peach, bird cherry, and the leguminous plants (see f. 118. b.)

2. **Bradlea** is the floral leaf, or leaf next the flower, but differing both in shape and colour from the other leaves of the flower. Examples of this may be seen in the lime tree, bulbous fumitory, cow wheat, *sage*, lavender, *monarda*, *hellebore*, fennel flower, *passion* flower, bird’s-foot, French honey-fuckle, *African* broom, *milkwort*, *rest-harrow*, lady’s-finger, kidney-bean, *cylus*, *lotus*, indigo, and many others (see f. 120.).

3. **Spina**, a thorn, proceeds from the woody part of the plant, and is exemplified in *prunus*, *rhamnus*, *hippophite*, *celastrus*, *lycium*, &c. (see f. 121.). Spines often disappear by culture; as may be seen in *pyrus* *malus*.

4. **Aculeus**, a prickle, proceeds only from the bark of the plant. Examples of this may be seen in the rose, *bramble*, currant, *barberry*, &c. (see f. 122, 123.).

5. **Cirrus**, a clasper or tendril, is a small spiral string, by which a plant fixes itself to any thing in its neighbourhood for support.
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support. Examples of this are the vine, the vetch, peas, cucumbers, bignonia, &c. (see f. 118.)

6. Glandula, a gland, is a small prominent body, serving as an organ of secretion. They are chiefly to be found on the footstalks and other parts of the leaves, and on the tender stipulae. Examples may be seen in palma Christi, cassava, passion flower, wild jëna and acacia; in willow, in almond tree, gourd, gelder rose, bird cherry, tamarisk, butterwort, sun-dew, apricot tree, &c. (see f. 119.)

7. Pilus, hair, is defined by Linnaeus to be a small excretory duct of some secretion in the plant.

SECT. LXXXV.

Hybernaculum (see N° 81.), the winter quarters, is that part which is destined by nature to inclose and defend the tender plant in its embryo state from external injuries, during the winter, is of two sorts, the bulbis and gemma.

1. The bulb is generally situated on the root, or descending stock, and is either
   Scaly, as in the lily, f. 125.
   Solid, as in the tulip, f. 126.
   Coated, as in the onion, f. 127, or
   Jointed, as in lathraea, martynia, adoxa.
   They are only large buds under ground.

4 Bulbs
Bulbs are sometimes placed on the stem, and other parts of herbaceous plants, as may be seen in some species of the lily and garlic.

2. Gemma, the bud, is seated on the ascending stock or trunk, and consists of _filiule_, scales, foot-stalks, and rudiments of the leaves, or scales of the bark. They are only small bulbs above ground.

Most part of the plants in cold countries have buds, but in warm countries scarce any of the plants have them.

Many trees have no buds; as _philadelphus, frangula, T. alaternus, T. paliurus, T. jatropha, hibiscus, babobab, jujucia, cassia, mimosa, gleditschia, erithryna, anagyris, medicago, nerium, viburnum, rhus, tamarix, berberis, eric, malpighia, lycatera, solanum, alceps, ruta, geranium, petiveria, peregrina_ of Plumier, _cupressus, thuia, sabina_.

Buds and bulbs are of various sorts, viz. Deciduous, as in _dentaria, ornithogalum, lilium, saxifraga_.

- Containing the leaves but not the flowers; as in _alnus_.
- Containing the leaves and flowers in distinct buds; as in _populus, salix, fraxinus_.
- Containing the leaves and female flowers only; as in _corylus, carpinus_.
- Containing the leaves and male flowers only; as in _pinus, abies_.

Containing
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Containing the leaves and hermaphrodite flowers; as in daphne, ulmus, cornus, amygdalus.

Containing both the leaves and flowers as in most trees. See Laëfig's Diff. de Gemmis Arborum in the Amaen. Academ.

In this last the leaves come out upon a small branch, which afterwards produces flowers.

CHAP. IV. Of the Fructification.

In the foregoing Chapter we have spoken of all the parts of plants except those of the fructification. In this fourth chapter we shall treat of the several parts of fructification; of the threefold structure of the fructification; of simple and aggregate flowers; and lastly, of luxuriant flowers.

SECT. LXXXVI.

Fructification is a temporary part of vegetables, appointed for the purpose of generation, terminating the old vegetable, and beginning the new. The parts of fructification are the seven following, viz.

1. The calyx, flower-cup or empalement.
2. The corolla, petals or painted leaves of the flower.
3. The stamina, threads or chives.
4. The pistillum, or pointal.
5. The
5. The *pericarpium*, or seed vessel.

6. The seeds.

7. The receptacle or base on which all the other parts of the fructification are connected.

I. The calyx (which is the termination of the outer bark of the plant, presenting itself in the fructification, in this form) comprehends the seven following species, viz. the *perianthium*, the *involucrum*, the *amentum*, the *spadix*, the *gluma*, the *calyptra*, and *vulva*, of each of which in their order.

1. The *perianthium*, or flower-cup properly so called, is the most common species of calyx, and situated close to the fructification. If it incloses the *stamina* and *germen*, it is called the *perianthium* of the fructification. If it incloses the *stamina* and not the *germen*, it is the *perianthium* of the flower. If it includes the *germen*, and not the *stamina*, it is the *perianthium* of the fruit.

2. The *involucrum* or cover (f. 134.) is situated at the bottom of an umbel at some distance from the flower. It is called universal *involucrum* or cover, if it is situated at the bottom of an universal umbel; and a partial *involucrum* or cover, if at the foot of a partial umbel.

3. The *amentum* or catkin (fig. 139) is that
that sort of calyx which consists of a great number of chaffy scales proceeding from a common receptacle or slender thread, as in the willows and poplars, &c.

4. The *spatha* or sheath (fig. 132, 136.) is a sort of calyx which bursts lengthways, and puts forth a stalk supporting the flowers; as in *narcissus*, snow-drop, *arum*, and the palms.

5. The *gluma* or chaffy husk (f. 133.) is that sort of calyx peculiar to grasses, composed of thin scales or valves, which are often terminated by an *arista*, a beard or awn.

6. The *calyptra*, a veil or hood, (f. 135.) is a sort of calyx peculiar to mosses, placed over their *antherae*, and resembling a Monk’s cowl, or rather an extinguisher.

7. The *volva* (see f. 141.) is a sort of calyx peculiar to the *fungi* or mushroom tribe, involving or inclosing their fructification. It is membranaceous and torn quite round.

II. The *corolla*, literally a wreath or garland, serving together with the calyx as covers to the parts they inclose, is the termination of the inner bark of the plant presenting itself in this form, and consists of the *petalum* and *nectarium*.

8. The *petalum* is the corollaceous covering of the flower. If the flower is monopetalous,
monopetalous, \( i.e. \) consists of one petal, the lower hollow part of such a corolla is called

The tube, see f. 142. letter \( a \).

And the upper part which spreads wider is called

The limb, see f. 142. letter \( b \).

Again, this upper part or limb in monopetalous flowers, from its different figure, has got different names, for it is either

Bell-shaped \( (campanulatus) \), without any tube below; or

Tunnel-shaped or conical \( (infundibuliformis) \), with a tube; or

Saucer or falver-shaped \( (hypocrateriformis) \), f. 142. with a tube.

Wheel-shaped \( (rotatus) \), without any tube below; or

Gaping \( (ringens) \), lipped or masked.

If the corolla be polypetalous, \( i.e. \) consists of many petals, the lower part of each petal is called

The unguis, or claw, see f. 144. letter \( a \).

And the upper part which is wider, is called

The lamina, or thin plate, see f. 144. letter \( b \).

Again, this upper part, or lamina, is either

Cross-shaped \( (cruciformis) \), of four equal spreading petals, f. 144.  

Butterfly-
Butterfly-shaped (*papilionaceus*), irregular, of four petals; the under one keel-shaped, the upper one ascending, and the two side ones standing single.

9. The *nectarium* is that part of the *corolla* which contains the honey, having a wonderful variety both as to shape and situation, and is sometimes united with the petals, and sometimes separate from them, see f. 138. 145. 147. 148.

III. The *flamina* are those parts of a flower appropriated to the preparation of the *pollen* or fecundating dust, and consist of the *filamentum*, the *anthera*, and the *pollen*.

10. The *filamentum*, or thread, serves to elevate the *anthera*, and connect it to the flower, see f. 143.

11. The *anthera*, or summit of the *flamen*, is that part which contains the *pollen* or fecundating dust, and discharges it when ripe.

12. The *pollen*, or impregnating dust, is that fine powder contained within the *antherae*, or tops of the *flamina*, and dispersed, when ripe, upon the female organ, for impregnating the same.

IV. The *pistillum*, or pointal, or female organ, adheres to the fruit, and is that part appropriated for the reception of the *pollen*, spoken of above. It consists of the *germen*, the *styulus*, and the *stigma*.

13. The
13. The *germen*, or seed-bud, is the base or lower part of the *pistillum*, containing the rudiments of the unripe fruit, or seed, in the flowering state of the plant.

14. The *stylus*, or style, is that part of the *pistillum* which stands upon the *germen*, and elevates the *stigma* or summit.

15. The *stigma*, the summit, or top of the *style*, is that part which receives the fertilizing dust of the *antheræ*, and transmits its *effluvia*, through the *style*, into the middle of the *germen* or seed bud.

V. The *pericarpium*, or seed vessel, is that part which contains the seeds, and discharges them when ripe. It comprehends the eight following species, viz. the *capsula*, the *siliqua*, the *legumen*, the *conceptaculum* or *folliculus*, the *drupa*, the *pomum*, the *bacca*, and the *strobilus*; of each of which in their order.

16. The *capsula*, a capsule or little casket, is a dry, hollow seed vessel, that splits or opens in some determinate manner, see f. 161, 162, 163.

Capsules, when opened or split, are divided outwardly into one or more pieces, called

*Valvulae*, or valves, see f. 162. letter *a*.

The parts which divide the capsule internally into cells, are called

*Dissepimenta*, or partitions, see f. 162. letter *b*.

And
And the substances which connect the partitions to the seeds, are called Columnellae, or little pillars, see f. 162. letter c.

And the empty spaces for containing the seeds, are called Loculamenta, or cells, see f. 162. letter d.

17. The siliqua, or pod (f. 157.), is a seed vessel with two valves, having the seeds fixed along the joining or edge of both valves.

18. The legumen, or cod (f. 155.), is a seed vessel with two valves, having the seeds fixed along the edge of one of the valves only.

19. The conceptaculum, a receiver, or folliculus, a little bag, is a seed vessel with one valve (f. 156.), splitting lengthways from top to bottom, and has no seam for fastening the seeds within it.

20. The drupa (f. 159.), or stone fruit, is a pulpy seed vessel, which has no valve or opening, and contains within it a stone or nut.

21. The pomum, or apple (f. 158.), is a pulpy seed vessel, which has no valve or external opening, and contains within it a capsule.

22. The bacca, or berry, is a pulpy seed vessel (f. 160.), which has no valve, and contains seeds which are naked, or have no other covering than the pulp.
23. The sēroblīus, or cone (f. 140.), is a feed vessel composed of woody scales, laid over one another like tiles; it opens only at top, the scales being fixed below to the center of the cone.

VI. Semen, the seed, is a deciduous part of the plant, containing the rudiments of a new vegetable, and fertilized by the sprinkling of the male dust. Under this head are comprehended the seed properly so called, the nut and propago.

24. The seed properly so called is made up of the following parts, viz.

1. Corculum, the little heart, the point or speck of life. It consists of the Plumula, or scaly part of the corculum, which ascends and becomes the stem, and the Rostellum, that simple part of the corculum, which strikes downwards and becomes the root.

2. Cotyledons, the porous and perishable side lobes of the seed.

3. Hilum, an external mark or scar in the seed, where it had been attached to the seed vessel.

4. Arillus, the proper exterior coat of the seed, which falls off spontaneously, see Pl. VIII. A.

5. Coronula, the crown of the seed, which is termed pappus or down, and is either feathered
feathered or hairy. The thread which supports the pappus is called stipes, see f. 164.

6. Ala, the wing of the seed, or the thin membrane by which it is dispersed, f. 152.

25. The nut is a seed covered with a hard bony skin.

26. Propago, the seed of the mosses, which has no tunic or covering.

VII. The receptaculum, or receptacle, the seventh and last part of the fructification on which the other six are connected, comprehends the receptaculum proprium, the receptaculum commune, the umbella, the cyma, and the spadix: and first of

27. The receptaculum proprium, or proper receptacle, which belongs to the parts of a single fructification only. It is called the receptacle

Of the fructification, when it is common to both flower and fruit. It is called the receptacle

Of the flower, when the parts of the flower only are fastened to it without the germin; and the receptacle

Of the fruit, when it is a base for the fruit, and at a distance from the receptacle of the flower; and the receptacle

Of the seeds, when it is a base to which the seeds are fixed within the pericarpium or seed vessel, f. 163.

28. The
28. The receptaculum commune, or common receptacle, is that which connects several florets together; so that if part of them were taken away, an irregularity would ensue, see f. 137. That thin substance, which grows on the common receptacle, and separates the florets, is called palea or chaff, f. 146.

29. The umbrella or umbel is a receptacle, where a number of small flower-stalks rise from the same center to an equal height, and form an even surface at top. It is called a simple umbel when it has no subdivisions; as in panax. It is called a compound umbel, and sometimes an universal umbel, when all the flower-stalks are subdivided into other smaller umbels, commonly called partial umbels, f. 134.

30. The cyma is a receptacle, where a number of slender flower-stalks rise from the same center to an equal height, as in the former; but the partial foot-stalks are irregularly dispersed, without order; as in elder, gelder rose, &c. f. 172.

31. The spadix (f. 136.), is the receptacle of the palms, and is always branched. It is also used to signify the flower-stalk of every plant, which was originally contained within a spathe or sheath; but in this last case it is often simple.
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SECT. LXXXVII.

The parts of a flower are the calyx, corolla, stamina, and pistillum.

The parts of the fruit are the pericarpium, the seed, and the receptacle.

The parts therefore of the fructification, which comprehends both, are the flower and fruit.

Obs. That the calyx is a part of the flower, though it is often present with the fruit, clearly appears from hence, that it never comes out after the flower is blown. It is true the calyx of the patagonula grows to a much larger size in the fruit than it had been of when in the flower; and there are many plants furnished with deciduous flower cups, which fall off as soon as the flowers are opened; as in the barrenwort and poppies.

SECT. LXXXVIII.

The essence of a flower consists in the antheræ and stigma.

The essence of the fruit consists in the seed.

The essence of fructification in the flower and fruit.

The essence of vegetables in the fructification: for,

1. The pollen is that fine dust of vegetables, which, being discharged, emits a subtle and elastic vapour imperceptible to the naked eye.

2. The
2. The seed is a deciduous part of a plant, containing the rudiments of a new plant, and quickened or enlivened by the pollen.

3. The *anthera* is the organ which produces and discharges the pollen.

4. The *pericarpium* is the organ which produces and discharges the seeds.

5. The filament supports the *anthera*, and connects it to the plant.

6. The *germen* is the unripe rudiment of the *pericarpium* or seed vessel, existing for the most part at the same time that the *antherae* discharge their dust.

7. The *stigma* is the moist summit or top of the *germen*.

8. The *style* supports the *stigma*, and connects it to the *germen*.

9. The *corolla* and *calyx* serve as covers to the *flamina* and *pistilla*; the *calyx* being a prolongation of the outer, and the *corolla* of the inner bark.

10. The receptacle is that which connects all the foregoing parts.

From these definitions it plainly appears

11. That a flower is constituted of the *antherae* and *stigma*, whether the covers (viz. the *calyx* and *corolla*) be wanting or not. And

12. That the fruit is constituted of the seed, whether there be a seed vessel or not. And

13. That
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13. That every fructification has the anthera, stigma, and seed. And lastly,
14. That every vegetable, without exception, is furnished with flower and fruit.

The essence of a seed consists in the corculum, which is connected with and wrapped within the lobe or lobes, and is besides closely covered with its proper coat.

The essence of the corculum consists in the plumula, which is the vital speck of the plant under the smallest dimension, and like the gemma or bud increases infinitely. The base of the plumula is the rostellum, which descends and strikes root, being originally contiguous to the mother plant.

The propagines or seeds of mosses have neither coat nor lobes, but are naked plumulae, where the rostellum is fixed into the calyx of the plant.

SECT. LXXXIX.

The perianthium or calyx may always, with certainty, be distinguished from the bractea or floral leaf; in that the former withers when the fruit is ripe, if not before; but the bractea continue longer.

Examples of the bractea or floral leaf may be seen in the cow-wheat, monarda, sage, lavender, bartisia, hebenstretia, musenda, lime-tree, fumitory.
That the *bractea* is often taken for the *perianthium* or *calyx*, appears from the *hel-lebore*, *nigella*, *passion-flower*, *hepatica* and *peganum*, where the *calyx* is wanting.

**Sect. xc.**

The *corolla* may be distinguished from the *calyx* by this rule; the former in point of situation is ranged alternately with the *stamina*, whereas the segments of the *calyx* stand opposite to the *stamina*.

That the *stamina* are ranged alternately with the petals, as the petals are with the *calyx*, and consequently that the *stamina* are opposed to the segments of the *calyx*, will plainly appear from the compleat flowers of the *tetrandria* and *pentandria*, I mean those which have both *calyx* and *corolla*.

Examples to prove the truth of this rule may be taken from the *chenopodium*, *urtica*, and *parietaria*, where it will appear that the *corolla* is wanting.

Some would infer, when one of the two covers is present, that this must be the *corolla*, as being the more excellent of the two; but the contrary will appear from the *ammania*, *isnarda*, *peplis*, *ruellia* and *campanula*, which often want or exclude the *corolla*, but not the *calyx*.

That the *calyx*, as proceeding from the outer bark of the plant, is coarser and thicker
thicker than the corolla, is abundantly evident; but their limits are scarce ever determinable, except from the colour, which is by no means sufficient; as appears from the bartisia, whose calyx is of a deep red.

Several flowers have coloured and naked petals, which, instead of falling off at the time of flowering, grow green, harden, and remain on the plants; as may be seen in the hellebore and star of Bethlehem.

That nature has put no absolute limits between the calyx and corolla, will appear from the daphne, where both are grown together, and quite united in the margin, like a leaf of box.

Some make the euphorbia to be monopetalous, but they have taken the calyx for the corolla; for that the peltae or shields in this flower are the real petals, appears from some annual Indian species of this plant, which have most distinct white petals.

SECT. XCI.

The number of the petals in a flower is to be reckoned from the base of the corolla; and the number of the segments in a petal is to be reckoned from the middle of the limb or lamina.

If the petals are quite distinct at the bottom, then the flower is said to be polypetalous, or to consist of more petals than one; but
but if the petals are united at the bottom, though ever so slightly, then the flower is monopetalous, or consists of one petal only. Thus the cranberry is monopetalous, and not tetrapetalous, because, though the petals fall off in four distinct parts, they were originally united at the base into one.

SECT. XCII.

We come now to the threefold structure of the fructification, viz. the most natural, the differing structure, and the singular structures, which are observable in all the parts of fructification, and ought to be described according to the number of these parts; and their figure, their proportion one to another; their situation, insertion, and connection: for other differences, such as magnitude or size, colour, smell, taste, are often fallacious, and not to be depended upon.

SECT. XCIII.

The most natural structure of the fructification is that which most frequently and commonly occurs, and that in the greatest part of plants.

SECT. XCIV.

The most natural number is where the calyx is divided into as many segments as the
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the corolla; and the filaments also are of the same number, each filament being furnished with a single anther: but the division of the pistillum usually agrees in number with the cells of the seed vessel, or the receptacles of the seeds.

The number five is most frequent in the parts of fructification, as appears from the plants of the pentandria, syngenisia, and others. The calyx and corolla are cut into five segments in a great many plants. The most natural number is exemplified in lysimachia and linum.

SECT. XCV.

The most natural figure is where the calyx is less spreading than the corolla, which is gradually widened upwards, and furnished within with the filaments and pistilla standing upright and tapering: when all these parts (except the calyx) are fallen off, the pericarpium big with seeds swells and continues to grow in largeness.

SECT. XCVI.

The most natural proportion is where the calyx is less than the corolla, and the stamina and pistilla of an equal length with the calyx, if it is an erect flower. In a drooping flower the pistillum longer than the stamina. In a decumbent flower the stamens and
and pistilla declining to the under side. In an ascending flower the stamina and pistilla placed close under the upper side. The drooping flower is exemplified in fritillaria, campanula, galanthus, and geranium; the decumbent flower in cassia, and all the leguminous plants; the ascending flower in betony, mint, horehound, &c. and all the plants of the didynamia gymnospernia.

When the pistilla are shorter than the stamina, the antheræ meet at top, as in saxifraga, parnassia.

SECT. XCVII.

The most natural situation is where the perianthium or calyx surrounds the receptacle; the corolla is seated on the receptacle, and alternate with the calyx; the filaments are situated within the corolla, opposite to its segments; the antheræ are seated on the tops of the filaments; the germen occupies the center of the receptacle; the style standing on the top of the germen; and the stigma seated on the top of the style. When these are fallen off, the germen grows to a seed vessel, supported by the calyx, and including within itself the seeds fixed to the receptacle of the fruit. The receptacle of the flower mostly grows under, seldom round or over, the seed vessel.
SECT. XCVIII.

The differing structure, or the structure differing from the most common, is taken from those parts of the fructification, which are often found to differ in different plants.

The differences or variations of structure are the foundation of the genera, and their characters. The more natural any class is, so much the less apparent is the differing structure. Every singular structure has differences or variations from the common, but every difference or variation is not singular.

SECT. XCVII.

The calyx differs in respect to, 1. number, composition, parts, segments; 2. figure, equality, margin, top or brim; 3. proportion; 4. place, and duration.

1. In respect to number, the calyx is either single, as in primula, and most other plants; or double, as in malva, bibiscus, and bixa; or wanting, as in tulipa, fritillaria, and several of the lily tribe. In respect of composition, the calyx is either imbricated with various scales laid over each other like tiles, as in hieracium, sonchus, camellia; or squarrose; i.e. composed of scales spreading wide open all round, as in carduus, onopordum, conyza, or augmented; i.e. when a shorter and different row of leaves surrounds the
the base of the calyx externally, as in coreopsis, bidens, crepis, dianthus; or multiflorous; i.e. common to many florets, as in scabiosa, and all the compound flowers of the syngenesia. In respect to parts, the calyx consists either of one leaf, as in datura, primula; or of two leaves, as in papaver, fumaria; or of three leaves, as in tradescantia; or of four leaves, as in fagina, epimedium, and the plants of the tetrodynamia; or of five leaves, as in cistus, adonis, cerbera; or of six leaves, as in berberis; or of ten leaves, as in hibiscus. In respect of segments, a monophyllous calyx is either entire, as in genipa; or cut into two segments, as in utricularia; or cut into three segments, as in alisma, cliffortia; or cut into four segments, as in rhinanthus; or cut into five segments, as in nicotiana; or cut into six segments, as in pavia; or cut into eight segments, as in tormentilla; or cut into ten segments, as in potentilla, fragaria; or cut into twelve segments, as in lythrum.

2. In respect to figure, the calyx is either globular, as in cucubalus; or club-shaped, as in fiene; or reflexed, as in asclepias; or erect, as in primula, nicotiana. In respect to equality, the calyx is either even, as in lycnis; or uneven, as in the helianthemum of Tournefort; or hath every other segment shorter, as in potentilla, tormentilla.
In respect to margin, the calyx is either quite entire, as in most plants; or serrated, as in some of the *hypericums*; or ciliated, as in some of the *centaureas*. In respect to the top or summit, the calyx is either acute, as in *primula, androsace*; or acuminated, sharp-pointed, as in *hyoscyamus*; or obtuse, as in *nymphaæa, garcinia*; or with one segment stumped or lopped off, as in *verbena*.

3. In respect to proportion, the calyx is either longer than the corolla, as in *agrostemma, sagina*, and some species of *antirhinum*; or of the same length with the corolla, as in some species of *cerastium*; or shorter than the corolla, as in *silene*.

4. In respect to place, the calyx is either situated under the flower, as in *linnaea, morina*; or under the fruit, as in *linnaea, morina*; or under the fructification, as in *peonia*. Obs. that *linnaea* and *morina* have each of them two calyces, the one of the flower, and the other of the fruit. In respect to duration, the calyx is either caducous, falling off, as soon as the flower is blown, as in *papaver, epimedium*; or deciduous, falling off with the corolla, as in *berberis*, and the plants of the *tetradynamia* class; or abiding till the fruit is ripe, as in plants of the *didynamia*.

The involucrum, another species of calyx, is either of one leaf, as in *bupleurum*; or of two
two leaves, as in *euphorbia*; or of three leaves, as in *butomus, alisma*; or of four leaves, as in *cornus*; or of five leaves, as in *daucus*; or of six leaves, as in *haemanthus*.

The *spatha*, another species of *calyx*, is either of one leaf, as in *narcissus*; or of two leaves, as in *stratiotes*; or imbricate, as in *musa*.

**SECT. C.**

The differences or variations of the corolla are in respect to, 1. the petals, segments, *nectaria*; 2. figure, equality, margin; 3. proportion; 4. place, and duration.

1. In respect to the petals, the corolla consists either of one petal, as in *convolvulus, primula*; or of two petals, as in *circæa, commelina*; or of three petals, as in *alisma, sagittaria*; or of four petals, as in plants of the *tetradynamia*; or of five petals, as in the umbelliferous plants; or of six petals, as in *tulipa, lilium, podophyllum*; or of nine petals, as in *thea, magnolia, liriodendrum*; or of many petals, as in *nymphaea*. In respect to segments of polypetalous flowers, they are either two, as in *alisne, circæa*; or three, as in *holosteum, hypecoum*; or four, as in *lychnis*; or five, as in *reseda*. In monopetalous flowers the segments of the corolla are much more common than in the poly-
polypetalous. Of the variations of the
nectaria we shall treat below under Sect.
110.

2. In respect to figure, the petals are ei-
ther waved, as in gloriofa; or plaited, as in
convolvulus; or rolled back, as in aspara-
gus, dodecatheon meadea; or twisted, as in
nerium, asclepias, vinca, apocynum, cynan-
chum, stapelia. In respect to equality, the
petals are either equal, as in primula; or
unequal, as in butomus; or regular, as in
aquilegia; or irregular, as in aconitum, la-
mium. In respect to margin, the petals are
either crenated, as in linum; or serrated, as
in tilia, alisma; or ciliated, as in ruta, me-
nyanthes, tropaeolum; or denticulate, i.e.
with little teeth between the divisions, as in
samolus, sideroxylon, and the rough-leafed
plants of Ray; or with a hairy surface, as
in menyanthes.

3. In respect to proportion, the petals
are either very long, as in catesbaea, sipho-
nanthus, brunsfelsia, craniolaria; or very
short, as in sagina, centunculus, ribes.

In respect to place, the base of the corolla
is commonly close to the calyx, if there be
one; or, as in very few instances, the corolla
is separated from the calyx by the germen,
viz. in adoxa, sanguisorba, mirabilis. In
respect to duration, the corolla either con-
tinues till the fruit is ripe, as in the nym-
phaea;
THE ELEMENTS. Part I.

The filaments of the stamens vary in respect to, 1. number, segments; 2. figure; 3. proportion; 4. or situation. The antherae in respect to, 1. number, cells, deficiency; 2. figure, opening; 3. connection; 4. and situation.

1. In respect to number, the filaments vary from one to ten, twelve, twenty, and upwards, as in the sexual system. The number of segments are sometimes two, as in *salvia*; in some three, as in *fumaria*; and in others nine, as in most plants of the *diadelpbia* class.

2. In respect to figure, the filaments are either capillary, *i.e.* like hairs, as in *plantago*; or plane and flat, as in *ornithogalum*; or wedge-shaped, as in *thaliestrum*; or spiral, as in *birtella*; or tapering, as in *tulipa*; or notched, as in *porrum*; or reflexed, turned back, as in *gloriosa*; or rough and hairy, as in *tradescantia, anthericum*.

3. In respect to proportion, the filaments are either unequal, as in *daphne, lycnis, faxifraga*;
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Saxifraga; or irregular, as in Lonicera, and the plants of the class didynamia; or very long, as in Trichosperma, Plantago, Birtella; or very short, as in Triglochin.

4. In respect to situation, the filaments are either opposite to the leaves of the calyx, as in Urtica; or alternate with them, as in Eleagnus; or inserted into the corolla, as in the monopetalous flowers, but scarce ever in the polypetalous; or inserted into the calyx sometimes in flowers which have no petals, as in Eleagnus, and always in plants of the Icosandria class, and also in Epilobium, Oenothera, Jussirea, Ludwigia, Oldelandia, Isnarda, Ammania, Peplis, Lythrum, Glaux, Rhexia: but the filaments are most commonly inserted into the receptacle, as are also the calyx and corolla.

1. In respect to number, the anthera is either one only on each filament, as in most flowers; or one common to three filaments, as in Cucurbita; or one common to five filaments, as in plants of the Syngenesia; or two antherae on each filament, as in Mercurialis; or three on each filament, as in Fumaria; or five on three filaments, as in Bryonia; or five to each filament, as in Theobroma. In respect to cells, the antherae have either one cell, as in Mercurialis; or two, as in Bellerorus; or three, as in Orchis; or four, as in Fritillaria. Deficient or wanting,
wanting, sometimes one anthera, as in che-
lone, martynia; or two, as in pinguicula,
verbena; or three, as in gratiola, bignonia,
some of the geranians; or four, as in cur-
cuma; or five, as in pentapetes, and some
of the geranians.

2. The figure of the antheræ is either
oblong, as in lilium; or globular, as in merrcurialis; or arrow-shaped, as in crocus;
or angular, as in tulipa; or horned, as in
hamamelis, erica, vaccinium, pyrola. The
antheræ burst either on the side, as in leu-
coium, and most plants; or at top, as in
galanthus, kiggleria; or from the base to the
top, the whole length, as in epimedium,
leontice.

3. The antheræ are connected or fasten-
ed by their base, as in most flowers; or by
their tops, as in galanthus, kiggleria; or on
their sides, as in canna; or grow to the
nectarium, as in costus.

4. The antheræ are situated or placed on
the tops of the filaments, as in most flowers;
or on the sides of the filaments, as in paris,
asarum; or on the pisillium, as in aristolochia;
or on the receptacle, as in arum.

The figure of the particles of the farina,
or fecundating dust, viewed with a micro-
scope, is very different in different flowers;
as for instance, it is quite round and prickly
like a hedge-hog in helianthus, perforate in
geranium,
geranium, double in symphytum, wheel-shaped and toothed in malva, angular in viola, kidney-shaped in narcissus, or, lastly, like a thin leaf rolled up, as in borrago.

SECT. CII.

The pistilla varies in, 1. number, segments; 2. figure; 3. length, thickness; and, 4. situation of all its three component parts; to wit, the germin, style, and stigma.

Of the germin, which is only the rudiment of the seed vessel, we shall treat in the next section, where the variations of the pericarpium are enumerated.

The styles, which are always distinct from the calyx and corolla, vary in number, as may be seen in the sexual system, where the number of pistilla is always taken from the styles, if there are any, and if not, from the stigmata. In respect to segments, the style is either bifid, i.e. cut into two segments, as in persicaria, cornutia; or into three segments, as in clethra, frankenia; or into four segments, as in rhamnus; or into five segments, as in geranium; or forked, as in clutia.

2. The figure of the style, is either cylindrical, as in monotropa; angular, as in canna; tapering, as in geranium; capillary, i.e. like a hair, as in ceratocarpus; or thicker above than below, as in leucoium.
3. In respect to length, the style is either very long, as in tamarindus, cassia, campanula, scorzonera, zea; or very short, as in papaver; or of an equal length with the stamina, as in nicotiana, and most other flowers. As to thickness, the styles are either thicker than the stamina, as in leucoium; or smaller than the stamina, as in ceratocarpus; or of the same thickness, as in lamium.

4. In point of situation, the style is placed either on the top of the germen, as in most flowers; above and below the germen, as in capparis, euphorbia; or on one side of the germen, as in plants of the icosandra polygynia; and others, as birtella, furiana. In respect to duration, the style is sometimes permanent or abiding, as in plants of the tetradynamia.

1. The stigma is either one, as in the generality of flowers; or two, as in syringa; or three, as in campanula; or four, as in epilobium, parnassia; or five, as in pyrola. The segments of the stigma are either rolled together, as in crocus; or capillary, like hairs, as in rumex; or rolled back, as in dianthus, campanula, and the plants of the syngenesia clasps; or bent to the left, as in silene; or divided into six parts, as in asarum; or divided into many parts, as in turnera.
2. As to figure, the stigma is either formed into a round head, as in tribulus, bugonia, vinca, ipomœa, clusia; or globular, as in primula, hoffonia, linœa, limosella; or egg-shaped, as in genipa; or obtuse, as in andromeda; or stumped, as in maranta; or depressed obliquely, as in æœa, daphne; or notched, as in melia; or orbicular, i. e. round and flat, as in lythrum; or target-shaped, as in sarracena, nymphœa, clusia, papaver; or like a crown, as in pyrola; or cross-shaped, as in penœa; or hooked, as in viola, lantana; or channelled, as in colchicum; or concave, as in viola; or angular, as in muntingia; or streaked with parallel lines, as in papaver; or feathered, as in rheum, triglochin, tamarix, and the grasses; or hairy, as in cucubalus, lathyrus.

3. As to length, the stigma is either long and slender, as in zeœa; or of the same length with the style, as in genipa. As to thickness, the stigma is sometimes like a petal or flower-leaf, as in iris.

4. In point of duration, the stigma is sometimes abiding, as in sarracena, hydrangea, nymphœa, papaver; but most commonly withers, as in the generality of flowers.

SECT. CIII.

The pericarpium, or seed vessel, varies in, 1. number, cells, valves, partitions; 2. species,
cies, figure, bursting; 3. confinement of the seeds; and, 4. situation.

1. As to number, which respects only the external division, the pericarpium is either wholly wanting, as in thymus, and all the other plants of the didynamia gymnospermia; or the pericarpium consists of one capsule only, as in lycnis; or of two capsules, as in paeonia, asclepias; or of three capsules, as in veratrum, delphinium; or of four capsules, as in rhodiolae; or of five capsules, as in aquilegia; or of many capsules, as in caltha, trollius, belleborus. As to cells, respecting only the internal division, the pericarpium consists either of one cell only, as in primula, trientalis; or of two cells, as in hyoscyamus, snap's, nicotiana; or of three cells, as in lilium; or of four cells, as in euonymus; or of five cells, as in pyrola; or of six cells, as in asarum, aristolochia; or of eight cells, as in limum radiola; or of ten cells, as in linum; or of many cells, as in nymphæa. As to valves, the seed vessel consists either of two, as in chelidonium, brassica; or of three valves, as in viola, polemonium, hel anthemum; or of four valves, as in ludwigia, cennothera; or of five valves, as in bottonia. The internal partitions are either parallel, as in lunaria, draba; or run cross the seed vessel, as in biseutella, thlæspi.

2. As to the different species of seed vessels, they are enumerated in section 86.
The figure of the seed vessel is either like a top, as in *pyrus*; or blown up like a bladder, as in *fistaphylea, cardispermum*; or like thin membranes or films, as in *ulmus*; or having three, four, or five angles and sides, as in *averrhoa, zygophyllum*; or jointed, as in *ornithopus, bedyjarum, raphanus*. The bursting of the seed vessel, when the fruit is ripe, is either on the top in four segments or parts, as in *dianthus*; or in five parts, as in *alpine*; or in ten parts, as in *ceraflum*; or this bursting is on the lower part of the *pericarpium*, either into three parts, as in *triglochin, campanula*; or into five parts, as in *ledum*; or the opening is lengthways at the angles, as in *oxalis, orchis*; or by a little hole, as in *campanula*; or the opening is horizontally, as in *anagallis, plantago, amaranthus, portulaca, hyoscyamus*. All jointed fruit split at the joints, which contain each one seed; as in *ornithopus, bedyjarum, hypecoum, scorpiorus, raphanus*.

The confinement of the seeds is sometimes elastic, bursting like a spring, as in *oxalis, elaterium, momordica, impatiens, cardamine, phyllanthus, euphorbia, justicia, ruellia, dictamus, hura, ricinus, tragia, jatropha, croton, clusia, acalypha*.

4. The situation of the *pericarpium* is at the receptacle of the flower, either below it, as in *vaccinium, epilobium*; or above it.
it, as in *arbutus, tulipa*; or both above and below it, as in *saxifraga, lobelia*.

**SECT. CIV.**

The seeds are observed to differ, or vary in, 1. number, cells; 2. figure, substance, *coronula*, or little crown of the seed, *arillus*, or exterior coat; 3. size; 4. situation; 5. *corculum*, or little heart of the seed; and, 6. receptacle.

1. The seeds are in number either one, as in *polygonum, colinsonia*; or two, as in the umbelliferous and starry plants; or three, as in *euphorbia*; or four, as in the rough-leaved and verticillated plants. In most plants each seed has one cell, but sometimes there are two, as in *cornus, xanthium, locustia, valeriana, cordia*.

2. The figure of the seeds is either girt, as in *arenaria, bryonia*; or heart-shaped, as in *medicola*; or kidney-shaped, as in *phaseolus, anacardium*; or egg-shaped, as in *pogala, isatis*; or prickly, as in *myosotis, lapula*. The substance of seeds is either bony, as in *corylus, lithospernum*, and the various kinds of nuts; or callous, as in citron, lemon, orange. The little crown of the seeds is either a small *calyx* formed of the *perianthium* of the flower, as in *scabiosa, knautia, ageratum, aridotis*; or of a *pappus*, consisting of single thread-like hairs, as in *hieracium,*
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Hieracium, sonchus; or a feathered or compound woolly pappus, as in crepis, scorzonera, tragopogon; or a chaffy pappus, as in bidens, silphium, tagetes, coreopsis; or wholly wanting, as in tanacetum. The arillus, or exterior coat of the seed, is to be seen in coffea, jasminum, cynoglossum, cucumis, dictamus, diofma, celastrus, euonymus.

3. The size of seeds is sometimes very small, as in campanula, lobelia, trachelium, ammania; and sometimes very large, as in coccus.

4. The situation of the seeds is either nestling, i.e. dispersed in the pulp, without any order, as in nymphaca; or connected to the future, or seam, as in the podded plants; or fixed to little pillars, which serve to connect the partitions to the seeds, as in mahoa; or placed on receptacles, as in nictiana, datura.

5. The receptacle of the seeds is chiefly to be considered in the compound flowers. Its figure is either plain, as in achillea; or convex, as in matricaria; or conical, as in anthemis, melampodium. Its surface is either naked, as in matricaria; or dotted, as in tragopogon; or woolly, as in andryala; or bristly, as in centaurea; or chaffy, as in hypocharis, anthemis.

The receptacles of the fruit of some simple flowers is very singular, viz. in the magnolia, uvaria, michelia.

6. The
6. The hilum, or scar of the seed, is most evident in *cardiospermum*, *staphylea*. The corculum is close to the hilum. The seat of the corculum (says *Caesalpinus*) is either in the top or bottom of the seed.

**SECT. CV.**

A singular structure of the parts of fructification is such a one as occurs but in a very few genera, and is directly opposed to the natural structure mentioned in sect. 93. This structure is exemplified in the *arum*, whose flamina are within the pistilla; in the adoxa, where the germen is between the calyx and corolla; in the salvia, whose filaments are jointed; in the eriocaulum, whose flamina are placed upon the germen, and the corolla and calyx are below the germen; and in the magnolia, where the receptacle of the fruit is a large round head, and the seeds, which are like berries, hang by a slender thread out of the capsule.

**SECT. CVI.**

The calyx is generally of a green colour, and seldom of those gay colours which the corolla, or painted leaves of the flower have; but in the *bartsia Americana* the calyx is blood-red; in the *cornus herbacea* the involucrum is as white as snow, and the petals black; in the *cornus Americana* the involucrum
volucrum is red, and heart-shaped; in the astrantia the involucrum is coloured; in the palms the spathe are of a blood colour.

Where the corolla is wanting, the calyx is usually more coloured, especially at the time of flowering; as in ornithogalum, persicaria, polygonum.

When the calyx or corolla are less coloured, the leaves often take a colour; as in amaranthus tricolor.

SECT. CVII.

In plants of the icosandria, and some others, the inner side of the perianthium or calyx surrounds the receptacle of the flower; and in the gourd kind, and some others, the inner side of the calyx grows to the receptacle of the flower, quite round.

This aphorism is thus explained:

In most plants the stamina and petals are inserted into the receptacle, in the bottom of the flower; but plants of the icosandria class, and many others, have a monophyllous calyx, i.e. consisting of one piece, the inner side of which is gilt round with a line, into which the stamina and petals are inserted. The same sort of calyx supporting the flowers is observed in other plants; as in lythrum, epilobium, anthera, ammania, isnarda, petlis, eleagnus. In the gourd kind, viz. cucumis, cucurbita, and others of the same
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fame natural order, as passi flora, fevillea, momordica, trichosanthis, bryonia, ficeros, melothria, gronovia, the calyx, to which the corolla is, as it were, glued, lines the receptacle of the flower quite round, and the same thing holds in the cactus. There are some where the receptacle elevates the pericarpia, or seed vessels; as passiflora, cap- partis, brynia, arum, calla, dracontium, pothos, zosteria, nepenthes, clutia, helicheres, fisyrichium.

SECT. CVIII.

In a polypetalous flower the filaments of the stamina are distinct or separate from the petals, but in monopetalous flowers the filaments of the stamina are inserted into the corolla most commonly. This rule holds in general: there are exceptions in both cases. For in flatice, which is pentapetalous, the filaments are inserted into the claws of the petals; and in melanthibium, which has six petals, the filaments are also inserted into the petals; and in lycnis, fa- ponaria, cucubalus, filene, and agrostemma, which are pentapetalous, every other stam- men is fastened to the claws of the petals. These are exceptions to the first part of the rule. And in some monopetalous flowers the stamina are separate or distinct from the corolla, viz. in ledum, azalea, andromeda, clethra;
clethra, erica, myrsine, memecylum, santalum, vaccinium, arbutus, royena, dioispyros, meleosphoma, and pyrola, which constitute the natural order called bicornes, i.e. plants with horned antherae. This holds also in cissus and aloe.

SECT. CIX.

The antherae are commonly placed upon the tops or summits of the filaments. But there are some exceptions to this general rule; e.g. where the antherae are fastened to the fides of the filaments, as in paris, asarum. And in aristolochia the antherae adhere to the stigma without any filaments.

SECT. CXX.

When the nectarium is distinct from the petals, it is commonly very irregular, and affords many singular variations.

That the nectaria commonly make a part of the corolla, is undeniable; but that they also often grow distinct or separate from the corolla, will clearly appear from the following examples, viz. aconitum, aquilegia, helleborus, isopyrum, nigella, garidella, epimedium, parnassia, theobroma, cherleria, sangu-gesia. The chief distinctions of the nectaria are, 1. spur-shaped nectaria, which are found both in monopetalous flowers, as antirrhinum, valeriana, pinguicula, and utricularia;
cularia; and also in polypetalous flowers, as in orchis, delphinium, viola, impatiens, fumaria. 2. Such as are on the inner side of the petals, as in fritillaria, lilium, swertia, iris, hermannia, uvularia, hydrophylhum, myosurus, ranunculus, bromelia, erythronium, berberis, vallisneria. 3. Nectaria which crown the corolla, as in passflora, narcissus, pancretium, olax, lychnis, silene, coronaria, flapelia, asclepias, cynanchum, nepenthes, cherleria, clusia, hamamelis, dosma. 4. Nectaria of a singular construction, as in reseda, cardiospermum, amomum, costus, curcuma, grevia, urtica, andrachne, epidendrum, helictores, salix. 5. Nectaria that are found on the calyx, as those in tropæolum, monotropa, bicus- tella, malpighia. 6. Such as are found on the antheræ, as in adenanthera; or on the filaments, as in laurus, dictamnus, zygodiphyllum, commelina, mirabilis, plumbago, campanula, roëlla. 7. Nectaria that are found on the germen, as those of hyacinthus, iris, butomus, cheiranthus, hesperis. 8. Nectaria that are found on the receptacle, as in la-thraea, helxine, collinsonia, jedum, cotyledon, sempervivum, mercurialis, kiggleria, clutia, phyllanthus, melianthus, dosma.

SECT. CXI.
The pistillum is commonly placed within the antheræ, but the arum is a singular exception;
exception; for, in this, the receptacle is lengthened in the form of a club, on the lower part of which are situated the pistilla, and the antherae on the upper; so that the pistilla stand on the outside and round the stamina. The same thing holds in the calla Aethiopica; and in runex there is a singularity in the insertion of the stamina.

SECT. CXII.

The style is commonly placed on the top of the germeH, except in a few genera; as the rosa, rubus, fragaria, potentilla, tormentilla, dryas, geum, comarum, fibbaldia, agrimonia, alchemilla, aphanes, furiana, hirtella; to which we may also add, pafferina, gnidia, fstrutbea, &telleria. See sect. 102.

SECT. CXIII.

The pericarpium, or seed vessel, is commonly shut, nor does it ever contain within it other lesser pericarpia, but often forms a berry when it is of a pulpy substance.

The seed vessel is exactly shut in most plants, but in reseda and dafisca it always gapes. In parnaffia it gapes at the time of flowering, and afterwards is shut. It does not appear that there is any seed vessel which naturally contains within itself other lesser seed vessels; for when several small seed vessels
vessels seem as it were to be contained within one larger, this outer one is only a common receptacle, as appears in magnolia, uvaria, michelia. Berries are distinguished into proper and improper. That pulpy fruit which is formed of the pericarpium is a berry properly so called, and that which is formed of any of the other parts is an improper berry. The end and design of berries is, that being swallowed by divers animals, they may thereby be disseminated by their dung, as in the misteltoe, and many others. The following are improper berries, and consequently so many examples of singularity in this part of the fructification: 1. when they are formed of the calyx, as in blitum, morus, basella, ephedra, coix, rosa, coriaria; or 2. of the receptacle, as in taxus, rbizosphora, anacardium, ochna, laurus, doryfania, ficus, fragaria; or 3. of the seed, as in rubus, magnolia, uvaria, michelia, praesium, uvalaria, panax, adonis, crambe, osteospermum; or 4. of the arillus, as in cuonymus, celastrus; or 5. of the nectarium, as in mirabilis; or 6. of the corolla, as in poterium, adoxa, coriaria; or 7. when the berry is a capsule, as in cuonymus, androscæum, cucubalus, epidendrum; or 8. when the berry is a dry fruit, as in linnae, gallium, tetragonia, myrica, trientalis, tropeolum, xanthium, juglans, ptelea, ulmus, comarum,
comarum, amygdalus, mirabilis; or 9. when it is a capsule externally, as in dillenia, clusia, nymphæa, capparis, breynia, morifona, stratotes, cyclamen, ftrychnus; or, io. when it is hollow, as in staphylæa, cardiospernum, capsicum; or, ii. when it is a folliculus, or little bag, as in adæa; or, 12. when it is a cod, as in hymenæa, cæsia, inga of Plumier, ceratonia; or, lastly, when it is a cone, as in anonna, juniperus.

The berry naturally does not split or burst, because it is soft, and made to be dispersed by the means of animals.

In the adonis capenfis the berries are evidently aggregate, i. e. several united into one.

SECT. CXIV.

Compleat flowers are either simple or aggregate.

A compleat flower has both the calyx and corolla; and an incompleat flower wants either the calyx or corolla. An apetalous flower wants the corolla, but not the calyx. A naked flower wants the calyx, but not the corolla; though this last would more properly be called a naked flower, if both calyx and corolla were wanting, which is a thing that very rarely happens.
A simple flower is that where no part of the fructification is common to more than one only. A compound fruit, or one with many capsules, does not constitute a compound flower; for a compound fruit may be, and often is, where the flower is simple.

An aggregate flower is one which has some part of the fructification common to several flowers or florets, and it is divided into the aggregate properly so called, the compound, the umbelliferous, the cymose, &c. A flower is said to be aggregate, when several florets are so joined by the mediation of some part of the fructification common to them all, that the taking away of one floret would destroy the form of that whole, of which it made a part. The part which is common in aggregate flowers is either the receptacle or calyx, and each partial flower in them is called a floret. The primary modes of aggregate flowers (see Pl. VIII. & X.) are the seven following, viz. 1. The umbellate or umbelliferous flower has a receptacle divided into several flower-stalks, all rising from the same center to an equal height. 2. The cymose flower has a receptacle divided into several flower-stalks, rising from the same center.
center to an equal height; but the partial foot-stalks are irregularly dispersed without any order, as in lauruslitinus. 3. A compound flower has a large and entire receptacle, with the florets sessile. 4. An aggregate flower, properly so called, has also an enlarged receptacle, with the florets not sessile as in the former, but each furnished with a foot-stalk; as in scabiosa, knautia, dipiacus, cephalanthus, globularia, lucaden-dron, protea, brunia, barrantia, faticce T.

5. An amethystaceous aggregate flower has a slender thread-like receptacle, furnished with chaffy scales; as in xanthium, ambrosia, parthenium, iva, alnus, betula, salix, populus, corylus, carpinus, juglans, fagus, quercus, liquidambar, cymnorum, ficus, drosleria, parietaria, urtica, pinus, abies, cupressus, thuia, juniperus, taxus, ephedra. 6. A glumose aggregate flower has also a slender thread-like receptacle, whose base is furnished with a common glume, or chaffy hulk; as in bromus, festuca, avena, arundo, briza, poa, aira, uniola, cynosurus, melca, elymus, lolium, triticum, secale, hordeum, fcripus, cyperus, carex. 7. A spadiceous aggregate flower has a receptacle common to many florets, contained within a spatha. The receptacle in these is called a spadix, which in the palms is always divided; but simple, and covered all round with florets,
A compound flower is a species of aggregate that contains many sessile florets, on a common entire receptacle, and within one perianthium or calyx; each floret being furnished with antherae which grow together in form of a cylinder. The properties then of a compound flower are the five following, viz. 1. A common, enlarged, and undivided receptacle; 2. a common perianthium or calyx, surrounding all the florets; 3. five antherae grown together in form of a cylinder; 4. monopetalous sessile florets; 5. a germin containing only one seed under each floret. It is essential to compound flowers to have the antherae grown together in form of a cylinder, and a single seed under each floret; but we must observe, that there are compound flowers, whose calyx is furnished with only one floret, as echinops, scebe, eorymbium; and one species of artemisia. There are commonly reckoned three kinds of compound flowers, viz. 1. The ligulate, or semisessilular of Tournefort; i. e. half florets both in the disk and radius; 2. tubular, or flosculous of Tournefort; i. e. whole florets,
florets, and nearly equal throughout; 3. radiated, when the florets of the disk are tubular or whole, and those of the circumference of another form; for they may have in the circumference, 1. either half florets, which are properly the radiated flowers of Tournefort; or, 2. whole florets, but unlike to those of the disk, as in centaurea; or, 3. naked florets, as in gna-phalium and artemisia. A compound flower for the most part consists of many florets, but seldom of a determinate number, except in the following instances, ligulate, prenanthes of five florets, tubular, eupatorium scrophulariae fol. of 20 florets, eupatorium perfoliatum of 15 florets, eupatorium digitatum, eupatorium zeylanicum, eupatorium secundum H. upf. eupatorium quartum H. upf. each of five florets, eupatorium volubile of four florets, radiated. Arctotis has in the radius or circumference 20 florets, rudbeckia 12, tetragonotheca and osteospermum each ten, coreopsis and othonna each eight, achillea, eriocephalus, micropus, seriphium, cagesbeckia, acmella, melampodium, chrysonognum, tages-tes, each five florets in the radius; one species of the cagesbeckia three florets in the radius; and the milleria one only in the radius, and three in the disk.
An umbellate flower is another of the aggregate kind. It consists of many florets on a common receptacle, which is divided into foot-stalks, rising to the same height, and all springing from the same center. A cyma is also of the aggregate kind. It consists of many florets placed on a common receptacle, which is divided into several foot-stalks, all rising to the same height, the primary foot-stalks springing from the same center, but the secondary or partial ones dispersed, without any order.

An umbel, then, is that mode of flowering, where all the foot-stalks spring from the same center with an even circumference. A simple umbel, where the receptacle is thus divided only once. A compound umbel is where all the common foot-stalks are subdivided into little umbels, commonly called partial umbels. The properties of umbelliferous flowers, properly so called, are the following; 1. a common receptacle, divided into several foot-stalks, which spring from the same center, and are equal in their circumference, whether the umbel at top be plane, convex, or concave; 2. a germen under each floret; 3. five distinct and deciduous stamina to each floret; 4. a bifid pistillum; 5. two seeds connected at their upper extremities. In umbelliferous
ous flowers the universal involucrum may vary, some consisting of four leaves, as in hydrocotyle, fison, cuminum; some of five leaves, as in bupleurum, scandix, bubon; some of seven leaves, as in ligusticum; some of ten leaves, as in artedia. The partial involucrum in some is halved, or goes half round only, as in ethusa, coriandrum, sanicula; in others it is caducous, as in ferula, heracleum. The disk or middle of the umbel also varies, being in some all male flowers, as in astrantia, caucalis, artedia, oenanthe, scandix: again, an umbell may be radiated, i.e. when the petals in the circumference or margin are larger than those of the disk, as in tordyllium, caucalis, coriandrum, ammi, and one species of heracleum.

The cyma, in the same manner as an umbel, has all the primary foot-stalks produced from the same center; but the partial ones scattered or dispersed irregularly, as in opulus, cornus sanguinea, and obhior-rhiza. That the receptacle is thus produced appears from the involucrum; and the cornus mas, or umbellata, clearly demonstrates the same; another species of which is the cornus sanguinea, whose flower-stalks are branched in the same manner as those in the lauruslinus.
In a luxuriant flower the covers of the fructification, viz. the calyx and corolla, are so multiplied, or increased in number, as to exclude or destroy the essential parts of the same. Luxuriant flowers are of three sorts; 1. multiplied; 2. full; and, 3. proliferous: but the mutilate flower is that which excludes the corolla. A flower then is said to be luxuriant, when some parts of the fructification are augmented in number, and others excluded. This is occasioned for the most part by the luxuriancy of nourishment. That flower which wants the corolla, though it ought naturally to have one, is called mutilate, and this defect is commonly owing to a want of sufficient heat. It often happens in ipomaea, campanula, ruellia, viola, tussilago, cucubalus.

We commonly say a flower is multiplied, when the corolla is so increased as to exclude only a part of the stamina; and such a flower is either duplicate or triplicate, &c. The perianthium and involucrum are very rarely increased, so as to constitute a multiplied flower, and the stamina scarce ever. The multiplied flower is distinguished from the full one, in that the corolla is so increased in the latter, that the stamina
flamina are totally excluded. But the multiplied flower has only a double, triple, or quadruple row of petals. Therefore a double flower is the first and lowest degree of plenitude or fullness. Instances of the triple corolla are campanula fol. urticae, flore duplici and triplici of Tournefort, stramonium flore violaceo duplici triplicive of Tournefort, stramonium flore altero alteri innato of Vailant. Monopetalous flowers are often multiplied, but seldom become full. The polypetalous flowers are also frequently multiplied, as in hepatica, anemone. The perianthium seldom constitutes a multiplied flower, though there are some instances of this; as in dianthus caryophyllus spicam frumenti referens, where the scales of the calyx are so prodigiously multiplied, as to constitute an entire spike in a very singular manner. Some of the Alpine grasses become, as it were, full, the chaff growing into leaves; as in the festuca vivipara. In the salix rosea, where the flamina or pistilla are destroyed by insects, the scales of the catkin grow into leaves. In the plantago rosea the bracteae of the spike grow into leaves. A coloured perianthium is not to be taken for a multiplied flower, though it be in some degree unnatural; as in primula prolifera odorata of Tournefort, primula prolifera flore majore of Tournefort, primula prolifera flore purpureo of Tournefort.
A flower is said to be full, when the corolla is so multiplied or increased, that all the staminæ are excluded. This is brought about by the staminæ growing into petals, which fill the flowers, and often suffocate the pistillum after all the staminæ are excluded. Polypetalous flowers are chiefly subject to plentitude or fullness, as in *malus*, *pyrus*, *persica*, *cerasus*, *amygdalus*, *myrtus*, *rosa*, *fragaria*, *ranunculus*, *caltha*, *hepatica*, *anemone*, *aquilegia*, *nigella*, *papaver*, *peonia*, *dianthus*, *filene*, *lychnis coronaria*, *lilium*, *fritillaria*, *tulipa*, *narcissus*, *colchicum*, *crocus*, *cheiranthus*, *hesperis*, *malva*, *alcea*, *hibiscus*. Plenitude or fullness very rarely takes place in monopetalous flowers, though there are some instances of this; as in *primula*, *hyacinthus*, *datura*, *polyanthus*, &c. It is evident that full flowers, having the parts of generation destroyed, must be barren. Nor ought we ever to constitute a genus from full flowers; because they are imperfect, or want those parts of fructification from which the generic characters are deduced. And here we must not omit to add, that full flowers are the greatest glory and delight of your professed florists and gardeners, &c.
There are many of the natural orders of plants which never produce luxuriant flowers. Of this kind are the following, viz. 1. All the apetalous plants (ord. nat. 12. 15.), *i.e.* those which have no petals.

2. The verticillated plants (ord. nat. 42.), *i.e.* such as have their flowers growing in whorls; they are the *labiatae* of Tournefort, or the *didynamia gymnosspermia* of Linnaeus.

3. All the *peronatae* of Tourn. (ord. nat. 40.), plants with masked flowers, except the *antirrhinum*.

4. All the *asperifoliae* (ord. nat. 41.), or rough-leafed plants of Ray (*didynamia angiospermia* of Lin.).

5. All the *stellatae* of Ray (ord. nat. 47.), *i.e.* starry plants, with two naked seeds, and leaves round the stem in form of a star, as the *rubia*, &c.

6. The *umbellatae* of Ray (ord. nat. 45.), or umbelliferous plants, except some which produce proliferous umbels.

7. The papilionaceous (ord. nat. 32.), or leguminous plants are not subject to any luxuriancy, except a few, which produce full flowers, as *ternatae flore pleno caeruleo*, of Tourn., *coronilla herbacea flore vario pleno* of Tourn., *anthyllis vulgaris flore pleno*, *spartium*.

A flower becomes proliferous when one grows out of another, which happens for the most part in full flowers. A proliferous flower
flower is said to be leafy, when its offspring produces leaves. Luxuriancy of nourishment, which is the cause of plenitude in flowers, being still more increased, occasions also their proliferation. In all proliferous flowers (except the compound), the pistillum springs up into another flower, therefore the offspring always shoots from the center of a full flower. A leafy proliferous flower is very rare, but instances of this have been seen in *rosa*, *anemone*, and some others; but the other sort of proliferation is frequently seen, as in *ranunculus*, *anemone*, &c.

**SECT. CXXIV.**

Proliferation of simple flowers is always from the pistillum, but of aggregate flowers from the receptacle.

Proliferation is brought about in two different ways; 1. from the center; 2. from the side.

1. Proliferation from the center is, when the pistillum shoots up into another flower standing on a single foot-stalk, and this happens always in simple flowers, as, e.g. in *dianthus caryophillus altillis major*, *flore pleno prolifero*; *ranunculus radice tuberosa flore pleno et prolifero of Tourn.*; *ranunculus tuberosus Anglicus polyanthos of Vaill.*; *anemone latifolia pavo dieța, proliferæ of Tourn.*; *anemone pavota latifolia multiplex of Valent.*; *geum flore*
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flore uno alteri innato of Tourn.; geum flore triplex, secundo primum, tertio secundo calyce innato of Tourn.; rosa rubra proliferā.

2. Proliferation from the side, which happens, in the aggregate flowers properly so called; is, when several flowers, each supported on a single footstalk, spring out of one common calyx, as in bellis hortensis proliferā, C. B. calendula proliferā, C. B. hieracium falcatum, C. B. scabiosa foliis gignidii proliferā.

The proliferation of umbelliferous flowers is, by increasing the umbel, so that from a simple one another springs up; as in cornus, periclymenum humile flore florī innato. In the same manner is a double compound umbel from a compound one; as in felinum, thy- felinum galiestre laestescens, it often happens.

SECT. CXXV.

The impletion or filling up of simple flowers is either by the petals or nectaria; for, the plenitude of simple flowers and that of compound ones is different. The impletion of aquilegia is in three different ways. 1. By the petals being multiplied, and all the nectaria excluded, which is the aquilegia flore roseo, C. B. 2. By the nectaria being multiplied, and all the petals excluded, which is the aquilegia flore multi- plici, C. B. 3. By the nectaria being multiplied,
tiplied, and the five petals retained, the spaces between the petals being each filled up with three nectararia one within another. The impletion of the nigella is by the nectararia only, for the five lower petals are, as in a natural state, egg-shaped and entire; but the other, which fill up the flower, are cut into many segments, three-lobed and plain; therefore these last are the multiplied nectararia. The impletion of the narcissus is from the multiplication both of petals and nectararia, or from the multiplication of the nectararia alone. The impletion of the delphinium is generally with plain petals, and the nectarium totally excluded. The change which is brought about in the saponaria Anglica is very singular, for this plant from a pentapetalous becomes a truer monopetalous flower. And very remarkable also is the alteration in the peloria, a singular variety of the common toadflax.

SECT. CXXVI.

Polypetalous flowers are most subject to multiplication; but the monopetalous flowers seldom go beyond a double corolla, which species of luxuriancy is most frequently met with in them. Yet plenitude of monopetalous flowers is no contradiction, as it has been reckoned by some; for there are instances of it in colchicum, crocus, hyacinthus,
cinthus, polyanthes. The implication or filling of monopetalous flowers is by the segments of the corolla; but that of the polypetalous by the multiplication of the petals. The opulus flore globofo of C. B. which is the gelder rose, is a most singular instance of plenitude; for the common opulus bears a cyma, which consists of a number of bell-shaped hermaphrodite flowers in the disk, and, in the radius or circumference, of barren flowers, i. e. wanting the pistillae, with plain wheel-shaped corollae; but in the opulus flore globofo all the flowers of the disk become like those of the radius, with large barren wheel-shaped corollae, so that, like the compound flowers, the implication is here only by a number of large barren flowers filling the disk. Hence the nature of a cyma comes nearest to that of an umbel, which thing, the cornus mas, which has an umbelliferous flower, compared with the cornus femina, which bears a cyma, plainly shews.

SECT. CXXVII.

The implication of compound flowers of the syngenesia class is, either by tubular or plain petals.

The compound flowers, as we observed before, are either, i. tubular, i. e. flocculous of Tournefort, which have whole florets,
rets, and nearly equal both in the disk and in the radius; or, 2. ligulate, i. e. semi-floccular of Tournefort, which have half florets only both in the disk and in the radius; or, 3. radiated, where the florets of the disk are tubular or whole, and those of the circumference ligulate or half florets.

Now the impletion of compound flowers is in two different ways; 1. by the radius only in radiated flowers, where the radius is so far multiplied as totally to fill the disk; as is the case in helianthus, calendula, chrysanthemum, anthemis, matricaria, ptarmica, tagetes, and the centaurea cyanus; 2. by the disk, in which case the radius is not multiplied, but the florets of the disk are lengthened, and become less divided at their brims; and in some the plain florets of the radius become tubular. Examples of this sort of impletion may be had in bellis, matricaria, and tagetes. In the carduus serratula, or saw-wort, the florets are both larger and longer. The impletion of the xeranthemum, or everlasting flower, which is by the multiplication of the paleæ or chaff, is very singular, and indeed proper only to itself.

SECT. CXXVIII.

Simple flowers in a state of impletion differ from compound ones in their natural state,
ftate, because the simple luxuriant flowers have each but one common *pistillum* in the center of the flower, whereas in compound flowers each floret has its own *pistillum* and *stamina*.

**SECT. CXXIX.**

Compound flowers, filled with plain petals, may be easily distinguished from those of the same sort in a natural state, by the former having their *stigmata* lengthened, and their *germina* enlarged and diverging. By this rule, we may distinguish the full semifloscular flowers from those in a natural state, as in *scorzonera* and the *lapsana vulgaris*; which last is frequently found with a full flower at Upsal; as was also the *tragopogon vulgaris*, in the year 1733, at the same place.

**SECT. CXXX.**

Compound flowers of the radiate kind, filled with plain petals, may be easily known from compound flowers with plain petals in a natural state, which are the semifloscular of Tournefort: by this rule, the full flowers have no *antheræ*, which the natural ones are furnished with.

This rule then serves to distinguish between the semifloscular flowers of Tournefort, and the radiate with a full flower;
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146 e. g. between the *hieracium* and *chrysanthemum*.

The compound full flowers, with plain petals, are the radiate of Tournefort, with the whole disk filled with plain petals, or half florets, similar to those of the *radius*; as in *chrysanthemum*, *helianthus*, and *calendula*.

On the other hand, the compound natural flowers, with plain petals, are the semiflorescular of Tournefort, as *hieracium*, *leontodon*, *sonchus*. Now in the semiflorescular the florets are always hermaphrodite; but the full radiate flowers never are furnished with *antherae*. Thus the full flowers of the *tagetes* have *pistilla* in each floret, without *flamina*; but the *leontodon* has each floret furnished both with *flamina* and a *pistillum*.

SECT. CXXXI.

In a compound natural flower, if the florets in the *radius* are furnished with *pistilla*, all the full flowers also of the same sort have each of the florets furnished with a *pistillum*; but if in the compound natural flower, the *pistilla* in the florets of the *radius* are wanting, the florets also of all the full flowers of the same sort want the *pistilla*.

In radiated flowers the florets of the *radius* are so multiplied (as has been observed above
above, in sect. 127.), as wholly to fill the
disk, in which case all the florets which
fill the disk are entirely similar to those of
the radius in a natural state, e. g. in ma-
tricaria, bellis, chrysanthemum, tagetes, with
full flowers, each floret is furnished with
its proper pistillum or style. But in helian-
thus, calendula, centaurea, with full flowers,
we may observe, that each petal or floret
wants the style, as the florets of the radius
in a natural state also do.

Seeing, therefore, that in a radiated
flower in its natural state, none of the flo-
rets of the radius are ever furnished with
antherae; this affords an easy and infallible
distinguishing mark between the semiflo-
cular flowers of Tournefort, and the ra-
diated full flowers, as we observed in the
last section.
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CHAP. V.

Of the Sexes of Plants.

SECT. CXXXII.

In the first place we shall shew, that there was only one pair of every living thing, whether animal or vegetable species, created at the beginning.

SECT. CXXXIII.

Though vegetables are destitute of senses, they are nevertheless endued with life, as well as animals. This will appear, if we consider the propulsion of their sap, their origin, nutrition, age, motion; their diseases, death, anatomy, and organization.

SECT. CXXXIV.

Every living thing derives its origin from an egg; consequently vegetables also, whose seeds are eggs; as appears by the producing offspring similar to the parent plant.

SECT. CXXXV.

That every vegetable is produced from an egg, reason and experience teach; and the cotyledons or seed lobes farther confirm it.
The cotyledons of animals proceed from the yolk of the egg, on which is produced the speck of life; therefore the seminal leaves, in which is wrapped up the corculum, or essence of the feed, are also cotyledons.

That the offspring proceeds not from the egg alone, nor from the male sperm alone, undeniably appears from the consideration of mules, the reason of the thing, and the structure of the parts.

That the egg, not impregnated, should produce an animal, is contrary to all experience; the same holds true in vegetables.

Every species of vegetable is furnished with flower and fruit, even when these are not discoverable to the naked eye.

Every fruit is preceded by a flower, as every birth by generation.

Fructification consists in the genitals of plants; so that their flowering is analogous to
to generation, and the ripe fruit to the compleat *fætus*.

**SECT. CXLII.**

Every flower is furnished with *antheræ* and *stigmata*.

**SECT. CXLIII.**

That the *antheræ* are the male organs of plants, and their dust the true sperm, will appear, if we consider their essence, their preceding the fruit, their situation, time, cells, castration, and the structure of their dust.

**SECT. CXLIV.**

That the *stigmata*, which are always connected to the *germen*, are the female organs, will appear, if we consider their essence, their preceding the fruit, their situation, time, their pulling off, and their being cut off.

**SECT. CXLV.**

That vegetable generation is performed by the falling of the dust of the *antheræ* upon the moist *stigmata*, where the particles burst and shed their seminal virtue, which is absorbed by the moisture of the *stigmata*, is confirmed by our sight, by their proportion, place, time, rains, culture of palm trees,
trees, nodding, funk, and syngeneious flowers; nay, by the genuine consideration of all sorts of flowers.

SECT. CXLVI.

The calyx then is the marriage bed, the corolla the curtains, the filaments the spermatic vessels, the antheræ the testicles, the dust the male sperm, the stigma the extremity of the female organ, the style the vagina, the germen the ovary, the pericarpium the ovary impregnated, the seeds the ovula or eggs.

SECT. CXLVII.

The stomach of plants is the earth, the lacteal vessels the root, the bones the trunk, the lungs are the leaves, and the heart is heat; hence a plant was by the antients called an inverted animal.

SECT. CXLVIII.

A flower which is furnished with antheræ only, is called a male flower; one which contains stigma, a female flower; and that which has both these, an hermaphrodite flower.

SECT. CXLIX.

A plant, which has only male flowers, is called a male plant; that which has only female
female flowers, a female plant; that which has only hermaphrodite flowers, an hermaphrodite plant; that which bears male and female flowers both together, is called an androgynous plant; and that which bears hermaphrodite and female or male flowers together, is called a polygamous plant; but these last mostly consist of male hermaphrodites or female hermaphrodites.

SECT. CL.

No luxuriant flowers are natural, but all monsters; full flowers are eunuchs, and therefore always miscarry; multiplied flowers do not always; proliferous flowers increase the deformity.

The foregoing aphorisms are the contents in brief of the following Treatise, called The Nuptials of Plants; in which the Author has endeavoured fully to illustrate and prove the several doctrines contained in these propositions.

Of the Sexes of Plants.

SECT. CXXXII.

LINNAEUS sets out on this subject, by endeavouring to shew, that there was only one pair of every living thing, whether animal or vegetable species, created at the beginning.

According
According to Moses's account, says he, we are sure that was the case in the human species; and that this first pair was placed in Eden, and that Adam gave names to all the animals. Now, that he might be enabled to do this, it was necessary that all the species of animals should be in paradise, which could not be unless the species of vegetables had been there likewise. This appears from the nature of their food, particularly that of insects, most of which live upon one plant only. If the world had been formed in its present state, all the species of animals must have been dispersed over the globe as they are at this present time; in which case Adam could not have given names to them. But these difficulties will vanish, if we suppose, that at the beginning all the earth was covered with sea, except one island large enough to contain all animals and vegetables. This supposition will appear highly reasonable, if we consider that the earth has been, and is still, gaining upon the sea; and that there are many fossil shells and plants found everywhere, which cannot be accounted for by the deluge. Now all vegetables and animals might in this island have a soil and climate proper for each, only by supposing it placed under the Equator, and crowned with a very high mountain. For it is well known,
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known, that the same plants are found on the Swiss, the Pyrenean, the Scotch Alps, on Olympus, Lebanon, Ida, as on the Lapland and Greenland Alps. And Tournefort found at the bottom of Mount Ararat, the common plants of Armenia; a little higher up, those of Italy; higher, those which grow about Paris; afterwards, the Swedish plants; and, lastly, on the top, the Alpine plants of Lapland. Again, it will appear that, from one plant of each species, the immense number of individuals now existing might arise, if we consider the amazing fertility of certain plants, e.g. the elecampane, one plant of which produced in one season 3000 seeds, one of India wheat 2000, one of the sunflower 4000, one of the poppy 3200, one of tobacco 40,320. But supposing any annual plant to produce yearly only 2 seeds, even of this plant after 20 years there would be 1,048,576 individuals; for they would increase yearly in a double proportion, viz. 2, 4, 8, 16, &c. Add to all this, that many plants propagate surprizingly by the roots; others, by being perennial, produce every season, for many years successively, a vast number of seeds from one individual; and others, which bear buds, may be said to produce so many individuals as there are buds, so that one tree of a very moderate size shall often produce 10,000. Lastly, the
the vast variety of ways which nature has provided for the dissemination of seeds is truly wonderful; for some are blown by the winds to a great distance, especially by the stormy winds in spring and autumn. In most plants the fruit is raised above the ground by firm stalks or stems, and where these are weak, the plants often climb, that the fruit may be elevated above the ground, and by that means the plants may be more easily shaken by the winds. For the same reason, all that species of seed-vesSEL called the capsule, open at the top, that the seeds may be more readily dispersed. Many seeds are winged, and by that means are spread far and near. These wings, for the conveyance of seeds to a great distance, consist either of a fine feathered or hairy down, beard, or tail, as in most of the compound flowering plants, and also valerian, scabious, thrift, pasque flower, poplar, cats-tail, reed-grass; or of a thin membrane or film, as in the fir, birch, meadow-rue, maple, ash, elm, hops, dock, &c. Some seeds, and seed vessels, are blown up, that their volume being increased they may become the lighter, as the winter cherry, campion, trefoil, bladder senna, fumitory, bladder-nut, chiches. Many seed vessels are en-dued with a remarkable elasticity, by which means they throw their seeds at a great distance,
distance, as touch me not, wood-sorrel, dittany, cucumber, lady's-smock, oats, cranesbill, horse-tail, ferns, &c. Many seeds, and feed vessels, are armed with hooks, &c, by which they stick to animals, and so are dispersed, as burdock, agrimony, dock, nettle, pellitory, arrow head, martynia, liquorice, enchanter's nightshade, crosswort, goose-grass, hounds-tongue, mounfear, vervain, wild carrot, fanicle, hemp, agrimony. Many seeds and fruits are swallowed whole by animals, and thereby disseminated or returned with interest, as mifieto, oats, juniper, vanelloe. Berries and other fruits are allotted by nature for food to animals, that while they eat the pulp, they may sow their seeds, which always pass through them unhurt. Many seeds also are scattered and dispersed by mice, squirrels, and other animals. The earthworms also, the hedge-hog, the mole, the swine, prepare the ground for the reception of seeds. Not to mention seas, lakes, rivers, showers, tides, by the help of which seeds are often conveyed unhurt to distant countries; a rare and wonderful instance of which we have in anafiatica, or rose of Jericho. Some seeds retain their power of vegetation for many years, and others are preserved long by nature's wise contrivance, as mimoja, caffia, cucumber. The bottom
of the sea does not destroy the vegetative quality of some seeds. The likeness of some seeds to snails preserves them from becoming a prey to animals, as in *salicornia, medicago*. Some plants hide their seeds in the ground, as the ground nut (*arrachis*), *trifolium subterraneum*, some species of the *lathyrus, valantia*, or *cros-wort*. Many are defended from animals by proper armour, as spines, prickles, thorns, tall stems, &c. Fleshly plants are propagated by the leaves. Among trees, each individual is, as it were, a garden hedged round by nature's wonderful contrivance. The seed bud, and the *corculum*, or little heart of the seed itself, both proceed from the pith of the plant; hence it follows, that all generation, properly speaking, is no more than a continued multiplication.

**SECT. CXXXIII.**

Though vegetables are destitute of senses, they are nevertheless endued with life, as well as animals. This will appear if we consider, 1. the Propulsion of their sap; 2. their Origin; 3. Nutrition; 4. Age; 5. Motion; 6. their Diseases; 7. Death; 8. Anatomy; and, 9. Organization.

Though it may seem at first like a paradox, that plants as well as animals are endued with life, yet, I believe, no one will readily
readily deny it, who attentively considers this truth, and duly weighs the arguments that are brought to confirm it. Though every one seems to know what life in an animal body is, yet the true definition thereof we owe to the great Dr. Harvey. He first discovered the circulation of the blood, and rightly maintained that life consisted in the circulation. Agreeable to his opinion, we may define life to be the spontaneous propulsion of the fluids or juices through their proper vessels. 1. Propulsion of the Sap.—If any limb of an animal be tied so tight with a ligature that the fluids cannot pass, a gangrene or compleat mortification is thereby produced. This is a common experiment in physiology, to demonstrate the propulsion of the fluids in the animal body. And likewise, if a branch or twig of any tree or plant be tied so tight that the fluids cannot be propelled beyond the ligature, then that part beyond the ligature withers and dies, in the same manner as in animals. The antients were persuaded that the fluids of plants passing from the root into the ascending trunk, descended again to the roots; but the most famous naturalist of this age, Dr. Hales, has refuted this opinion; for he has demonstrated that the fluids which are carried from the root through the trunk to the branches do not descend
descend again, but are carried off by the transpiration of the leaves. Whereforever then there is a spontaneous propulsion of the fluids, there is life. In vegetables of every kind there is a propulsion of fluids; therefore every one must allow that they are endued with life. It appears also, that some of the antients were of the same opinion, but they carried things too far, by ascribing souls also to plants; and thus, while they would be thought to be very quick-sighted, they were blind with their eyes open. For they taught that there were three sorts of souls; the rational, which they ascribed to man; the sensitive, to brutes; and the vegetative, to plants. But barely to enumerate such notions is a sufficient confutation of them; yet we must allow, that the difference betwixt animal and vegetable life consists in the former having sensation, and the latter none. Though what has been said may be sufficient to shew, that plants as well as animals are endued with life, yet it will not be foreign to the purpose to confirm the same truth by other arguments.

2. Origin.—Of the origin of plants we shall speak in the following section.

3. Nutrition.—The next argument we shall draw from nutrition. Wherever there is nutrition, it is manifest there is a propulsion
pulsion of fluids, and consequently life; this being implied in the very sense and meaning of the word nutrition or nourishment. Now all herbs and plants receive their nourishment from the earth, and therefore are endued with life. That the food or nourishment of plants is derived from the finest and most subtle part of the earth, which by the means of water enters the pores of the roots, has been clearly shewn, by various arguments, in Kylbel's Dissertation on this subject. Hence it is, as daily experience in all sort of soils evinces, that plants which are not supplied with a sufficient quantity of fluid impregnated with this very fine and subtle earth, decline, wither, and at last die, being starved for want of proper nourishment. For this reason plants growing in a dry and parched soil become poor and slender, and shew evident signs of a want of nourishment. But it is quite otherwise with plants that grow in a soil of copious nourishment, which are not only green, strong, and thriving, but also seem to rejoice and grow luxuriant in their happy state, in the same manner as the lactic vessels of the human body absorb much nourishment from a plentiful supply of food, and render the body fat and well-favoured; and the contrary, from a defect of food.

4. Age.
4. Age.—No one can doubt but that every living thing has its beginning and ending, and undergoes innumerable changes. Thus we see, that infancy is weak, feeble, barren; but youth is comely, flourishing, and luxuriant; manhood is fertile, plump, strong, and of full stature; and lastly, old age flags, droops, becomes dry, hoary, languid, the sad presages of its approaching dissolution. And are not plants subject to the same vicissitudes, and go through the same stages? In their infant or very young state they are small and weak, destitute of flowers and fruit; when more advanced, they wanton in beautiful and shining flowers, being then most agreeable, and, as it were, in the joyous spring of life; in summer, being then more plump, firm, and strong, but less splendid, they bear fruit; in autumn, or old age, they droop, grow dry, and wither, returning to dust from whence they sprang. The ivy in its first or tender state has spear-shaped leaves, and bears neither flower nor fruit. This is that variety which Bauhine calls *hedera humi repens*, ivy creeping on the ground. The same plant, when more advanced, bears five lobed leaves, climbs on trees and walls, and is barren. This variety Bauhine calls *hedera major flerilis*, the greater barren ivy. In its next or more mature state it sends forth

three
three lobed leaves, and, leaving its props and supporters, it rises by its own strength, and puts on the appearance of a pretty tall tree, being loaded with flowers and fruit. This is the *hedera arborea* of C. B. tree ivy. But when old, it puts forth egg-shaped leaves without lobes. This is the *hedera poetica* of C. B. poets ivy. Daily experience abundantly shews, that all plants, as well as the ivy, undergo the same fate. From the seed spring up tender shoots, which at first are not larger than small shrubs; then, by degrees, they acquire a firm trunk, and also bear flowers and fruit; lastly, the branches flag, and are covered, as well as the trunk, with moss, first one branch decaying, and then another, till the whole tree is decayed; and, having run through its several stages of existence, at last dies.

5. *Motion.*—It is evident that a dead body has no motion of its own; if therefore any body has spontaneous motion, it must also have life. For proper and internal motion in every body depends on the spontaneous propulsion of fluids, and where such a propulsion of fluids is, there is life. That there is motion in plants is apparent to every one; *e. g.* herbs in green-houses or stoves incline or turn towards the light, and if they find a hole in the walls, shutters, or frames, there they endeavour to pene-
penetrate. Several plants, especially those with compound yellow flowers, nod, and during the whole day turn their flowers towards the sun; to wit, to the East in the morning, to the South at noon, and to the West toward evening; as the same is observable in the Sonchus arvensis, tree bow-thistle. And I believe every body knows, that a great part of plants in a serene sky expand their flowers, and, as it were, with careful looks behold the light of the sun; but before rain they shut them up; e. g. the tulip (See sect. 145.). The flowers of the draba Alpina, Alpine whitlow grass, the *parthenium* foliis ovatis crenatis, bastard fever-few with egg-shaped crenated leaves, and the *trientalis*, or winter-green, hang down in the night, as if the plants were asleep, lest rain or the moist air should injure the fertilizing dust. The trefoils, and one species of wood-forrel, shut up or double their leaves before storms and tempests, but in a serene sky expand or unfold them, so that the husbandman can pretty clearly foretell tempests from them. And it is well known that the *baubinia*, or mountain ebony, sensitive plants, and *cassia*, observe the same rule. The flowers of goats-beard open in the morning at the approach of the sun, and shut about noon; hence it is called by the English John-go-to-bed-at-
at-noon. Parkinsonia, tamarind tree, *es-chynomene,* or bastard sensitive plant, and several others of the *diadelph*ia class, in serene weather, expand their leaves in the daytime, and contract them in the night. The tamarind tree is said by Alpinus and Acosta to enfold within its leaves the flowers or fruit every night, to guard them from cold or rain. This seemed like a paradox to Syenus and Ray: but the flower-stalk with the flower or fruit lies upon the winged leaves, from the bosom of which it springs; hence it is, that while the leaves fold themselves up every night, they shut up or enclose the fruitification within them. Some of the *mimosae,* or sensitive plants, and the *oxalis,* or wood-forrel with pinnated leaves, upon being touched roll up their leaves, and turn downwards or shrink, and after a little space extend them again, as if they had both life and sensation. (See sect. 145.) As it cannot be denied, but that man, or any other animal, destitute of motion, grows pale and weak; so, on the other hand, it is a certain truth, that motion or exercise renders them florid, stout, fat, and healthy; since exercise enlarges the limbs, as Avicenna rightly observes. Hence the rustic excels the courtier in strength of body and larger limbs, being used to much walking, and other exercise; and it is well known
known that the right hand of mechanics, and other people inured to labour, is for the most part bigger than the left. These obvious truths need no laboured demonstration. Plants in gardens and green-houses, though they have sufficient heat and nourishment, are slender, weak, and lose the colour of their leaves, and seem to languish for want of motion: and trees, surrounded with high walls or buildings, and confined within narrow bounds, are slender, and grow tall, but not strong. Pines in very thick woods, where the high winds have not free access to shake them, grow tall and slender, and chiefly fit only for hop poles; while others planted in open fields, and frequently shaken by stormy winds, have not only thick and strong stems, but also strike deep root, and raise beautiful and spreading branches.

6. Diseases. — When life, in any manner of way, is hurt or injured, that state we call disease; to which vegetables as well as animals are subject. By too great heat they are parched, languish and droop; by too much cold they are often killed, or at least are subject to cold tumours, analogous to kibes and chilblains in the human body. Sometimes they are liable to canker, sometimes to vermin, from whence they are said to be lousy.

7. Death.
7. Death. — Death is the privation of life. Every living thing is subject to death, as constant experience teaches. Since then we know that vegetables as well as animals die by diseases and external injuries, we may ask how can vegetables exchange life for death, if they were not previously endued with life. For if we break a flone, which has no life, into a thousand parts, it by no means undergoes such a change as we observe in vegetables.

8. Anatomy. — Whoso is desirous of knowing the internal fabric of plants, let him consult Malpighi and Grew's Anatomy of Plants, who have in a wonderful manner laid down the composition, and enumerated and delineated the fibres, membranes, tubes, cells, tracheae or air vessels, and other parts of those organical bodies; though I make no doubt, but posterity will explain these parts in a quite different manner.

9. Organization. — We have already shewn that the fluids or sap of vegetables is propelled through the vessels, and transpires by the leaves. The structure of their parts informs us, that those fluids are separated through glands, in which other fluids also are prepared for the fruit, the fertilizing dust, the nectar or honey juice. Almost all the hairs we see on plants are nothing but excretory ducts; and almost all the indentures
indentures of the leaves have their glands, which separate a peculiar fluid or juice. To suppose, with the vulgar, that the moisture we see in a summer's morning on the leaves of plants is always a dew, is a great mistake; for it is generally a fluid separated from them by their own peculiar glands. All which arguments here adduced, abundantly prove, that plants as well as animals are endued with life.

SECT. CXXXIV—CXXXVII.

It is well known that the antients supposed two sorts of generation, to wit, equivocal and univocal. This latter, they said, took place, when any thing was produced from its proper egg or matrix; the æquivocal, when any living thing was generated fortuitously or by chance, and the confused mixture of particles. Thus, e.g. fleas were generated from urine and saw-dust; that myriads of little insects like atoms came up out of slimy water; and maggots out of cheese in the summer; that several sorts of herbs quickly sprang up out of mould taken from a considerable depth below ground; and lastly, they believed that worms were produced from putrid carcases, having, they said, had ocular demonstration of the same. Others thought that the Creator, at the beginning, mixed seeds and eggs
eggs with the earth every where; so that when such earth was dug up, and the sun by his heat had hatched the seeds, from thence, I say, they imagined that herbs, plants, and animals sprung up, which were concealed therein from the creation. But all the ingenious men of this age, who have imbibed the sound principles of natural philosophy and natural history, have long ago rejected this opinion, which abounds with ridiculous chimaeras. For God at the first gave to every living thing its own proper seed; and to each a tendency or propensity to propagate its species; and established this first and great law to remain unalterable, "Increase and multiply." If from putrefaction, and the heat of the sun, living creatures and plants could be produced, it would be needless, and consequently highly unworthy of the Supreme Being, to have created so many and so amazingly curious vessels for the preparation of the seed, for in that case putrefaction would be equivalent to creation. And if very minute insects and other animals could be produced from putrefaction, and hatched by the heat of the sun, why might not horses, elephants, and other large animals, be produced in the same way? For in large bodies the mechanism is easier, as the matter is more manageable; but in such minute
minute insects, and, as we may say, such nothings, what wisdom, what power, what inexplicable perfection is displayed, since nature is never more compleat than in her most minute works? Plin. N. H. He must be void of understanding who does not perceive the absurdity of equivocal generation, when he sees a body made with such wonderful art, and adorned with so many thousand pipes and canals, that no mechanic, even the most perfect of mortals, can find out all the contrivance, much less imitate this wonderful fabric; yet can, as it were by a wilful mistake, say, that he believes all those things were made by a fortuitous and confused concourse of atoms. For it would follow from hence, that new species both of animals and plants would always occur, neither of which we observe, or have any account of. In this case too, there could be no arguing from the genera to the species. In a word, there would be no such thing as certainty, but all confusion. Redi, having a mind to examine equivocal generation, put recent flesh into a glass vessel, covered with a very thin linen cloth, and exposed it to the sun; after a little time, he found that flies laid their eggs upon the linen cloth; but no maggots were produced in the flesh. We cannot conclude that insects are produced by
by equivocal generation, because we see many thousands of them about pools and ditches, where the putrifying filth of those places furnishes plentiful nourishment for them, which is the reason that their eggs are rather deposited there, and are more easily hatched, and thrive better, even as lice on the scald heads of children abound more, because of their plentiful nourishment. The stapelia hirtusa produces a flower that smells like carrion, for which reason the flesh-flies, deceived by the smell, fill the whole flower full of their eggs, taking it for putrid flesh. We have no reason to believe, what some have asserted, that wheat degenerates into barley, and barley into oats, and oats into brome-grass; for every species produceth its own like; nor was it ever known that the fierce eagle produced the timorous dove. Having confuted equivocal generation, it will follow that every living thing is produced by univocal generation, or from an egg. Now vegetables we have proved before are endowed with life, therefore they also proceed from eggs. And indeed the great Harvey long ago maintained this doctrine, that every living thing derives its origin from an egg. But some of the moderns have strenuously endeavoured to overthrow this opinion; their cause being chiefly supported
ported by such arguments as the following: If, say they, we take a part from the root, and set it in the ground, it strikes root, and a new plant springs up; again, if a polypus is cut into several parts, from each of these parts an entire and compleat polypus is formed, according to the late discoveries of Trumbull and others. But do we not as frequently see that a plant produces from the same root several shoots or stems? for a stem is nothing but a root above ground; for which reason, if we turn a tree, e. g. the lime tree upside down, the stem will become the root, and the root be changed into branches, which we may reckon among the late discoveries in gardening. Besides, what we have said is farther confirmed by the branches, all of which spring from the stem or root; but the stem or root from whence this branch or shoot was taken, rose from a seed or egg. The same thing may be said of the polypus among animals, and therefore a polypus lives a vegetable life, or a vegetable lives the life of a polypus; and this manner of propagation, though very rare in the animal kingdom, is most common in the vegetable kingdom. No one ought to wonder that new leaves are produced every year from the root or branches, for in the same manner do we daily see the feathers of birds produced.
A feather, which is a most curious piece of workmanship, consists of a concave base, filled with a vessel like a lymphatic, so that the aliment can pass upward but not downward; next there is the mid-rib, and the lateral branches both partial and proper, so that a feather may be compared to a fern twice compounded. Now daily experience informs us that feathers, though adorned with such curious mechanism, fall off every year, and that others, springing from the body of the bird, succeed in their room. Moreover, it is evident that feathers grow only out of the body of the bird, that this body is their root, and that this root owes its origin at first to a feed or egg. The same also holds in plants: therefore polypi, and plants of every kind, have undoubtedly feeds or eggs, by which they are multiplied, without being cut or propagated by shoots, layers, branches, or suckers. Add to this, that the famous Bern. Jussieu discovered eggs or feeds in the polypi; as may be seen in the Transactions of the Stockholm Society for the Year 1746.

Here we are to observe, that all viviparous animals have their eggs, out of which comes their offspring, though these eggs are contained in their proper matrix, and excluded in due time, in the same manner as an egg in the nest, cherished by the incubation
cubation of the bird, whose uterus is the nest. Nor can we deny, but the smallest vegetables have seeds, although often not discoverable by the naked eye. In ducks-meat, Valisnerius has discovered the seeds; and Michelius in the mucor and byssus; Bobart in the ferns; Linnaeus in the mosses; and Reaumur in the fungi. The antients thought that mistletoe was produced without seed, having seen it often grow from the underside of branches; but how the seeds of the mistletoe could be conveyed from one tree to another, and there adhere to the underside of the branches, was very difficult for them to conceive. But time has discovered, that the thrush, swallowing the berries on account of the pulp, afterwards voids the seeds entire, which stick with the excrements to the branches. These viscous seeds are washed by the rains, so that some of them are often protruded to the lower side of the branches, where they grow; and thus,

The thrush, when he befools the bough,
Sows for himself the seeds of woe.
Some people are persuaded, that the sessile and flat fungus es on trees are morbid excre- cences, but it is plain they are true species of those agarics which are furnished with caps and stems, and grow on the ground, whose seeds falling on a moist tree produce,
as it were, half caps without stems. That feeds are the eggs of plants appears from hence, that as every egg produces an offspring similar to the parent, so also do the feeds of vegetables, and consequently they also are eggs. The containing parts of a hen's egg are the shell, the external film or membrane, the internal membrane lying immediately under the former, the chalaza or membrane inclosing the yolk, twisted at the extremities. The parts contained are, the air within the external membrane at the obtuse end of the egg, the thinner and exterior part of the white, the interior and thicker part of the white, the yolk, the hilum, scar or cicatrice, in the center of which is the speck of life. Pl. XI. fig. 15. When an egg is set under the hen, after two days incubation, the speck of life becomes red, sends out its blood vessels through the yolk, and at last we find the whole chick is formed out of the speck of life, the yolk becomes the secundines, the white, that fluid which nourishes the chick in the egg, or liquor of the amnion, and the two membranes become the amnion and chorion. A feed has also a shell, external membrane or film, a membrane including the yolk, the yolk itself, and the scar or point of life. Pl. XI. fig. 16. In feeds the white is wanting, there being no
no use for it, as the moisture of the earth supplies its place, and nourishes the embryo of the plant. Likewise the eggs of fishes have no white, because they are always in the water. When the flower is going off, the seed begins to swell, and on its outside there is seen a vesicle, which is the amnion of Malpighi, furnished with an umbilical cord or navel string, which is produced through the chorion to the opposite side of the egg. While with the egg the amnion increaseth, on its top is observed another small body, which likewise increaseth continually, till it has filled the whole chorion and egg; and the amnion and chorion are turned into the external shell or coat of the seed. Logan's Exper. 9. by which it appears that the same changes are brought about in the seed as in the egg; and therefore, that the seeds are the eggs of plants cannot be doubted. That plants spring from the yolk of the egg is farther confirmed by the lobes, which, when we speak of cows and other similar quadrupeds, are nothing else than several secundines, always adhering to the fetus, drawing their supply of fluids from the matrix, which fluids they prepare for the nourishment of the tender fetus. That most plants have seminal leaves or lobes is very well known. Now these seminal leaves once constituted
constituted the whole seed, except the hi-

lum, or little heart, in which is the point
of life; and these lobes prepare the nourish-
ment for the very tender plant, until it be
able to strike root in the earth; in the same
manner as the yolk in an egg, becoming the
placenta, prepares the nourishment, and
sends it by the navel string to the chick;
after which they drop off. Hence it ap-
ppears, that the feminal leaves are the lobes.
But since all lobes come from the egg or
seed, we may fairly conclude that plants
are produced from eggs.

SECT. CXXXVIII.

From what has been said it appears, that
all vegetables have eggs from which they
are produced. Now daily experience teaches
us, that no egg can produce an animal, till
it be impregnated or fecundated by the
male: a hen indeed will lay eggs, but not
such as will produce chicken, unless they
are impregnated or fertilized by the cock or
male. That all generation precedes the
birth appears throughout universal nature.
In quadrupeds it does without doubt: but
as to fishes there is a vulgar notion that
their generation follows or comes after the
birth or exclusion of their eggs, and that
the male sperm is emitted upon the eggs
after they are excluded from the matrix of
the
the female. But this opinion will soon be laid aside, when it is now made to appear, by modern observations, that the male fish emits his sperm a day or two before; that the female, which follows him, greedily devours the same, and thus conceives by the mouth before the exclusion of the eggs. Amphibious animals have their proper laws; for they copulate as all other animals, but with this difference, that the male of serpents, in like manner as the crab, have two penes, and the rattle-snake four rough echinated penes. The generation of frogs is still very obscure; and is likely to be so, till Reaumur shall favour the public with his later observations, which is much to be wished for. In the meantime however, there is no doubt to be made, but that the exclusion of their eggs follows after their copulation. There have been many different opinions of the physiologists, how, or in what manner, generation was brought about, or rather the fecundation, but this remains as great a mystery as ever. The effervescencies, precipitations, and other ridiculous notions, of the antients are now justly laid aside; but the physicians have hitherto acquiesced chiefly in two opinions: the first was, that of the great Harvey, to wit, that in the speck of life, or cicatrice, the entire rudiments
rudiments of the future foetus were present, perfect in all its members, and that it was only requisite that the male sperm should add or excite the first spirit, motion, and life. His followers also contend, that so curious and wonderful a machine as an animal body is, could never be formed and perfected by another machine. And that therefore in the ovarium of the first female there must needs be her offspring or ova, and in them others, and so on in an infinite series through all the subsequent descending generations. In a word, that in the ovarium, or loins, of Eve, the whole race of mankind were contained, whether past, present, or future. Now allowing that matter were infinitely divisible, yet it exceeds all belief, that so many myriads should be contained in one egg. The second hypothesis, or supposition, how generation, or the secundation of the egg, was brought about, was that of Leuwenhoek, that the cicatrice of the egg was empty, and the male sperm replete with myriads of animalcules, which being admitted into the ovarium of the female, some of them entered the empty ovula contained therein, increased, and at last became a compleat foetus. Thus his followers established their opinion on vain figments instead of rational experiments. Gordon argued, that the cicatrice
cicatrice was hollow, and that one animalcule of the male sperm filled it, and by a wonderful metamorphosis was transformed into a compleat animal. Dalempatius maintained, that these animalcules were compleat, wrapped up in a thin involucrum. Andry fancied imaginary valves and perforations in the ovula. Lister maintained, that those animalcules served only to excite venery. Valisnerius, that the male sperm was by them only kept in motion. Many of the moderns have adopted this last opinion. For the carina, or keel-shaped appearance, which Malpighi observed as the first rudiments of the fetus that appeared in the egg after incubation, was very like those animalcules: but they have all erred in this affair. For, in the first place, those corpuscles which Leuwenhoek discovered in the male sperm, are by no means animalcules having proper and voluntary motion, but mere inert particles diffused through the male sperm, like so many oily particles swimming in a fluid, as we clearly observed by means of Liberkynius’s choice microscopes. 2. If they were really animalcules, according to Leuwenhoek’s opinion, to be metamorphosed in the ovula, they must necessarily have their own two tunics; and, by casting those tunics successively one after another, they must be changed,
changed, first, from the state of a larva, or grub, into the state of a pupa, nympha, chrysalis, or aurelia, and next into a complete animal: but the amnion and chorion of the fætus derive their origin from the egg, and not from those animalcules, as they are called. 3. That the Author of nature always acts in the most compendious way, as I think no one will readily deny; so, on the other hand, neither will any one believe that the same All-wise Creator formed so many myriads of animalcules for the sake of one only. 4. How this hypothesis will account for generation, I cannot see; for, supposing that those corpuscles were really animalcules, then they also would have their animalcules by which they were produced, and these last others, and so on without end, which is the greatest absurdity. 5. The secundines are from the yolk, and it is well known, that the yolk is found in an egg not fecundated; if, therefore, we should ascribe the rudiments of the fætus to the male sperm, then the umbilical cord, with its membranes, would be totally distinct from the yolk, and by that means not have the same common tunic with the yolk, which we know to be false. How then generation, or the fecundation of the ovula, is effected, we are wholly ignorant. When a horse copulates with a she-af, the species produced,
produced, which we call hybrid, mongrel or mule, is neither like the male nor female; which would certainly be the case, were the rudiments of the fætus to derive their origin wholly from one sex only. If a water spaniel is impregnated by a pointer, the female puppies are like the bitch, and the males like the dog. The same thing holds good, as I know from experience, when a Friseland hen is impregnated by a common dunghill cock. Dr. Bartholin, in his observations, tells us of a certain Negro, who, during his confinement in jail at Copenhagen, got a wench with child. She in due time was delivered of a boy, who was in colour altogether like the mother, except the penis, which was black, a sufficient indication who the father was. All these things plainly shew, that the rudiments of the fætus are not derived wholly from one sex only. We have now shewn that plants have eggs, which are their seeds, and that no egg can produce a fætus till it be impregnated by the male, and of consequence neither can the eggs of vegetables. Hence it will follow that plants must necessarily be furnished with the organs of generation,

SECT. CXXXIX.

That we may make a full enquiry into this subject of the generation of plants, it will
will be proper to investigate the situation of their genital organs. Now we have proved that the seeds are the eggs of plants, and from the last section it appears that wherefoever the fecundated eggs are, there we are to seek for the organs of generation; and we shall find the genital organs of plants where the seeds are produced. But the seeds are produced where the flower and fruit are; therefore the flower and fruit are the genital organs of plants. Some have asserted that certain vegetables wanted flowers, and others both flowers and fruit. Tournefort maintained that the *algae*, or flags and mosses, had seeds, but no flower; and that the *fungi*, and some others, had neither flowers nor fruit. Hence some of the moderns have argued against the fructification. But for one to deny flowers and fruit even to the most minute vegetables, which he finds in all the larger species that can fall under his inspection, is the part of a madman, not of a fair and rational enquirer. For it is the same as if we should conclude concerning some minute species of insects, that they had neither feet, nor eyes, nor mouth, nor genitals, because we cannot discover them with the naked eye. Bobart sowed the seeds of ferns, which grew very well. Plumier discovered the flowers in some of the fern kind, and the
Chap. V. OF BOTANY. 183

fame may be easily investigated in the trichomanes of Linnaeus. Linnaeus discovered the seeds of mosses, and in the polytrichum we have pretty clear signs of both sexes. In the lycopodium selaginoides, or prickly club-moss, Linnaeus observed, that one part of the fructification contained the fertilizing dust, and the other the seeds, which were evident signs that the plant had both flower and fruit. B. Jussieu traced the flowers of the pilularia or pepper-grass. Reaumur discovered the fructification in the fuci. Linnaeus numbered the stamina and pistilla in the jungermannia epiphylla, or broad-leaved jungermannia. Valisnerius has delineated in the lemma or duck's-meat, the calyx, the stamina, the pistillum, the capsula, and the seeds. Michelius has frequently numbered the stam- na of the fungi, and has found their seeds, which grew very well. Nov. Gen. Tab. 68. 73. and 74. Hence therefore we may conclude, that these lowest tribes of vegetables are all furnished with flowers and fruit, although by reason of their exceeding minuteness they have not hitherto been distinctly known to botanists. In short, there never was a clear and evident example produced of any plant which wanted flowers and fruit, and therefore we may justly say, that in their fructification consists the essence of plants.

N 4  sect.
Universal experience attests, that the flower always precedes or goes before the fruit, in the same manner as generation precedes the birth in animals; so that not one example of the contrary can be produced in any individual. The *colchicum autumnale*, or meadow-saffron, flowers in the autumn, but the fruit, with the stem and leaves, appears the following summer in the months of May and June. The hazle puts forth his flowers early in the spring, but ripens his fruit or nuts in August. In a word, the flowers always come before the fruit in every plant, without exception.

Since in animals all generation precedes the birth, and in vegetables every flower precedes the fruit, we must necessarily ascribe fecundation to the flower, and the birth or exclusion of the seed to the ripe fruit.

Here we may define a flower to be the genital organs of a plant serving for fecundation, and the fruit to be the genital organs serving for the birth or maturation of the seed. There has been much dispute among botanists concerning the definition of
of a flower; many have asserted that the essence of a flower consisted in the corolla or petals; this opinion Knautius embraced, and also denied that there ever were any flowers destitute of petals. But experience and our senses tell us, that there are many plants, some of which want the calyx, as the tulip, fritillary, &c. others the corolla, as the grasses, cats-tail, bur-reed, and pine; others the filaments of the stamina, as the birthwort; others the style, as the tulip, grass of Parnassus, &c.; but that all flowers whatever, except the mosses only, are furnished with the antherae or stigmata, or both together; and as this holds universally in every species of plant (the mosses only excepted), these parts must necessarily constitute the essence of a flower. If we find a flower with antherae, but no stigmata, we may also assuredly find another flower either in the same, or a different plant of the same species, which has stigmata with the antherae, or without them. Pontedera, on the authority of the Hortus Malabaricus, contends, that there are some plants which have no antherae; e. g. the cycas circinalis, or fagoe palm tree, the cel-tis, or nettle tree, with some others. But in this he is mistaken, for even the number of the antherae in those plants he mentions is at present very well known to botanists. The
The same objection has been made in regard to the _ipsotes_, or quill-wort; but Linnaeus discovered the _antherae_ of this plant; it. Scan. Hence we perceive the error of the followers of Rivinus, who took the _nectaria_ in the hellebore, _nigella_, and passion-flower, for flowers; which _nectaria_ have properly no _pistilla_ nor _antheræ_. For the act of fecundation two things are requisite, namely, the genital organs of both sexes; because, as was said above, one of the sexes alone cannot propagate the species. Now the act of fecundation is performed in the flower, therefore it follows, that the genital organs of both sexes must be present in the flower. We are here however to observe, that the genital organs of both sexes are not always present in one and the same flower. It is sufficient that the genital organs of the male be in one flower, and those of the female in another. Since every plant bears seeds by which its offspring can be propagated, and no egg can be hatched before fecundation, it will follow, that fecundation is as necessary as the seeds themselves. Hence it appears, that the genital organs of both sexes, which serve for fecundation, are altogether necessary, if the flower is perfect, and that they are the essential parts. But we find no parts of a flower that are essential but the
the *antherae* and *stigmata*; therefore these parts are the genital organs of both sexes, serving for fecundation.

**SECT. CXLIII.**

The male organs of generation in animals are very different. Some have a *penis*, as the quadrupeds, birds and serpents, some of the fishes, insects and worms; others have no *penis*, as many of the true fishes, and those called shell-fish. Some have seminal vesicles, as the greatest part of quadrupeds; others have none, as the dog kind. Some have testicles distinct from the seminal vesicles, as the quadrupeds; and others have both testicles and seminal vesicles united in one, as the fishes. Now we maintain that the *antherae*, the male organs of generation in flowers, are nothing else but the bodies which prepare and contain the male sperm; therefore these *antherae* are the testicles together with the seminal vesicles, and their dust the genuine male sperm of plants, answering to those particles which are called *animalcules* in the male sperm of animals. The truth of this we shall prove by the following arguments.

1. *Preceding the fruit.*—The *antherae* and their dust always come before the fruit. When the fruit sheds its seeds, it is come to maturation. This is the case with the *antherae*;
antheræ; for when they shed their dust, they are come to maturation, and have done their office; yet their dust is always shed when the flower is in full vigour, and then the antheræ drop, and are useless.

2. Situation.—The antheræ are always so situated in the flower, that their dust, which is the male sperm, may reach the pistillum or female organ; for the stamina either surround the pistillum, as in most flowers; or, if the pistillum incline to the upper side of the flower, the stamina do the same, as in the didynamia; or if the pistillum nods, the stamina ascend, as in the cassis, and the common winter-green. Several plants in the monœcia class have the male flowers over the female, as Indian corn, palma Chrifti. 3. Time.—The antheræ and stigmata are in full vigour at the self-same time, and this not only when both are in one and the same flower, but also when they are in distinct or separate flowers, so that the long catkins of the hazle, birch, alder, never discharge the dust of their antheræ before the stigmata below them are come out. The male hemp never sheds his dust before the pistilla of the female plant appear. 4. Cells.—Tournefort was of opinion that the antheræ did the office of kidneys, purging the several parts of the plant from all such particles as were
were not fit for its nourishment, by receiving them into their cells, and that their valves were burst open by those accumulated excrements. Pontedera's opinion was, that the *antherae* are nothing else but a cluster of cells, which receive a peculiar juice or fluid, and then transmit it through the filaments to the receptacle, from whence it is carried to the embryos of the seed; but the falsehood of this opinion will appear from the consideration of all the plants of the *dioecia* class, the figure of the *pollen*, artificial fecundation, caprification, and the culture of palm trees. If we cut asunder the *antherae* before they shed their dust, we find their structure altogether as wonderful and curious as the seed vessels themselves. For within, they consist either of one cell, as the *mercury*; or two, as *hellebore*; or three, as the *orchis*; or four, as the *fritillary*; and they open or split either longitudinally, as the *leucoium*, or greater snow-drop; or at the base, separating into pieces or valves, as the barren-wort; or from the top, as the common snow-drop; or at the two points or horns, as the whortle, heath, winter-green, and marsh rosemary. 5. Castration.—If we cut off the *antherae* of any plant which bears but one flower, taking care at the same time that no other plant of the same species is near it, the fruit proves
proves abortive, or at least produces seeds which will not vegetate. This is a certain truth, which any one will find upon trial. 6. Figure.—The figure of the fertilizing dust will clearly convince any one that this fine powder is not accumulated by chance, or from the dryness of the antherae. Malpighi, Grew, Moreland, and Geoffroy, who have all viewed the figure of these particles with good microscopes, found all the particles exactly equal to one another, but in different genera as great a difference in shape and figure, as the seeds themselves ever have. As for example, in the sun-flower the particles are globular and echinated, or full of prickles; in the bloody cranes-bill, they are like a perforated globule of fire; in the mallows, they appear like wheels with teeth; in the ricinus, or palma Christi, they are shaped like a grain of wheat; in the pansies, they are angulated; in the Turkey wheat, flat and smooth; in the borage, like a thin leaf rolled up; in the narcissus, kidney-shaped; in the comphrey, like double globules, &c. The powder of the antherae in point of fecundation answers to Leuwenhoek's animalcules in the male sperm; and the stigma, which receives this dust, is always moistish, that the dust may instantly adhere or stick to it. The observation of the famous botanist Bernard Jussieu
Jussieu concerning the maple, deserves our notice. "Those gentlemen (says he), who have examined the fertilizing dust of the maple by microscopes, have drawn the particles in form of a cross. But I found their form to be globular, and as soon as the particles touched any moisture, they burst into four parts or valves, in the shape of a cross." From which observation we may infer, that those particles are hollow globules containing some subtle matter within, and that as soon as the hollow globules touch the moisture, they burst and discharge their exceeding fine contents. This last observation throws some light on the generation of animals from its analogy to the seminal animalcules. Upon the whole it abundantly appears, that the *antherae* are the male organs of generation, and their dust the genuine male sperm. Since in every flower the *antherae* and *stigmata* are the genital organs serving for fecundation, and the *antherae* the male organs, it is obvious to every one, that the *stigmata*, the other essential part of the flower, is the female organ of generation, which we shall more fully prove by the following arguments.

**Sect. CXLIV.**

The parts of the *pistillum* are three, the *germen*, the *style*, and the *stigma*. The *ger-
men, or feed bud, while the plant is in flower, is always imperfect and immature, being only the rudiments of the future fruit; the style is no essential part, for it is wanting in many species of plants; but the germin can never bring the fruit to maturity, except it be within the flower along with the stigma. Hence it follows, that the stigma is that part of the flower which receives the impregnating dust. This will farther appear; 1. From the Situation.—For we are to consider that the stigma is always so situated, that the antherae, or their impregnating dust, can reach it, as we have shewn above. Hence the syngenesious plants are rarely barren. Moreover the stigma has always a figure proper and peculiar to itself, so that in most (though not all) plants it is double, when the fruit consists of two cells, as in the masked and umbelliferous plants; triple, when the feed vessel has three cells, as in the lilies; quadruple, when the feed vessel has four cells, as in the grass of Parnassus; there are five stigmata when the feed vessel has five cells, or five feeds, as in the geranium, winter-green, wood-sorrel; there are fix stigmata when the feed vessel has six cells, as in the asarabacca; there are ten stigmata when the feed vessel has ten cells, as in the pork-physic; there are many stigmata when the feed vessel has many
Chap. V. OF BOTANY.

many cells, as may be seen in the mallows, or in the poppy, which is furnished with as many receptacles for the seed as there are stigmata. 2. Time.—The stigmata are always in full vigour at the same time with the antheræ. For, in the Indian wheat, as Logan observes, on the same day that the antheræ burst their inclosure, and hang down in the open air, are seen the bundles and extremities of the stylæs coming out of the sheath of the spike to open view. 3. Falling off.—The stigmata in most plants, when they have discharged their office, drop off in the same manner as the antheræ do; which is a most evident sign that the stigmata contribute nothing to the ripening of the fruit, but serve only for the purpose of generation. 4. Being cut off.—If the stigmata be cut off before they have received the impregnating dust of the antheræ, the plant is castrated as to the female organs, and the fruit perishes: a sufficient demonstration that the stigma is that part of the female organ of generation destined for conception. The stigma of a flower has, besides, two other singular properties; namely, that it is always divested of the cuticle or film, nor has it any bark as the other parts, and then it is always bedewed with a moisture. Hence it appears, that the arguments of Pontederæ

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have no force to invalidate our doctrine. For when he would oppose the doctrine of the generation of plants, the whole force of his argument was drawn from the umbelliferous plants, whose styles are not come up when their stamens appear. But the stigma is that part which serves for the purpose of generation, and not the style, which may be wanting in many, as it is not an essential part of the flower. It is sufficient therefore, that the stigmata in the umbelliferous plants be in full vigour at the self-same time with the antherae, though the style be lengthened after conception, which is the case also in the maple.

SECT. CXLV.

The generation then of plants is brought about by the antherae shedding their dust on the stigmata. It is not sufficiently clear in what way the generation of animals is accomplished; but thus far we are certain of, that the male sperm must come in contact with the female organ, if there be any impregnation. In the vegetable kingdom the genital dust is carried by the air to the moist stigmata, where the particles burst and discharge their exceeding fine or subtle contents, which impregnate the ovary. That this is the case, will be shewn by the following arguments. 1. Sight.—When a plant
a plant is in flower, and the dust of the antherae flying about, that part of this dust lights upon and clings to the stigma, is obvious to every beholder. The flower of the pansies shews this in a most agreeable manner; for, when the flower is scarcely opened, you shall see the stigma, like a concave globe, gaping wide open on one side, and of a pure white colour; but, as soon as the five stamina have discharged their dust, you may observe the whole stigma filled with this genital dust, and covered all over with a yellow or brownish colour, yet the tube of the pistillum remains clear and transparent. Before this impregnation, if you gently squeeze the stigma, there oozes from it a certain sweetish liquor, which retains and attracts the genital dust. In the heath-hyssop also the stigma gapes or opens to receive the male dust, upon which it shuts, and the ovary being thus impregnated ripens its seed. The iris shews us a particular structure; for the stigmata spreading wide wholly cover the antherae, yet they are so situated in regard to the petals, that by means of a gentle wind under the stigmata the male dust can mount by the channels of the petals. The campanula differs from other flowers in this, that the male dust adheres to the side of the rough style, and from thence is communicated to the stigma.
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S stigma by certain canals. In the syngene-

fious plants the stigma rise through a cy-
linder of the antheræ, and as each stigma
comes up, it always brings along with it
the fertilizing dust; hence fecundation
rarely fails in such plants, as was observed
before. 2. Proportion.—For the most part,
the stamina and pistillum are of the same
height, that the male dust may more easily
come at the stigma; but in some plants it
is not so, and then a singular process of fe-
cundation may be observed. In the geran-

nium inquinans, or African tree cranes-bill,
with a thick mallow leaf and scarlet flower,
where the pistillum is shorter than the stami-
na, the flowers before they blow are pen-
dulous, but upon their opening they stand
upright, that the powder may fall upon the
stigma; after which they again nod till the
fruit is ripe, and then they stand upright a
second time, that their seeds may be more
easily scattered about. The same may be
seen in the claytonia fibirica. Some of the
pinks have pistilla longer than the stamina:
the flowers do not nod, but the pistilla are
reflected or bent back like rams horns to-
wards the antheræ. The flower of the ni-
gella arvensis, or horned field fennel flower,
when it first opens, has the five pistilla erect
and longer than the stamina; but when the
flower is well expanded, the styles are bent
back
back that they may touch the antheræ which surround them: when they have received the male dust, they are again elevated, and ever after remain erect. In the tamarind tree, passion-flower, and cassias, the styles are reflected nearly in the same manner towards the antheræ. 3. Place.—

The stamina for the most part surround the pistillum, so that some of the dust is always blown by the wind on the stigma. Plants of the didynamia class, which have their flowers erect, and standing at an acute angle with the stem, bend their stamina and pistilla to the upper lip of the flower, where the stigma, placed among the antheræ, is generally defended from rain. Plants of the diadelphia class, which have their flowers nodding at an acute angle from the perpendicular line, have the stamina and pistilla declining within the keel of the corolla, which is compressed or flat, that the fecundation may be thereby facilitated, while the vexillum keeps off the rain. Plants of the monœcia class have the male flowers mostly placed above the female, that the dust may more readily fall on the pistilla, as may be seen in the carex, Indian wheat, Job's-tears, bur-reed, cats-tail, lesser burdock, cassava, ambrosia, water-milfoil, arrow-head, and palma Christi. Yet there are a few exceptions, among which we shall
shall reckon the pine and the fir, where the antheræ are so very numerous, that if any animal, or the wind, shake the tree, we may see the dust flying upwards like smoke; and so plentiful is the dust, that if, in the time of flowering of the pine, fir, or juniper, it chances to rain, the banks of the adjacent standing waters are painted with yellow rings of the dust from those trees. The teucrium flavum, or shrubby ghermander, has a yellow corolla, the two upper segments of which ascending, press like fingers the antheræ, which are placed on nodding filaments, to the stigma, that the genital powder may touch it, and they continue to cover it for some days after the fecundation, and then resume their former place. The veratrum album, or white hel-lebore, has its male flowers placed below, but the others and upper flowers are all hermaphrodites; for which reason the male flowers, as not being so necessary, are placed lower. 4. Time. — Here we are to observe, that the stamina and pistillum come at the same time, and that not only in one and the same flower, but also where some are male and others female, on the same plant, a very few only excepted. The wonderful contrivance of the great Author of Nature in the jatropha, or cassava, and the plantain tree, is truly worth our observation. The jatropha
jatropha urens, or prickly cassava, has a corymbus, whose first or uppermost forks bear female flowers, which come out a day or two before the males, the other forks or branches of the corymbus produce male flowers, but the female flowers, which come out first, cannot be impregnated by their dust, because they were withered before the males expanded; and therefore those female flowers prove abortive, unless they are impregnated from some other corymbus which has male flowers at the same time. The musa paradisaica, or plantain tree, produces a spadix, which contains often 200 germina, the few female flowers of which continue in blow for some days; when the female flowers have done blowing, the males succeed, and continue in flower till the fruit is ripe, in which are to be found no seed at all. Wherefore the authors of the Hortus Malabaricus have asserted that seeds were evidently wanting in the plantain tree, which seemed a paradox to me; but when I saw the first female flowers destitute of males, and that the males which followed came too late to impregnate the females, I clearly perceived that no seeds would ever be produced in this species, unless several plants placed together were to flower nearly at the same time, and then one could impregnate the other.
other. There is one thing farther remarkable in the 

\textit{musa}, and that is, that it produces two sorts of flowers very different in the same plant, some of which want the 

\textit{stigma}, and others the \textit{anther}; the first may be called male hermaphrodites, and the latter female hermaphrodites. Here then we have an unexampled species of 

\textit{polygamy}, where those different flowers may impregnate each other, and one female joined with barren males is impregnated by the males belonging to another female, which is itself barren. Another thing which merits our observation in regard to time is, that when the male and female flowers are in distinct cups on the same plant, or on different plants of the same species, and where the male flowers are not erected perpendicularly over the females, there it is necessary that the flowering be over before the leaves come out, lest the fecundation should be hindered by the intervention of the leaves; \textit{e.g.} in the mulberry, mistletoe, alder, birch, hornbeam, beach, oak, hazel, walnut, and also in the willow, sea-buckthorn, \textit{myrica} or Dutch myrtle, poplar, ash, and dogs mercury.

5. \textit{Rains}.—In almost all sorts of flowers we see how they expand or open by the heat of the sun, but in the evening, and in a moist state of the air, they close or contract.
tract their flowers, left the moisture getting to the dust of the antherae should coagulate the same, and render it incapable of being blown on the stigmata; but (which is indeed wonderful) when once the fecundation is over, the flowers neither contract in the evening, nor yet against rain. Flowers with covered antherae never shut up in the night time; e.g. those of the di-dynamia and diadelphia classes. The antherae of the rye hang out beyond the flower, and if rain falls while it is in flower, the dust is clotted, and hence the husbandmen do truely predict a bad crop of rye, for the kernels are not so numerous, because many of the florets prove abortive. But the antherae of the barley lie so close within the husk, that the rain cannot get at it. If rain falls upon the bloom of the apple, pear, or cherry, the gardiner immediately dreads the blossoms falling off, or proving abortive; and experience confirms the truth of this, for the powder of the antherae is spoiled; yet this accident oftener happens in the cherry than the apple or pear, for all the antherae of the cherry flowers discharge their dust at once; but the case is not so in the others. Smoak also is injurious, by drying up the moisture of the stigmata. 6. Culture of Palm Trees.—That the cultivators of the common palm tree, or
or date tree, cut off the male spadixes, and place them over the females, is recorded by Theophrastus, Pliny, Prosper Alpinus, Tournefort, Kempfer, and others; and if they neglect to do this, the dates are harsh, bad tasted, and many trees wholly destitute of nuts or fruit. The date tree is every year thus impregnated in Arabia, Persia, and Egypt, by the inhabitants. " The male spathe being ripe (says Kempfer) are taken from the top of the tree, the spadixes taken out, and divided into lesser branches, that the rudiments of the fruit may be sprinkled with the minute atoms of their dust; a small branch of the male spadix is fixed into the middle of the female spadix, and thus discharges its dust on the seed buds. It is remarkable that the spadixes dried are still proper to impregnate the females, and may be kept a whole year without losing their virtue. It sometimes happens that the females are impregnated by the dust blown to them by the wind; but since this is precarious, it is better done by the hand. If there is no impregnation, the female trees inevitably drop all the rudiments of the fruit, which is a great calamity to the owners, and to the country people in general, who are supported by their crop of dates, as we are by our crops of corn. I remember it happened in my time, that the
the Grand Signior meditated an invasion of the city and territory of Basflora, which the Prince of the country prevented, by giving out that he would destroy all the male palm trees on the first approach of the enemy, and by that means cut off from them all supplies of subsistence during the siege." Thus far Kempfer. Hear also what Tournefort says on this subject. " Hagdi Muftapha, ambassador from Tripoli, told me, that a branch of the flower of the male palm was inserted into the spatha of the female just at the time the spatha used to open; for when the flower is fully expanded, it sheds its dust, without the assistance of which the dates would be harsh and ill-tasted, disagreeable, and without stones or kernels, and only fit to be given to camels and other beasts of burden." In the males and females of the pistachia nut-tree they observe the same method as in those of the date tree. For in Sicily (says Geofroy in his Materia Medica) the countrymen pluck clusters of flowers from the male pistachia, with the fecundating dust of which they impregnate the female flowers. Others gather the male flowers, expose them to dry in proper bags, and scatter the proliferous dust on the female flowers, that the fruit may not prove abortive, and the crop fail. 7. Nodding Flowers.—Since
Since the male dust is generally of a greater specific gravity than the air, in most plants that have the pistillum longer than the stamina, the All-wise Creator has made the flowers nodding, that the powder may more easily reach the stigma, as may be seen in the common snow-drop, greater snow-drop, bow-bread, narcissus, fritillary, campanula, and dogs-tooth violet, &c. Now it cannot be said that this happens merely from the weight of the flower, for sometimes the fruit in the same plants, which is ten times heavier than the flower, grows erect, as in the crown imperial, fritillary, and others. 8. Sunk Flowers.—The stems of many plants grow under water; but a little before they blow, the flowers emerge or rise above the surface of the water, as we see in the water-lily, frogs-bit, broad-leaved pondweed, perennial arsmart, &c. There are others in which all the parts grow under water, as the water-milfoil, water-foldier, several of the pondweeds, all which, about the time of flowering, raise their flowering stems above the water, which stems sink again as soon as the time of flowering is over. The valisneria of Micheli, a kind of pondweed, which grows in Italy, bears a very long scapus, or flowering stem, but twisted in form of a screw; hence it appears very short. This plant grows
grows in rivulets and ditches under water, and bears on the extremity of its stem one flower only. About the time of blowing the scapus is lengthened, till the calyx has reached the surface of the water; which done, the flower is expanded, and after a few days, the flowering and impregnation being over, it sinks again, the stem turning in a spiral form as before. This is the female plant. The valisnerioides of Micheli grows in the same places under water, having a flower stem scarce an inch high, which consequently does not reach the surface of the water; this bears many flowers, which, when the time of flowering approaches, drop from the scapus, and rise like little bladders; as soon as they have reached the surface of the water, though before shut, they then open, and swimming about shed their dust on the female flowers, which are also swimming in the same places. This is the male plant of the former. H. Cliff. 454. Micheli, without attending to the sex, has carefully observed and faithfully described this circumstance.

9. Syngenesious Flowers.—The compound flowers are formed in different ways. In the polygania aequalis all the florets are furnished with stamina and pistilla. In the polygania superflua all the florets have stamina and pistilla in the disk or middle
dle of the flower, but in the radius there are only female flowers, which are impregnated by the male dust of those in the disk. In the polygemia superflua the disk is filled with hermaphrodite florets as in the former; but the female flowers, which constitute the radius, cannot ripen their seed, being all without stigmata. Lastly, the florets of the polygemia necessaria, which fill the disk, have the stamina and pistilla, but for want of the stigmata these florets bear no seed, and the plants would all have been barren, had not the All-wise Creator furnished the radius, which consists only of female florets, with compleat pistilla that have the stigmata, and consequently ripen the seed. 10. Consideration of all Sorts of Flowers.—The tenth and last argument is drawn from the genuine consideration of all sorts of flowers. And here for brevity's sake we shall examine only a few out of the many that might be adduced in proof of the Linnaean doctrine of the generation of plants. The celosia, or cock's-comb, is furnished with a pistillum surrounded by five stamina, whose filaments are joined below by a thin plaited film. In moist weather this film is relaxed, and the antherae stand at a great distance from one another, but in dry weather the film is contracted, by which means the filaments come close together,
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gather, so that the **antheræ** almost touch the **stigma**, and hence the impregnation is assisted. The **faxisfrage** has ten **flamina**, in the center of which are two **pistilla**. After being in flower for some days, two of the **flamina**, which stand opposite to one another, meet, that their dust may fall perpendicularly down on the **stigmata**, while their **antheræ** force open, as it were, each others fariniferous cells by rubbing against one another; next day these two **flamina** recede from one another, and two others supply their place, and thus they continue to do till all the males have disch arged their dust in the same manner. The grafts of Parnassus has five short **flamina**, one of which, as soon as the filament is sufficiently lengthened, touches the **stigma** with its **anthera**, and, having discharged its fertilizing dust, immediately rises, and whereas it was bent inward before, it now bends backward, and the filament grows afterwards almost as high as the **corolla**; then the second **stamen** comes forward in the same way and manner; then the third, fourth, and fifth, till they have all discharged their office. The **lychnis flos cuculi**, or meadow pinks, and the **gypsophila fastigiata**, a kind of sope-wort, have procumbent stems; but when the time of flowering approaches, these are raised upright, that the dust of the **antheræ**, being
being exposed to the wind, may be more readily blown upon the stigmata. This is also the reason why the greatest part of flowers are elevated on flowering stems above the ground, that the wind may more easily shake them. For the narcissus, snow-drop, violet, cross-wort, and some others, have their stems erect, but after the time of flowering their stems recline to the ground. Almost all the spiked plants begin their flowering below, or in the lower part of the stem, that in case the dust of the first should not prove sufficient, that of the latter may make up the loss. Of this sort are also the corymbiferous and umbelliferous plants, not to say the compound flowers, where the florets constituting the radius open first, then follow the interior florets, and the disk is elevated or raised, that the exterior florets may also receive some of their dust, if they were not sufficiently impregnated before. This is so certain and constant a rule, that when I found the hieracium præmorsum, the greater broad-leaved hawk-weed, or greater upright mouse-ear, observe a different order, i.e. the uppermost flowers come out first, I thought it a singular instance in nature. The pellitory clearly shews us the process of generation; if we observe it in a morning at a proper hour, we shall see how its antheræ burst with
with great elasticity, and emit their dust all round; and, of consequence, also upon the pistillum. The same experiment succeeds, if we touch the antherae with the point of a needle, as Vaillant has observed. The melons, pompions, cucumbers, gourds, &c. have two sorts of flowers; the one male, which are called barren; the other female, which bear the pistilla and fruit. The gardeners advise, that the barren flowers should be carefully pluckt off, by reason they think these deprive the plant too much of its nourishment. But without doubt they are mistaken; for they had better take the entire male flowers and sprinkle the females with their dust at noon, or roll the male flowers on the female, by which means the male dust will readily reach the stigmata, and the females thus impregnated will ripen their fruit; for the reason why the fruit drops off is for want of being impregnated, and not for want of nourishment, as is the vulgar opinion. Hence it is, that if gardeners do not give air to their flowers, so that generation may be assisted by the help of the wind, the fruit drops off, or miscarries. In 1723, a pompion flowered in Stenbrohalt garden, the male flowers of which were carefully pluckt off every day, as soon as they appeared, left they should draw from the female flowers too much of their nourishment; the
consequence was, that not one fruit appeared on the plant that season. If one pluck the flowers of the male hemp, before those of the female plant are opened, he will get none, or but very few ripe seeds. Yet it happens sometimes, that the female hemp bears one or two male flowers, by which some of the females may be impregnated; and this circumstance deceived Camerarius. The hops are of two sorts, the one male, and the other female; and that which they commonly call the fruit, is only the calyx expanded and lengthened; hence the female plants, though not impregnated, can bear cones. This it was which deceived Tournefort, so that he would not acknowledge the sexes of plants; because a female plant of the hops in the Paris garden thrived well, and bore fruit in plenty every year; when no male plants of the hops were within several miles of it. The same thing happens in the mulberry and blite, the berries of which are only succulent calyxes, but not seed vessels or ovaria. In the tulip there is an agreeable experiment of the gardeners. If one has only red tulips, out of any one flower of this sort let him take all the antheræ, before they shed their dust; then let him take a tulip with a white flower, and sprinkle with its antheræ the stigma of the red one; when its seed ripens, let
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let him sow it in a bed by itself, and he will have some flowers red, some white, and some of both colours; in the same manner as from two animals of different colours, the offspring is of various colours. One Richard Baal, a gardener at Brentford, sold a great quantity of cauliflower seed, which he raised in his own garden, to several gardeners in the suburbs of London, who carefully sowed the seeds in good ground, but they produced nothing, but the common long-leaved cabbage, for which reason they complained that they were imposed upon, and commenced a suit against the aforesaid Baal in Westminster-hall; the judge's opinion was, that Baal must return the gardeners their money, and also make good their loss of time and crops. Ray's Hist. I. p. 42. This cheat we ought not to lay to the poor gardener's charge, for it is wholly to be ascribed to his good plants being impregnated by the common cabbage. Wherefore, if one has an excellent sort of cabbage, he ought not to let it flower in the same bed with any other of an inferior sort, lest the good sort should be impregnated with the dust of the other, and the seeds produce a degenerate race. If one intends to plant the poplar or willow for walks, let him take only the male plants for this purpose; for if the females
are planted, they will multiply so fast as to form a grove instead of a walk. The juniper does not produce fruit every year in equal plenty, for if rain falls during its time of flowering, the fruit is deprived of the farina, and falls off. A female plant of the juniper grew for many years in Clifford's garden, but never produced any fruit for want of a male plant. The rhodiola, or rose-wort, grew in the Upsal garden from the year 1696, at which time professor Rudbeck brought it thither from the mountains of Lapland; but it never ripened its seeds, being without a male plant. It is needless to mention more examples, though I could easily deduce some singular experiments from many more plants, to corroborate our doctrine of the generation of plants, which the brevity of this dissertation does not allow. I shall not speak of the maize, the generation of which is denied by Siegfbeck and others, from the situation of the antherae and pistilla; but refer for this to a treatise written by Mr. Logan of Philadelphia, intituled, Experiments concerning the Generation of Plants. And as to the hazle, see the experiments of the famous Mr. Bradley, professor of botany in Cambridge. As to the fig tree, we shall explain its peculiar manner of generation, which is called caprification,
more at large. Tournefort, while he was in the islands of the Archipelago, accurately observed this, and has described it in the following manner. "There are three varieties of the *caprificus*, or wild fig, which is the male, called by the natives *fornites*, *cratirites*, and *orni*. These produce their fruit at three different times of the year; the fruit of the *fornites*, or first variety, begin to bud in August, and hold to the end of November, at which time many small insects make their escape from them, and lay their eggs on the *cratirites*, or second variety, whose fruit are now coming out. The *cratirites*, or second variety, bud in the end of September, and hold till May following. The insects sometimes come out of these before the *orni*, or third variety, are budded; in which case, the husbandmen carefully seek for those trees of the *cratirites* whose insects have not yet come out, and tie them on the branches of the *orni*, that the insects may lay their eggs thereon. The *orni*, or third variety, bud in May, and are ripe in July. In all the three varieties, certain insects are generated, which deposit their eggs, and these eggs become worms, and afterwards are turned into flies before the fruit falls off. The countrymen chiefly gather the *orni* in June and July, a little before the dog-days,
days, or when the insects begin to fly, and tie them with threads to the cultivated fig tree; then the insects, by wounding the orifices of the cultivated figs, make their way into the cavities of the fruit, which ripen after this in about fourteen days.” This riddle we shall now explain. The *capriscus*, or wild fig, is the male plant, and the cultivated fig the female. The flowers are disposed within the cavity of the receptacle, which is so close shut, that often it will scarce admit the end of a common needle through the pore in its extremity. Now the fig-flies, which are of the *ichneumon* kind, being transformed, and furnished with wings, about the time the *farina* of the male fig is ripe, make their escape from those male figs, and being wholly covered with their dust, after copulation, they seek for a place to lay their eggs, and flying to every one of the female figs, they enter their cavities, which are filled with *pistilla* from all sides, by which means they must necessarily brush off that *farina*, or male dust, with which they were covered, and thus the seeds are impregnated. It is true, the female fig can ripen its fruit, though the seeds are not impregnated, because this fruit is not a *pericarpium*, or seed vessel, but only a receptacle: so also the hop, mulberry, strawberry, and blite, can produce fruit,
fruit, though their seeds do not ripen, because their fruit is nothing but a receptacle or calyx. Some botanists who were ignorant of this, seeing those trees produce fruit without previous impregnation, thought they had found an unanswerable argument against the generation of plants; but they did not consider, that the fruit of the fig is not a seed vessel, but a common receptacle. Yet it appears, that the fruit of the fig, if the seeds are impregnated, grow to a much larger size than those which are not; which Tournefort also observed; for he tells us, that a fig tree, in Franche Compte, where there is no caprifiction, produced every year only 25 pound weight of figs; but that another of the same size in one of the islands of the Archipelago, produced yearly 280 pound weight of figs, which is above ten times the quantity of the other. This age hath clearly refuted the opinion of Camerarius, who maintained that the seeds of figs never produced any plants. For Linnaeus tells us, that fig trees are raised every year in Holland from the seeds, provided the fruit is brought from Italy. But if the fruit grew in France, England, Germany, or Sweden, where there are no wild figs, the seeds produce nothing; on the other hand, if those seeds are sown, which grew in Italy
or the Greek islands, where the male fig abounds, the plants spring up with ease, putting forth leaves, which at first are like those of the mallow. The same experiment was tried with good success in the Upfal garden in the year 1744. I shall only briefly mention the utility of insects in the fecundation of plants. In a great many flowers there is a nectarium, or honey juice, separated by the flower, which Pontedera thinks is that balsam which the seeds imbibe, to make them keep and preserve their vegetative quality longer; and as long as this balsam is not dried up or spoiled, so long the seeds are fit to germinate. Several insects, as bees, flies, butterflies, live on this honey juice only. Quintilian, the Roman orator, has a very singular case in one of his orations. "A poor man and a rich man (says he) had each a small garden adjoining to one another. The rich man had many fine flowers in his garden, and the poor man had bees in his. The rich man complained that his flowers were spoiled by the poor man's bees, which he warned him to remove. The poor man not complying, the other scattered poison on his flowers; on which the poor bees all died; and Dives is guilty of this great injury. The poor man pleads that the bees did no hurt at all to the rich man's
man's flowers; that neither the Creator, nor any human laws, had ever restrained bees within any certain limits; and therefore the rich man might hinder the bees from settling on his flowers if he could." But the other might have objected, that the bees were so far hurtful to his flowers, that they sucked the honey juice, and carried off the fertilizing dust. But after all, my opinion is, that the bees are more useful than hurtful to flowers, since by their unwearied labours they spread the fertilizing dust, so that it may reach the pistillum: for it is not clear what use the honey juice is of in the economy of flowers.

From what has been said it appears, that the generation of plants is performed by the genital dust of the antherae falling on the moist stigma, or female organ, which dust by the help of the moisture adheres and bursts, discharging its contents, the subtle particles of which are absorbed by the style, into the ovarium, germin, or seed bud. We deny, however, that the dust of the antherae penetrates through the style to the germin and rudiments of the seed, as Moreland, Geofroy, Logan, and some others, were of opinion; for one example from Vaillant of the poppy will be sufficient to disprove this, since it appears, by ocular inspection, to be false. The species meant,
meant, is the *papaver orientale*, or the oriental rough poppy, with a large flower. If one opens a flower of this plant, cutting its *pistillum* perpendicularly downwards, he shall find the *lamellee*, or folds, the *placentæ*, and the small seeds sticking to them, all of a pure white colour, though at the same time the *stylo* and all the *stigma* are wholly tinged with a purple hue from the dust of the *antheræ*. From whence we may fairly conclude, that not one grain or particle of the *farina* enters the folds of the receptacle, or the seeds themselves. The *malva alcea*, and the *malva moschata*, i.e. the vervain mallow, and the jagged-leafed vervain mallow, have kidney-shaped *antheræ*, or summits, which contain a dust consisting of large globular particles conspicuous enough to the naked eye, and having their diameters equal to those of the *styles*; whence it is evident they never can pass through the *styles*. Needham has observed, that the dust of martagon lily consists of rough or prickly globules, which as soon as they touch any moisture burst on the sides, and, like an *aëolipile*, with great impetuosity discharge a gelatinous matter, filled with innumerable points and atoms, which impregnate the *ovula*, or rudiments of the seeds. All the females also among animals discharge a seminal fluid at
the same time with the males, and therefore this seminal fluid is also necessary on the part of the female. This same viscid and ropy fluid on the stigma of plants is called by Malpighi a turpentine, or balsam. Hence Ray also says, that in no kind of animals that he knew did the sperm enter the ovarium, and in many kinds not even the uterus, or womb itself, but only its exceeding subtle effluvia to impregnate the ovula, or eggs. Upon the whole I think that the flowering of plants may be truly called their generation, and that the Antients with great propriety named the flower, the joy of plants.

**SECT. CXLVI.**

The calyx is then the marriage bed, in which the stamina and pistilla, the male and female organs, celebrate the nuptials of plants; and here also those tender organs are cherished and defended from external injuries. The corolla, or petals, are the curtains, closely surrounding the genital organs, in order to keep off storm, rain, or cold; but when the sun shines bright, they freely expand, both to give access to the sun's rays, and to the fecundating dust. The filaments are the spermatic vessels by which the juice, secreted from the plant, is carried to the antherae. The antherae are
the testicles, and may not improperly be compared to the soft roe or milt of fishes. The dust of the antherae answers to the sperm and seminal animalcules; for, though it is dry, that it may the more easily be conveyed by the wind, yet it gets moisture upon touching the stigma. The stigma is that external part of the female organ which receives the male dust, and on which this male dust acts. The style is the vagina, or tube, through which the effluvia of the male dust pass to the germin or seed bud. The germin is the ovary, for it contains the unimpregnated or unfertilized seeds. The pericarpium, or seed vessel, answers to the impregnated ovary; and, in fact, is the same with the germin, or seed bud, only increased in bulk, and loaded with fertile seeds. The seeds are the eggs, of which we have spoken more fully in sect. 136, and 137. We ought to observe, that the calyx is a production of the external bark of the plant; the corolla, of the inner bark; the stamina, of the alburnum, or white sap; the pericarpium, or seed vessel, of the woody substance; and the seeds of the pith of the tree; for in this manner they are placed; and in this manner also they are unfolded. Therefore in a flower we find all the internal parts of a plant unfolded. This, though obscurely, was taken notice
notice of by Cæsalpinus, and also by Mr. Logan of Philadelphia. Flowers then are nothing else but the genitals of plants, with this difference from those of animals, that their organs of generation are reckoned obscene, and modesty forbids us to examine them; for which reason nature has taken care frequently to hide them from our sight. But in the vegetable kingdom it is quite otherwise; for here those parts are not hid, but rather exposed to the view of all. Add to this, that they are the most beautiful of all the parts of plants, in which the study, love, and contemplation of men are conversant. As the genitals of all animals have a rank and strong smell in rutting time, so the flowers or genitals of plants also send forth a smell, which, though very different in different plants, is for the most part very agreeable, so that one fancies himself drinking nectar with his nostrils. We see then how the great Creator has enriched the most innocent nuptials of plants with the most singular and superb ornaments. Let us behold the marriage bed, or *calyx*, with what art it is constructed; the curtain, or superb covering called the *corolla*, how neat and elegant its extremity or termination, how splendidly cut or carved, how fine and thin, and with what lively and beautiful colours it
it is adorned! that we may truly say, in the emphatical language of scripture, *that Solomon in all his glory was not arrayed like one of them.* The *amaranthus tricolor* wants this beautiful covering of the *corolla*; but here nature has taken care to cover the flowers with a shade or fine-coloured crown of the leaves, which is laid over the flowers, that the few males, being defended from showers, might more easily and safely discharge their *farina* on the females below. All animals appear most beautiful and shewy just before their copulation. The hart tosses up his prominent horns; the birds shine and glitter with gay colours; the fishes taste then most deliciously. But when the time of copulation is over, the hart loses his lofty or towering horns; the birds lose much of their beauty; and the fishes a great deal of their former flavour or fine taste. Now plants are subject to the same changes: for in the spring and flowering time their verdure and beauty is most amazingly gay; but, when that is over, they lose much of their former splendor. Thus copulation weakens and debilitates. In the silk-worm, moths, and butterflies, one may see, when their copulation is over, how their wings droop, and their life expires; but if a butterfly is shut up in a room alone, and not suffered to copulate with others,
others, it will often remain in health and vigour for half the year. In the annual and biennial plants one may observe, that before they have flowered, they resist the cold of winter, e.g. the pinks, lichnises, and others; but if they flower the first year, as soon as winter approaches they generally die; if, on the other hand, they do not flower, they will often continue in vigour three or four years. The plantain tree has often continued in the gardens of Holland for a hundred years; but when it has once flowered, no art, skill, or experience, can prevent its lofty stem from perishing the following year. The corypha, or umbrella palm tree, remains barren for thirty-five years, growing in that time to the height of seventy feet; and in the space of four months after that time, it rises thirty feet higher, puts forth its flowers, and produces its fruit the same year; which done, it totally dies, both root and stem. Hort. Cliff. 482. The lavatera arborea, or sea-tree mallow, will rise to the height of a common pear tree, bearing the winter frosts very well; but when it has once blown, though it were to produce but one flower only, not all the assistance of gardeners or green-houses, or any art, can prevent its perishing on the first approach of winter.
The stomach of plants is the earth, from which they receive their nourishment; and the finest and most subtle part of the soil is their chyle. The root, which carries the chyle from the stomach to the body of the plant, is analogous to the lacteals or chyliferous vessels of animals. The trunk, which supports and gives strength to the whole plant, is analogous to the bones. The leaves, by which plants transpire, are instead of lungs. The leaves may be also compared to the muscles of animals; for by their agitation with the wind the plant is put in motion. For this reason, herbs furnished with leaves cannot thrive, except they have air; but succulent plants, which have no leaves; *e.g.* some of the euphorbias, torch-thistles, melon-thistle, prickly pear, and the *fapelias*, though shut up in green-houses, and quite deprived of the external air, do thrive very well. If you shut up a tree or a shrub, which is full of leaves, in a close room in the summer-time, it will die; but if in the winter, when it has lost all its leaves, it will remain safe. Heat is to plants analogous to the heart in animals. Plants have no heart, nor indeed have they any occasion for such an organ, for they live in the same manner as *polypes* do in the animal kingdom:
kingdom: their juices mixed with air are propelled through their vessels, but not circulated back again by returning vessels. The blood-vessels of animals are divided into various branches, so also are the vessels of plants. Plants for the most part have their genital organs placed at their ramifications, in the same manner animals have theirs at the ramification of the iliac vessels, with this difference however, that the ramifications of plants ascend, whereas those of animals go downwards or backward; hence the antients called a plant an inverted animal.

SECT. CXLVIII.

From what has been said it follows, that a flower, which is furnished with antheræ, but wants the stigmata, is a male flower; that a flower which has stigmata, but no antheræ, is a female; and one that has both, is an hermaphrodite flower. Nor need we wonder, that in the vegetable kingdom many plants are hermaphrodite, though in the animal kingdom there are very few of this kind; for here one sex can easily go to the other; whereas plants are fixed to one spot, and cannot go from it. Justly therefore has the All-wise Creator furnished snails and other slow-paced animals with the genital organs of both sexes,
left (seeing they rarely meet) the species should be extinct or lost: during their copulation then, the one acts on the other, and each acts the part of male and female, while both impregnate and are impregnated by each other.

Sect. CXLIX.

We call a plant which has only male flowers, a male plant; that which has only female flowers, a female plant; and that which has only hermaphrodite flowers, an hermaphrodite plant. A fourth sort, having on one and the same stem both male and female flowers distinct, is called an androgynous plant. There is also a fifth sort, namely, when on one and the same plant there are not only hermaphrodite flowers, but also male or female flowers; and this is called a polygamous plant. When male flowers are added to the hermaphrodite, they serve to impregnate those which have not been impregnated by their own males, e. g. in the cross-wort, and white hellebore; or, if female flowers are added, they are impregnated by the farina of the hermaphrodite flowers, as in the pellitory and orrache. It is very remarkable, that the seeds of the hermaphrodite flowers in the orrache are altogether unlike to the seeds of the female flowers both in
in shape and size, yet they produce the same plant, as well as the seeds of compound flowers do, which grow in the disk and in the radius, or in the center and margin of the flower. To this place we may refer a third sort of polygamous plants, in which there are two sorts of hermaphrodite flowers on one individual, one sort wanting the stigmata, and the other the antheræ, as in the plantain tree.

SECT. CL.

When there are more petals in flowers than they ought to have, such are said to be luxuriant; and they are of three sorts, viz. Full, when all the stamina are wanting, and petals only grow in their room; Multiplied, when some of the stamina are wanting, and some remain; or Proliferous, when another flower with its proper flower-stalk grows out of the pistillum, or center of the flower. All luxuriant flowers are justly reckoned monsters, since the essential parts are changed into a different nature and figure; which notwithstanding is much admired by florists, who take great delight in full and multiplied flowers, or double flowers as they commonly call them. It is remarkable, that when monopetalous flowers are changed into luxuriant or full ones, only the corolla is increased, as in the gelder
THE ELEMENTS Part I.

gelder rose, African marygold, feverfew, &c. Yet this holds chiefly in compound flowers, and but seldom in any other. Hence we may see, that no full flowers are ever natural, but always propagated from single ones, for nature never produces any race of mere monsters. These full flowers are at first produced from a superabundance of nourishment. And since these full flowers are destitute of all the *flamina*, they are also deprived of the male organs of generation, which should impregnate the *stigma*; but no seeds will germinate (as we have observed before), unless they have been fertilized by the male dust; therefore such flowers must necessarily be barren, or produce no seeds. Of this sort are the pinks, the *hepatica*, *stock-julyflower*, Indian cress, pomegranate, rose, *ranunculus*, marsh mary-gold, *lychnis*, violet, wall-flower, piony, and *narcissus*, &c. All these, with full flowers, never produce seeds, but are propagated by suckers, off-sents, or slips, *i.e.* by dividing the roots. I am well aware, that the poppy, the fennel-flower, and some few among the compound flowers, do sometimes produce good seeds, because some of their *flamina* remain to impregnate the *pistillum*. The same way of reasoning may be applied to all proliferous flowers, *e.g.* the *ranunculus*, rose, *aven*; for they are all barren, because
because they want the *germen*, and female parts of generation, when the proliferation is from the center of the flower; but their offspring sometimes produce good seeds, providing they are not full flowers. From this dissertation the reader may perceive, how similar nature is to herself, and how exact in following her own laws in all her works. Who would ever believe so many truths were discoverable concerning plants? though, without doubt, there are many more that remain still undiscovered. I shall conclude with the words of Pliny; "That there is in plants a natural instinct to generation; and that the males, by a certain blast and subtle powder, do consummate the nuptials on the females."

*Nat. Hist.* b. xiii, ch. 4.
THE FOUNDATION OF BOTANY CONSISTS IN A REGULAR DISPOSITION AND DENOMINATION, OR NAMING OF THE PLANTS, BOTH GENERICAL AND SPECIFIC.

A REGULAR DISPOSITION, OR ORDERING OF VEGETABLES, MAY BE LAID DOWN EITHER IN THE FORM OF SYNOPSIS, OR SYSTEM; AND BOTH ARE COMMONLY CALLED BY THE NAME OF A METHOD: WHICH, I THINK, SHOULD FIRST LAY DOWN THE MORE PERFECT AND COMPLETE PLANTS, AND THEN PROCEED TO THOSE THAT ARE SMALL AND IMPERFECT.
Chap. VI. OF BOTANY.

SECT. CLIV.

A *synopsis* gives us such a division of the plants, as is, for the most part, merely arbitrary, and is therefore generally, now-a-days, rejected by most botanists. For a *synopsis* lays down a way to botany, but does not determine the limits, as may be seen in Ray; for he has two classes, one of herbs, and another of trees, which he calls anomalous, or irregular and uncertain, not reducible to any head or class, or division of his method.

SECT. CLV.

A system, or systematical method, consists of five members or branches, which are peculiarly appropriated to itself, to wit, Classes, Orders, Genera, Species, and Varieties. This systematical method was first invented by Tournefort, and is infinitely preferable to a *synopsis*.

SECT. CLVI.

A system is a clue to guide us to botany, which without any such guide is a mere chaos, or rude and indigested heap of confusion. As for example, let any unknown Indian plant be presented to a lover of botany, who understands no system, and he shall turn over all the descriptions, figures, cuts, plates, indexes, and catalogues in vain, nor
nor shall he at last find out the plant, unless it be by mere chance: but the systematical botanist can soon determine, whether it be a genus which is already known, or whether it be a new genus never before described by any.

sect. clvii.

Of species of plants we reckon so many as there were different and constant forms of plants created in the beginning by the Infinite and Eternal Mind: and those different forms, according to the laws of generation, have always produced others similar or like to the parent plants, from whence they respectively sprang. Neither have we any reason to think that there are any new species of vegetables since the creation.

sect. clviii.

Of varieties there are as many as there are plants, differing in certain circumstances of form and appearance, produced from the seed of the same species. The varieties of plants are accidental changes, generally owing to the climate, soil, exposure, heat, winds, bruises, age, diseases, too much or too little nourishment, culture, &c. and by a change of soil, &c. are generally reduced to their proper species.
The varieties of plants are chiefly in point of magnitude, plenitude, crispation, *i.e.* curled leaves and petals, colour, taste, smell. Varieties might be excluded from botany, but that for economical uses the *large* and *curled* varieties are most esteemed; and *full* or *double* flowers; as also the fine, beautiful-coloured, striped, and blotched varieties are in great esteem among gardeners and florists; and those varieties which are most remarkable for taste and smell are most valued by physicians; it becomes necessary therefore to enumerate the chief varieties under every species where there are any.

**Sect. CLIX.**

We say there are so many *genera* as there are similarly constructed fructifications of distinct natural species; that is to say, when two or more distinct species agree in all or most of the parts of fructification, they are said to be of the same *genus*; not but that there are in botany many *genera* which consist of no more than one species each, as we shall have occasion afterwards to observe under *sect. 203.*

**Sect. CLX.**

A class is an assemblage of several *genera* agreeing in the parts of fructification,
according to the principles of nature and art; or, in other words, a class is a collection of genera, to all of which one certain common character is so appropriated, as that thereby all the genera of this class may be distinguished from all those of the other classes. That there are natural classes (see above in sect. 77.), such as the umbelliferous plants, verticillate, siliquose, or podded plants, leguminous plants, or pulse, compound plants, grasses, &c. is evident enough. And the artificial classes are only to supply the places of the natural, till the whole of these last be discovered.

SECT. CLXI.

The orders are subdivisions of the classes, that too many genera might not occur at once to be distinguished, which might create trouble and difficulty; for ten or twelve genera are more easily distinguished than an hundred.

SECT. CLXII.

The species and genera are always the work of nature. The varieties are often owing to culture; but the classes and orders are partly natural, and partly artificial.
SECT. CLXIII.

The habit or outward appearance of plants is a certain conformity or agreement between vegetables that are nearly allied to each other, or of the same genus in respect to placentation, radication, ramification, intorsion, gemmation, foliation, stipulation, pubescence, glandulation, lacticlence, inflorescence, &c., which terms we shall presently explain, only first observing, that the natural method so much sought after by botanists, is in a great measure deduced from the habit; and that the fructification, which is the invention of the moderns, is not yet so thoroughly understood, as to discover all the classes of the natural method, though it may be considered as the primary guide thereto.

I. Placentation is the disposition of the cotyledons or lobes of the seed, at the time when it begins to germinate or sprout. In respect to placentation, plants are said to be, 1. Acotyledones, i.e. without cotyledons or lobes, when these are wholly wanting; as in mosses, ferns, flags, and fungusses. 2. Monocotyledones, having a single cotyledon (though these are properly acotyledons, since the cotyledons remain within the seed): these are perforate, as in the grasses; unilateral, on one side, as in the palms; or reduced, as in the onion. 3. Dicotyledones,
with two cotyledons; these are either unchanged, as in the leguminous plants, apples, stone-fruit, and the plants of the class didynamia; folded, as in gossypium, or cotton; doubled, as in malva, the mallow, and the plants of the class tetradyamnia; rolled-up, as in buck-wheat; spiral, as in the glass-wort, marsh samphire, basella, or Malabar nightshade, ceratocarpus, and all the oleraceous tribe, or pot-herbs; reduced, as in the umbelliferous plants.

II. Radication is the disposition of the root, in respect to the descending and ascending stock, and the radicles; see examples above in sect. 80. Roots may be farther distinguished into, 1. Bulbous, scaly, as in the lily; coated, as in the onion; double, as in the fritillary; solid, as in the tulip. 2. Tuberous, handed, as in orchis; in bundles, as in piony; pendulous, as in the dropwort, and wild olive. 3. Jointed, as in wood-sorrel, toothwort, lathraea, and marynia. 4. Spindle-shaped, as in the carrot, parsnep, radish, &c. 5. Globular, as in the earth-nut, bulbous-rooted crowfoot, and the chaerophyllum bulbosum, or bulbous wild chervil, Pl. VII.

III. Ramification regards the situation of the branches, which the leaves also observe. Some plants have no branches, though they have leaves on the stem; as in dittany, piony,
piony, barrenwort, May-apple. Opposite and alternate leaves on plants for the most part shew them to be widely different, if we except a few, of which some of the species have opposite leaves, and others alternate; as in the spurges, cistus, lantana, or pliant-mealy tree, antirrhinum, or snapdragon, lily, and the willow-herb. The lower leaves at the branches are opposite, and the upper leaves at the flowers alternate, in the jasmine, veronica, borrago, and calves-snout. The lower leaves are alternate, the upper leaves on the branches opposite, in the pondweeds, and the potentilla supina, or lesser mountain cinquefoil. The lower leaves are opposite, and the upper set on by threes, in the nerium oleander, or rosebay. The lower leaves are set on by threes, and the upper are alternate, in ruscus, or the butcher's-broom. The lower leaves are set on by fours, and the upper are alternate, in coreopsis alternifolia, or Virginia corn marygold with a winged leaf, and antirrhinum chalepense, or the snap-dragon of Aleppo. The natural situation of the leaves on plants differently branched, is best learnt from the radical leaves.

IV. Intorsion is the bending or turning of any part of a plant towards either side. Caules volubiles, winding or twining stems, either
either to the left thus (, as in black briony, yams, hops, honeysuckle, buckwheat; or to the right thus ), as in kidney-bean, spurge, convolvuluses, hatchet-vetch, &c. Cirrhido volubiles, twining claspers or tendrils, wind to the right, and back again. Most leguminous plants have claspers of this sort. The rough bindweed, and most species of pepper, have claspers on the foot-stalks of the leaves. The corolla bends to the left (i.e. the curvature looks to the right, if you suppose yourself in the center, and looking towards the south), in periwinkle, oleander, asclepias, periploca, and stapelia; to the right, in pedicularis palustria, or marsh lousewort, &c. Tribentalis, or winter-green, is singular in having all the petals imbricate, one side of each lying over the other to the right. The gentian is imbricate, contrary to the sun, before the petals open. Some pistilla bend to the left, as in cucubalus, and silene, or campions. Some germina, or seed buds, are twisted to the left, as in the screw tree, and meadow-sweet. Of flowers some have a resupination, that is, the upper lip of the corolla looking towards the earth, and the under lip towards the sky, as in some of the violets, some species of the satyrium, and the basil, &c.: others have an obliquity, as in that species of hyslop
Chap. VI. OF BOTANY.

Hyssop called *lophanthus*, the Siberian cat-mint, and some species of the lousewort. Of spikes, some are *spiral*, as in *claytonia*, and many of the rough-leafed plants; or *crooked*, as in *saururus*, lizard's-tail, the sensitive plant, poppy, red *sedum*, and martagon lily. In various plants there is found a twisting of the fibres, which serves as an hygrometer for measuring the degree of moisture of the air; *e.g.* in the oats, there is an awn, or beard, twisted like a rope; in the geraniums, the *arillus* of the seed has a spiral tail; and in the *bryum hygrometricum*, the *peduncles*, or flower-stalks, are twisted contrary ways above and below.

V. Gemmation is the construction of the bud, which consists of leaves, *fīpulæ*, foot-stalks, and scales.

*Buds* of foot-stalks are either,

1. *Opposite*, as in *ligustrum*, *phillyrea*, *nystanthes*, *fyringa*, *hypericum*, *coriaria*, *buxus*, *jasminum*, *vaccinium*, *arbutus*, *andromeda*, *ledum*, *daphne*, *laurus*, *myrica*, *linnaea*, *diervillia*, *licicera*, *euonymus*, *fraxinus*, *acer*, *esculus*, *bignonia*, *opulus*, *sambucus*, and *psi-dium*: or,

2. *Alternate*, as in *sali*, *spiræa*, *genista*, *solanum*, *hippophoe*, *berberis*, *ilex*, *ribes*, *juglans*, *pisilacia*, and *plumbago*.

*Buds* of *fīpulæ* are either,

3. *Opposite*, as in *cephalanthus*, and *rhamnus catharticus*, or,

4. *Alternate*,
4. Alternate, as in *populus, tilea, ulmus, quercus, fagus, carpinus, corylus, betula, alnus, ficus,* and *morus.*

Buds, partly of *stipulae,* and partly footstalks, are,

5. Alternate, as in *sorbus, crategus, prunus, mespilus, pyrus, malus, cotoneaster, amyg-dalus, cerasus, padus, melianthus, rosa, rubus, vitis, robinia, cytisus, potentilla fruticosa,* and *staphylea.*

Buds are,

6. Irregular, in *abies, pinus,* and *taxus.*

Buds are wholly,

7. Wanting in several plants, as has been shewn above in sect. 85.

VI. Foliation is that complication or folding which the leaves have whilst they lie concealed within the buds and first shoots of plants. This part of the habit of plants, which has been altogether overlooked by former botanists, contains the following distinctions. The leaves are either said to be,

1. *Involuta,* rolled in; when their lateral margins are rolled inward in a spiral form on both sides; as in the honeysuckle called *diervilla,* spindle tree, buckthorn, apple tree, poplar, violet, plantain, starheaded water plantain, *potamogeton natans,* water lily, lizard’s-tail, annual starwort, hops, nettle, *hepatica,* dwarf elder, and bladder-nut. See tab. XI. fig. 2.

2. *Revoluta,*
2. *Revoluta*, rolled back; when their lateral margins are rolled backwards in a spiral form on both sides; as in rosemary, oleander, marsh rosemary, some of the docks, pellitory, primrose, colts-foot, shrubby cinquefoil, &c. See tab. XI. fig. 3.

3. *Obvoluta*, when their alternate margins embrace the straight margin of the opposite leaf; as in pinks, *lychnis*, fopewort, teazel, scabious, valerian, horehound, sage, &c. See tab. XI. fig. 7.

4. *Convoluta*, rolled together; when the margin of one side surrounds the other margin of the same leaf like a hood; as in arum, pepper, frogs-bit, plumb, apricot, lettuce, hawk-weed, goats-beard, bitter-vetch, tare, pea-se-everlasting, starwort, butterwort, whortle-berry, barberry, cabbage, horse-radish, comfrey, hounds-tongue, eringo, marsh trefoil, faxifrage, dittany, barrenwort, and many of the grasses. See tab. XI. fig. 1.

5. *Imbricata*, imbricate; when they lie over each other in parallel lines, and with a straight surface; as in *fyringa*, privet, *phil-lyraea*, St. John’s-wort, fopswort, pur-flane, bay tree, spurge-laurel, sea-buckthorn, butcher’s-broom, perennial blue-bottles, *campanula*, Greek valerian, &c. See tab. XI. fig. 6.

R

6. *Equi-
6. *Equitantia*, riding; when the sides of the leaves are parallel, and approach each other in such a manner, that the inner leaves are included within the outer (which is not so in the conduplicate, or following mode of foliation); as in the day-lily, *iris*, *calamus aromaticus*, *carex*, *poa*, and some other grasses. See tab. XI. fig. 5.

7. *Conduplicata*, doubled together; when the sides of the leaf are parallel, and approach each other; as in the oak, beach, hazle, hornbeam, lime, cherry, almond, black alder, walnut, ash, forb, rose-bush, bramble, silver-weed, pease, parsnip, and most of the leguminous plants. See tab. XI. fig. 4.

8. *Plicata*, plaited; when their complications are in plaits lengthways, like the leaves of lady's-mantle, &c.; as in birch, alder, beach, vine, maple, water elder, currant, marsh mallow, common mallow, hops, nettle, passion-flower, and lady's-mantle. See tab. XI. fig. 8.

9. *Reclinata*, reclined; when the leaves are turned backwards and downwards to the foot-stalk; as in May-apple, leopard's-bane, *anemone*, pasque-flower, *hepatica*, and tuberous moistchatel.

10. *Circinalia*, lying in wreaths or ringlets; when the leaves are rolled in spirally downwards; as in the ferns, and some of the palm trees.
VII. Stipulation is the situation and structure of the stipulae at the base of the leaves. For the stipulae, as well as the leaves, are of different forms and structure in different plants. 1. In some plants there are no stipulae, as in the rough-leaved plants, borage, &c.; plants of the didynamia class, starry plants, madder, &c.; podded plants, as horseradish, &c.; those of the lily kind, orchises, and many of the syngenesia class. Others have stipulae, as the papilionaceous plants, those of the icosandria, and also the cajsa, sensitive plant, log-wood, and several others. 2. Most plants have two stipulae, one on each side of the footstalk. Some have only a single one, as the melianthus, or honey-flower, on the inside; butcher's-broom on the outside. 3. In some the stipulae are deciduous; as in the cherry, almond, poplar, lime, elm, ash, oak, beach, hornbeam, hazle, birch, alder, fig, and mulberry, &c. In others abiding, as in the plants of the diadelphia class, and those of the polyandria polygynia. 4. In some they grow close to the plant; as in the rose, bramble, cinquefoil, honey-flower, &c. But in most plants they are loose. 5. In some they are situated on the inside of the leaf; as in the fig and mulberry. In others on the outside of the leaf; as in alder, birch, lime, and the plants of the diadelphia class.
VIII. Pubescence is that armour of plants by which they are defended from external injuries. This is of several sorts.

1. Roughness, which is composed of particles scarce visible to the naked eye, that are scattered over the surface of the plant. 1. This roughness is glandular, consisting of little glands, which are either like millet-seed; like little bladders; as in fig marygold; like lentils; globular, as in orach; serving for secretion; like little chains; or like little bottles. 2. This roughness consists of small bristles, which are either cylindrical, conical, hooked, bearing glands, forked, hatchet-shaped, as in hops; aggregate and starry, as in madwort, and screw tree; or aggregate and simple, as in sea-buckthorn. 3. This roughness consists of joints, which are either simple, knotty, tailed, branching, as in mullein, or feathery.

2. Wool, which is a preservative for many plants against the bad effects of too much heat; as in the Canary ironwort, Canary sage, the sage called Æthiopis, the horehound, base horehound, mullein, woolly-headed thistle, and the onopordon, another species of thistle.

3. Down, which has commonly a hoary appearance, serves to defend plants against winds; as in the woolly Malabar tree, tomex, snail-trefoil, sea purflane.

4. Strigaæ
4. Strigae (to express the meaning of which the English language has no word) are hard, rigid, and sharp-pointed prickles, disposed in rows, and serve as a defence against the injuries of small animals; as in the torch-thistle, prickly pear, Syrian mallow, Bramble, Barbadoes cherry, &c.

5. Hooks: these stick to animals as they pass by; and are either three-pointed, as in lappula; or crooked and bent inwards, as in burdock, horehound, lesser burdock, Guinea henweed.

6. Stings, keep off naked animals by their venomous points; as in the nettle, cassava, acalypha, tragia.

7. Prickles, serve to keep off particular animals; as in brasiletto, caper-bush, cleome, or bastard mustard, aralia, the berry-bearing angelica, sensitive plants, volkameria, pisonia or fingrigo, parkinsonia, coral tree, false acacia, jolanum, rough bindweed, convolvulus, duranta, cotton bush, drypis, some spurges, goats-thorn, goats-beard, and hugonia; in which last the prickles are spiral.

8. Forks, consist of two or three prongs, and serve as a defence against various animals; as in barberry, gooseberry bush, triple-thorned acacia, fig marygold, hard-seeded chrysanthemum, black horehound, barleria, fagonia, and prickly burnet.

9. Thorns,
9. Thorns, or spines, serve to keep off cattle. These are either upon the branches, as in the buckthorn, pear, plum, hloe, and orange trees, sea-buckthorn, *gmelina*, common buckthorn, boxthorn, lilythorn, flaff-tree, furze, base horehound, rest-harrow, &c.; or on the leaves, as in aloe, *agave*, false *acacia*, holly, manchineel, carline thistle, artichoke, bears-breech, juniper, saltwort, milkwort, butcher's-broom, and some of the *solanums*; or on the calyx, as in the thistle, mad-apple, &c.; or on the fruit, as in *caltrops*, *spinach*, agrimony, and thorn-apple.

IX. Glandulation comprehends the secretory vessels of plants, which are either,

1. *Glandulae*, glands properly so called; some on the foot-stalks of the leaves, as in passion-flower; some on the serratures of the leaves, as in willow; some on the base of the leaf, as in the almond, gourd, quick-in-hand, bird-cherry, marsh elder; some on the back of the leaf, as in the tamarisk; some on the surface of the leaf, as in sundew, butterwort; some on the *f stipulae*, as in the apricot; some like hairs, as in the currant-bush; and others like small pores, as in the tamarisk.

2. *Folliculi*, or little bags, are vessels filled with air; as in *urticularia*, or water milfoil, and *aldrovanda*.

3. *Utriculi*,
3. *Utriculi*, or little bottles, are vessels filled with a secreted fluid; as in *nepenthes*, *marcgravia*, and side-saddle flower.

X. Laêtescence, or milkynefs of plants, is when a quantity of juice flows out on any injury being done to them. The colour of this liquor is either white, as in the spurges, poppy, dogs-bane, swallow-wort, cardinal flower, sheeps scabious, *campanula*, maple, *sumach*, milk-parsley, one species of melon-thistle, sow-thistle, dandelion, hawk-weed, goats-beard, nipple-wort, and several others, the compound semiflofcular flowers of Tournefort; or the colour is yellow, as in *celandine*, *bocconia*, *puccoon*, and gamboge; or red, as in *rumex sanguinea*, or bloodwort.

XI. Inflorescence is the manner in which flowers are connected by their foot-stalks to the plant; this by former botanists was called a mode of flowering. See tab. VIII. and X. In this respect plants are either,

1. Verticillate, producing their flowers in rings or whorls round the stem; as in horehound, &c.; or,

2. Corymbiferous, bearing their flowers in a corymbus; as in mustard, horse-radish, turnips, and all the plants of the tetrady-namia class.

3. Spicate, producing their flowers in spikes; as in *arum*, American nightshade, pepper, and many of the grasses.

R 4  

4. Pani-
4. Paniculate, having the flowers in panicles; as in many of the grasses.

5. Axillary, when the flowers come out from the bosom of the leaves or branches, as do most flowers; therefore the following modes of flowering are rare. 

1. When the flowers come out directly opposite to the leaf, as in pepper, lizard’s-tail, pork-phytic, bittersweet, vine, geranium, water crowfoot, the annual cistuses, Jew’s-mallow, and cissus. 

2. When the flowers come out alternately between the opposite leaves, as in asclepias, or swallow-wort. 

3. When the flowers come out at the side of the base of the leaf, as in nightshade, claytonia, and all the rough-leaved plants, as goose-grass, madder, &c. 

4. When the flower-stalk is inserted into the foot-stalk of the leaf, as in Syrian mallow, and turnera. 

5. When the flowers bear tendrils, as in heart-pea, and vine. 

6. When the flowers come out above the wings of the leaves, as in the rough-leaved plants, and Montpelier cinquefoil. 

And here we might mention some other particulars belonging to this subject; e. g. the time of germinating, or how long time seeds take from sowing to springing out of the ground, which in some is very short, as in plants of the tetradynamia; in others a year, as in hypecoum, horned poppy, corn cow-wheat, and
and ranunculus falcatus; and in others two years, as in the medlar, rose, cornel, and white thorn; also the time of opening their buds, and time of flowering, which in some is annual, in others oftener; and lastly, the time they take to come to perfection, which is very different in different plants.

SECT. CLXIV.

The primary disposition or arrangement of vegetables, ought to be derived from the parts of fructification only. Former botanists urged the insufficiency of the parts of fructification in serving as a foundation for the classes and genera, when, perhaps, they were not all so accurately known as at present. However, they are now, as described by Linnaeus, abundantly sufficient and numerous. See above in sect. 86. chap. IV. All genera, therefore, established on the habit and other circumstances of plants, and not on the fructification alone, are to be rejected. Thus the limodorum of Tournefort, or purple bird's-nest, with a fibrous root, is by Linnaeus made a species of orchis. Biforta of Tournefort, with a fleshy root, is a polygonum. Rapa of Tournefort, with a gibbose root, is a brassica. Sifarum, or skirrets, of Tournefort, with a tuberous root, is a fium. Hermodactylus
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modaëtylus of Tournefort, with a tuberous root, is an iris. Anacampferos, orpine, of Tournefort, with an upright stem, is a sedum. Psyllium, or fleawort, of Tournefort, with a branched stalk, is a plantago. Suber, or cork tree, of Tournefort, with a fungous bark, is a quercus. Larix of Tournefort, with the leaves in bundles or packets, is a pinus. Genistella of Tournefort, or dwarf-broom, with jointed leaves, is a genista. Dracunculus, or dragons, of Tournefort, with pedate leaves, is an arum. Trichomanes, English black maiden-hair, of Tournefort, with pinnated leaves, is an asplenium. Faba, the bean, of Tournefort, with leaves without claspers, is a vicia. Cerasus, the cherry, of Tournefort (facie propria), is a prunus. Absynthium, wormwood, of Tournefort (facie externa), is an artemisia. Moly, of Boerhaave, with a sweet smell, is an allium. Colocynthis of Tournefort, with a bitter fruit, is a cicumis. There are a great many more examples adduced, but these are sufficient to illustrate our meaning.

Sect. CLXV.

Vegetables, which agree in the parts of fructification, are not to be arranged in different classes, orders, or genera. Gesner was the first who suggested this aphorism;
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Caesalpinus the first who reduced it into practice; Morison revived, and Tournefort improved, this grand discovery in the science of botany.

SECT. CLXVI.

Vegetables, which differ or disagree in the parts of fructification, are not to be arranged in the same classes, orders, or genera. The truth of this rule is evident, it being the reverse of the former.

SECT. CLXVII.

The characteristic or distinguishing mark of each genus is to be fixed from the number, figure, proportion, and situation or connection, of all the parts of fructification. There are seven species of calyx, viz. perianthium, involucrum, amentum, spatha, gluma, calyptra, volva. Parts of the corolla two, viz. petalum, and nectararium. Of the stamina three, viz. filamentum, anthera, and pollen. Of the pistillum three, viz. germen, stylus, and stigma. Of the pericarpium eight species, viz. capsula, siliqua, legumen, conceptaculum, drupa, pomum, bacca, arrobiulus. Of the seed three species, viz. semen, nux, propago. Of the receptacle five, viz. receptaculum proprium, receptaculum commune, umbella, cyma, spadix: in all 38. By the help of these, like so many letters or characters,
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racters, we are enabled to read the genera. And each of these parts is to be considered in respect to number, figure, situation, and proportion; by which means the characters are increased to four times the number, or 152, which being multiplied by 38, the number of parts, produces 5776; and therefore the fructification is sufficient, at least, for so many genera; and we are sure that such a great number of genera never existed. From this it plainly appears, that there is no occasion to have recourse to the habit, the colour, magnitude, or any other circumstance in plants, but the fructification alone, in order to constitute, ascertain, and determine, the genera.

SECT. CLXVIII.

In establishing the genera we ought to have a particular regard to the habit, lest an erroneous genus should now and then be constituted on too slight an examination. An experienced botanist can often readily determine, from the habit of plants, the tribe or family to which they belong; by this means the habit becomes a check against constituting wrong genera. Thus nigella, helleborus, caltha, are known to be different genera at first sight by their different habit, which is farther confirmed by
Chap. VI. OF BOTANY. an accurate examination of their fructification. Again, *sambucus* and *ebulus*, agreeing in habit, are to be joined under one genus, as their fructifications also agree. The same may be said of *trifolium* and *triphyllum*. The first is tetrapetalous, and the other monopetalous; yet they agree in habit, and are both found to be of the same genus, notwithstanding this slight difference. Though we are closely to consult the habit, yet no mark taken from thence is ever to be expressed among the distinguishing characters of the genera. Characters taken from the habit, though not sufficient in themselves to distinguish all the genera, yet often serve to discover a plant at first sight. Such characters may be made in the following manner: in the *caryophillei*, pink or carnation-like plants, such as *dianthus*, *cucubalus*, *agrostemma*, *lychnis*, *saponaria*, *silene*, *arenaria*, *alsine*, *cerastium*, *holosteum*, *fagina*, *spergula*, *stellaria*, &c.; the cotyledons or lobes are two, the roots are fibrous, the branches opposite, jointed, and erect; the bending of the pistilla is to the leftward; the leaves in their buds, or first shoots, are obvolute or rolled against each other, lance-shaped, and undivided; they have no stipules; scarce any armour offensive or defensive; and, lastly, their mode of flowering is dichotomous or forked.
forked. And thus may the characters be made out in the other tribes of Linnaeus's fragments of a natural method in sect. 77. ch. II.

SECT. CLXIX.

Those parts of the fructification which serve to establish one genus, do not necessarily answer the same purpose in another genus; or, in other words, those parts of the fructification which are constant in one genus, are found to be inconstant in another: thus, in carica, the flowers of the male plant are monopetalous, and those of the female pentapetalous; in myrica, some species have naked seeds, others berries; in fraxinus, some have a naked flower, others a corolla; in geranium, some have regular corollae, others irregular; in linum, some are tetrapetalous, others pentapetalous; in aconitum, some are tricapsular, others quinquecapsular; in trifolium, some are monopetalous, others polypetalous; some monospermous, others polyspermous. Some have urged, that a monopetalous and polyspermous, a monospermous and a polyspermous plant, can never belong to the same genus; and therefore, contrary to nature, they have formed many spurious genera.
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SECT. CLXX.

We rarely find a genus in which all the parts of fructification are constant throughout the species. To this inconstancy is owing, the great number of factitious or spurious genera in Tournefort and others; for, although such variations afford excellent specific distinctions, they are not sufficient to constitute real genera. All genera therefore grounded on the variation of some parts of the fructification, are to be rejected. Thus cardaliaca of Tournefort, motherwort, with a five-toothed calyx, is by Linnaeus made a species of leonurus. Linaria of Tournefort, toadflax, with a tailed corolla, is an antirrhinum. Glaucium of Tournefort, yellow horned poppy, with a rosaceous corolla, is a chelidonium. Polygonatum of Tournefort, Solomon's seal, with a tubular corolla, is a convallaria. Centaurium minus of Tournefort, with a tunnel-shaped corolla, is a gentiana. Auricula urfi, with a faucer-like corolla, is a primula. Oxycoccus, with a tetrapetalous corolla, is a vaccinium. Porrum, leek with trifid flamina, is an allium. Radiola, all feed with a quadrifid flower, is a linum. There are many more examples, but these are sufficient to illustrate the proposition. For if genera were to be multiplied in this manner, without any necessity, we should soon
soon have as many genera as species, and the science of botany, as far as it respects arrangement, be at an end.

SECT. CLXXI.

In many genera some striking or singular mark of fructification is observed, which we call the essential character. Thus the essence of brunella, torenia, euphrasia, alysium, and crambe, consists in the teeth of the stamens; that of curcuma, chelone, big-nonia, martynia, in a mutilate stamen; that of ranunculus in its nectarium, which is a small prominence in the claw of each petal; that of hydrophyllum in its closed chinks within the divisions of the petal; that of helleborus, and nigella, in their hollow nectaria; that of hyoscyamus, in the covering of its seed vessel, by which it is distinguished from winter-cherry; that of pan-cratium, sea-daffodil, in the insertion of its stamens into the upper part of the nectarium, by which it is distinguished from narcissus, where the stamens are placed within the nectarium, and fastened to its tube; that of reseda, in its lateral nectarium; that of campanula, in its five-valved nectarium; and that of iris, in its singular stigma, which resembles three petals or flower-leaves.
When any singular mark of fructification, peculiar to any genus, is not found in all the species of that genus, we should take care not to confound those several genera, but keep them separate; or, in other words, the striking or singular characteristic mark of every genus must run through all the species. For want of attending to this rule, we are apt to confound genera that should be distinguished. Thus aloe and agave were formerly incorporated into one genus, as were likewise ranunculus and adonis, andromeda and erica. Aloe is now separated from agave, American aloe, because its flamina are inserted, not into the petals, but into the common receptacle; adonis is separated from ranunculus, because it wants the prominence in the claws of the petal, which is the distinguishing mark of ranunculus; andromeda from erica, because of the two horns of the antheræ, which are more conspicuous in the erica than the andromeda.

When the striking characteristic mark of any genus is found in another genus near akin to it, we should be careful not to separate one and the same genus into more than it naturally should be, nor to accumulate a whole natural tribe under one genus. Thus,
Thus, in \textit{sedum}, \textit{semperivium}, \textit{rhodiola}, \textit{craffula}, \textit{tillea}, \textit{cotyledon}, the \textit{nectaria} adhere to the base of the \textit{pistillum}. Yet all these distinct \textit{genera} are not, on this account, to be combined under one \textit{genus}. So also in \textit{epilobium} and \textit{oenothera} the \textit{calyx} is tubulose, yet they are distinct \textit{genera}. In \textit{mespilus}, \textit{cratægus}, and \textit{sorbus}, the structure of the flower is alike, but they are not therefore to be united into one \textit{genus}.

\textbf{SECT. CLXXIV.}

The more constant any part of fructification is throughout a great number of species, the more certainly it is to be depended on, as a characteristic mark in distinguishing the \textit{genera}. The \textit{nectarium} of the \textit{genus hypecoum} is constant, but not the jointed pod. The spotted berry of the \textit{convallaria}, is found in all the species; the \textit{corolla} in lily of the valley, Solomon's seal, and one blade, which are three species of \textit{convallaria}, is very different. The \textit{corolla} of wild \textit{jena} is constant, but not the pod. In the \textit{genus lobelia}, which includes several \textit{genera} of other authors, the \textit{corolla} is constant. The seed vessel in cardinal-flower, \textit{rapuntium} of Tournefort, \textit{laurentia} of Michelius, and \textit{lobelia} of Plumier, which are all species of the Linnaean \textit{genus}, are all different. That of the \textit{lobelia} of Plumier,
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is pulpy; and of the cherry kind, containing a nut, or stone with two cells; whereas in the other species it is a dry membranaceous capsule. In vervain, the calyx and corolla are constant throughout the species; the stamina and seeds are different.

SECT. CLXXV.

In some genera, one part of the fructification, and in other genera, another part of the fructification, is observed to be more constant than the rest; but every one of them is subject to variation sometimes. Thus we find the pericarpium to vary in the congeners of impatiens, campanula, primula, papaver, cistus, fumaria, and arbutus; the calyx in those of nymphæa, and cornus; the corolla in those of vaccinium, convallaria, andromeda, gentiana, and linum; and the seeds in those of ranunculus and alisma.

SECT. CLXXVI.

If the flowers agree, though the fruits differ, such genera ought to be joined. Thus, in caffia, bedysfarum, sophora, lavatera, hibiscus, and mimosæ; the flowers are similar, but the fruit different in the same genus.

SECT. CLXXVII.

The figure of the flower is more constant than that of the fruit; the proportion
tion of the parts is very different, but it is always most constant. That the flower is more certain than the fruit, appears by many examples; as from *campanula*, *primula*, *antirrhinum*, *alisma*, *hibiscus*, *cistus*, *fumaria*, *arbutus*, *clematis*, *papaver*, *ranunculus*, *hesperis*, *datura*.

**SECT. CLXXVIII.**

The number of the parts is more subject to vary than the figure, yet it is best explained by the proportion of number; but flowers varying in number upon the same plant, are to be determined by the primary flower. Thus, in *ruta*, *chrysophleum*, *monotropa*, *tetragonia*, *euonymus*, *philadelphus*, *adoxa*, the number of the parts varies from five to four; the natural number therefore must be determined by the primary flower. But in the variations of the number of parts, there is a proportional affinity; thus in flowers, the *flamina* vary from ten to eight, and from five to four; the *corolla* and *calyx* from five to four, and the whole flower from four to three; and the fruit from five to three, and from five to four.

**SECT. CLXXXIX.**

The situation of the parts is most invariable, scarce ever differing in plants of the same
Chap. VI. OF BOTANY.

fame genus. For which reason Tournefort, in the orders of his classes, reckoned the situation of the receptacle of great moment.

Sect. CLXXX.

Rivinus and his followers have laid too great a stress on the regularity of the petals. For we see in the umbelliferous plants, some have regular corollaæ, others irregular, in the same genus; and in the European geraniums the corolla is regular, but in the African geraniums irregular, &c.

Sect. CLXXXI.

Nature has made the nectarium of the greatest consequence. The nectarium had not so much as a name before Linnaeus described it; but that it is of very great consequence in determining the genera, is evident from the following genera, in which it is the distinguishing mark, viz. orchis, satyrium, monotropa, fumaria, viola, malpigbia, bannisteria, adenanthera, commelina, laurus, helxine, dictamnus, zygophyllum, swertia, liliun, fritillaria, hydrophyllum, ranunculus, hermannia, berberis, fiaphylea, passiflora, narcissus, pancratium, mirabilis, nerium, fiapelila, asclepias, diosma, campanula, plumago, byacintbus, rhododendrum, cheiranthus, sinapis, kiggleria, clutia, aquilegia, nigella, aconitum.
aconitum, parnassia, epimedium, theobroma, refeda, grevia, helleborus, isopyrum, tropæolum, impatiens.

SECT. CLXXXII.

The stamina and calyx, being less liable to luxuriance, are far more certain than the petals; for there are many plants that vary in the figure of the corolla or petals in the same genus; as in vaccinium, pyrola, andromeda, nicotiana, menyanthes, primula, veronica, gentiana, hyacinthus, scabiosa, narcissus. Some vary in the number of petals; some species, for example, of the ranunculus being pentapetalous, and others polypetalous; as also in helleborus, there are some pentapetalous, and others polypetalous; and in statice, there are pentapetalous and monopetalous species; and in fumaria, dipetalous and tetrapetalous. And sometimes the number of petals is found to vary in the same species, as in carica, jatropha.

SECT. CLXXXIII.

The structure of the pericarpium, so much insisted on by former botanists, appears by innumerable examples to be of less consequence than they believed it to be. All genera therefore established on distinctions of the pericarpium, fruit, or seeds only, are
are to be rejected as fictitious; thus, the 
lycoper
ticon of Tournefort, having a fruit
with many cells, is made a solanum by Lin-
næus; asarina of Tournefort, having a
fruit with many valves, is an antirrhinum;
rhamanistrum of Tournefort, with a jointed
fruit, is a raphanus; onobrychis of Tourne-
fort, with a fruit having one seed, is an
bedysarum; anemonoides of Tournefort, with
naked seeds, is an anemone; perlsiaria of
Tournefort, with triangular seeds, is a po-
lygonum: there are sixty or seventy exam-
ple s brought in here by Linnaeus of the
same kind, but these few are sufficient to
illustrate the meaning of this aphorism.

SECT. CLXXXIV.

Luxuriant flowers, eunuchs and mutilate
flowers, being all monstrous productions of
nature, are allowed no place in constitu-
ting the genera. In full flowers no num-er of petals can be assigned, and the fia-
mina in most generic characters of this sort
would be totally excluded. Mutilate
flowers have no corolla, and for this reason
in some species of campanula, ipomæa, and
ruellia, the corolla would be wholly ex-
cluded from the description, contrary to
the nature of the other species.
In multiplied and full flowers, the genus may be discovered by the calyx, and the lowest series of petals; and in proliferous flowers, by the offspring. The calyx in full flowers is never altered, and therefore from it we may often discover the genus; as in hepatica, ranunculus, and alcea. And in polypetalous flowers, the lowest series of petals remaining always the same in number, even in full flowers, we may from thence often discover the genus; as in papaver, nigella, and rosa.

Characters (marks or signs) are the definitions or descriptions of the genera; these characters are of three sorts; the fictitious, the essential, and the natural. For the habitual character, or that taken from the habit or outward appearance of plants, so much made use of by former botanists before the discovery of the fructification, is now grown obsolete and out of use in determining the genera.

The essential character furnishes the genus to which it is applied, with a single mark so particular and striking, as to distinguish the genus in which it is found, from
from every other genus at first sight. It serves to distinguish such genera as arrange themselves under the same natural order. Its excellence consists in its brevity. The knowledge of those genera in which it is found, is most easily and quickly acquired; though perhaps not a tenth part of all the known genera can be thus characterized. Out of many examples that might be produced, we shall only mention the following genera, viz. salvia, iris, plantago, parnassia, narcissus, dianthus, ranunculus, acanthus, hibiscus, passiflora. Thus the essential mark of salvia, is its transverse filament; of iris, consists in its petal-shaped stigmata; that of plantago, in its capsule, which splits horizontally; that of parnassia, in its singular nectaria ciliated and globular; that of narcissus, in its tunnel-shaped nectarium, with the petals fastened to its inside; that of dianthus, in having four scales at the base of the calyx; that of ranunculus, in its nectarium, which is a small prominence at the claw of each petal; that of acanthus, in its calyx of three pair of leaves; that of hibiscus, in its outer calyx, which consists of many leaves; that of passiflora, in its crown-like nectarium.

SECT. CLXXXVIII.

The factitious, accidental, or artificial character,
character, can only distinguish the genus in the same artificial order, by a greater or less number of characteristic marks, but can never distinguish the genus in a natural order. Such therefore, whether essential or natural, as cannot sufficiently distinguish the genus in a natural order, are fictitious or artificial characters; as those of Tournefort, Ray, Rivinus, &c. It is well defined by Ray, when he says, "that no more characteristic marks of the genus are to be collected, than are found absolutely necessary in determining the genus with certainty and precision. The characters of the classes and orders only, in the sexual system, are artificial, as was before observed at sect. 162.

SECT. CLXXXIX.

The natural character collects all the possible marks of the genera, and therefore includes both the essential and fictitious. Linnaeus first introduced those characters in his Genera Plantarum. As the natural character includes all the possible marks of the genera, it serves equally well for every system; lays a foundation for other new systems; and remains unchanged, whatever number of new genera may hereafter be discovered; and can only be amended, upon the discovery of new species, by excluding the superfluous marks.

SECT.
The factitious character is only succedaneous, or serves to supply the place of others; the essential is the most excellent, but scarce possible to be had in all the genera. The natural character is, with the utmost difficulty, made out; but, being once made out, is the base of all systems, preserves the genera entire and unchanged, and is applicable to every true system, that has been, or shall be, invented. The factitious characters are such as those of Ray, Tournefort, Rivinus, &c. The essential characters being such as can distinguish genera, which have the greatest affinity to one another in a natural order, serve equally to distinguish such genera when separate from one another. The natural character lays down all the possible characteristic marks, is useful in every method that is, or can be, invented; and affords a foundation to the old and new systems, that are built upon the fructification.

Every true botanist therefore should be acquainted with the natural character. If the essential characters of all the genera were discovered, the knowledge of plants would become easy, and many of the natural characters would be of no value or importance;
importance; but we are to understand that no man can ever be a good botanist without the knowledge of the natural character; for whenever new genera were discovered without the natural character, a botanist would always be at a loss. He who thinks himself an expert botanist from the essential character only, and neglects the natural character, both deceives, and is deceived; since the essential character, upon the discovery of new genera, must often be fallacious. The natural character is the foundation of the genera, and without it no one can judge rightly of any genus; and therefore I conclude, that it is, and always will be, the absolute foundation of the knowledge of plants.

SECT. CXCII.

The natural character lays down all such differing and singular marks of fructification as run alike through all the species, omitting the other marks as superfluous. It is a work of infinite labour to limit the characters through all the species. All the parts of fructification are to be examined, even the most minute; since, without the knowledge of the fructification, there is no certainty of the genus.
No character is compleat and infallible, until it has been applied to all the species. The most finished botanist, and he only, is proper to make out the most compleat natural character, such as is applicable to the greatest number of species, every one of which will necessarily exclude some superfluous mark or other. The natural character is made out by the most accurate description of the fructification of the first species; then all the other species of that genus should be compared with the description of the first, and all marks in which they disagree should be excluded, by which means the character will become at last complete.

The mode of flowering does not afford a proper characteristic mark. That part of the plant on which the fructification is situated, is not a characteristic mark, though Ray, Rivinus, Heucher, Knaut, Kramer, &c. were of a different opinion; but, being hurtful to the science, it has been rejected by the greatest botanists, as Tournefort, Vaillant, and others. The several modes of flowering, as the verticillate, corymbose, spicate, paniculate, &c. we have mentioned above, see sect. 163. Ray, Rivinus,
vina, Boerhaave, have given the mode of flowering a place in their characters of the genera, that they might follow nature more closely, and have thereby lost sight of nature the sooner.

**SECT. CXCV.**

The character should have the name of the genus at top, whose description it is to contain.

**SECT. CXCVI.**

Every one of the seven principal parts or species of fructification should, in a natural character, begin a new line, sentence, or paragraph, by which means every thing will appear more distinct, the part in question presently found, and deficiencies quickly observed.

**SECT. CXCVII.**

The name of the part of fructification should begin the line in different letters or characters; for the same reason as in sect. 196.

**SECT. CXCVIII.**

No character should assume any mark of similitude, except it be common and obvious to every body; otherwise it will not be understood by those who are unacquainted
quainted with the art or science from whence the similitude is borrowed.

SECT. CXCIX.

The character should desribe those marks which run alike through all the species in the most compendious terms. The terms of art every botanist should be well acquainted with. From your descriptive characters let all pompous expressions and flowers of rhetorick be excluded, for there is nothing more hateful than the style of an oration in botanical characters. By means of the terms of art, we are enabled to express our ideas in a few words. Let the character of the genus *linum*, in the florid style of an oration, serve as an example to illustrate this aphorism.

The external green tegument or covering, which incloses the flower before its expansion, is, as it were, divided at the base into five equal parts, yet in such a manner that each part is of a greater length than breadth, and is narrow at each extremity; the tops of the sections ending in sharp points. These five parts have a perpendicular situation, and are very short, compared to the leaves of the flower; neither do they fall off with the inner-coloured leaves of the flower, but remain till the fruit is ripe. Within these outward leaves there are also five other leaves,
leaves, which are tender, of a fine colour, oblong, spreading more and more in breadth as they ascend, almost in the shape of a tunnel; they are also much larger than the external green leaves. Then within these five large coloured leaves of the flower there are five thread-like parts at the upper extremity, gradually tapering to a point. These are almost perpendicular, and in length do not exceed the external leaves of the flower. On the top of each is fastened a small, simple, thickish substance, which opens at the base into two acute segments, and scatters a dust. Having taken an accurate view of these parts, we next observe in the center of the flower a certain substance, which afterwards grows into the fruit, and about the time of flowering is almost shaped like a little ball, on the top of which are fixed five slender threads, of the same thickness throughout. They stand almost perpendicular, and are of the same length with the five thread-like parts described above, but these have no thickish heads on their tops, but are turned a little outward. When the time of flowering is over, the fruit grows dry, is almost globular, but marked with five obscure angles, having at the top a sharp point. If we cut this fruit transversely, we shall see it internally divided into ten apartments,
and when it opens spontaneously, we shall find that it opens into five equal parts, within which are contained ten seeds nearly of an oval figure, but longer, and sharp-pointed at one end, being also a little flat, and their surface smooth and polished.

Now let us hear the character of the same genus in the comprehensive language of a botanist.

The calyx, or empalement, consists of five leaves, which are erect, lance-shaped, acute, small, and permanent.

The corolla has five petals, tunnel-shaped; each being in form of a wedge, obtuse, spreading, and large.

The stamina are five tapering erect filaments, of the same length with the calyx. There are five other withered alternate filaments. The antherae are arrow-shaped.

The pistillum has an egg-shaped germin; five styles, erect, filiform, of the length of the stamina. The stigmata are simple and reflexed.

The pericarpium, or seed vessel, is a roundish five-cornered capsule, with five valves, and ten cells.

The seeds are single, egg-shaped, flatish, sharp-pointed, and very smooth.
Only the pure and proper terms of art (81—85) are to be used; obscure and erroneous terms are never to be admitted. Neither should doubtful terms be used; for, as Ray observes, the marks of the genera ought to be clear, distinct, and exactly defined; not in obscure and indetermined expressions, of which we are uncertain how far their meaning extends.

Here follows an explanation of some terms made use of by Linnaeus in his generic characters.

**Masculus flos**, a male flower, is the *slerilis*, or barren flower, of Tournefort; the *paleaceus*, or chaffy flower, of Ray; the *abortivus*, abortive flower, of other writers.

**Apetalus**, without petals, is the *imperfectus*, imperfect flower of Rivinus; the *flamineus* of Ray; the *incompletus*, incomplete flower of Vaillant.

**Petalodes**, having petals, is the *perfectus*, perfect flower of Ray, &c.

**Calyculatus**, having a calyx, is the *completus*, compleat flower, of Vaillant.

**Irregularis**, irregular, is the *diformis*, diformed flower, of Jungius; and the *anomalus* of Tournefort.

**Ringens**, gaping flower, is the *labiatus*, lipped flower, of Tournefort; *barbatus*, bearded flower, of Rivinus; the *personatus*, masked flower, of Tournefort.

**Multifidus**,
Chap. VI. OF BOTANY.

Multifidus, jagged, is the laciniatus, cut flower, of Tournefort; monopetaloides, of others.

Compositus, compound, is the conglobatus of Pontedera; aggregatus of Knaut; and the capitatus of Ray.

Planipetalus, flat florets, is the semistipulatus, half florets, of Tournefort; lingulatus, tongued florets, of Pontedera; cichoroceus, succory flowers, of Vaillant.

Radiatus, radiated, is the stellaratus, starchy flowers, of Morison.

Discus, disk, is the umbo, the shield, of Morison.

Anthera is the apex, summit, of Ray; capsula staminis of Malpighi.

Receptaculum, receptacle, is the sedes, the seat, of Ray; placenta, after-birth, of Boerhaave; thalamus, the bed, of Vaillant.

Amentum, catkin, is the julus, nucamentum, catulus, of others.

Strobilus, is the conus of other botanists.

Drupa, stone-fruit, is the prunus and fructus mollis officulo, a pulpy fruit with a stone, of Tournefort.

Gymnospermus fructus, is the semina nuda of Rivinus.

Angiospermus fructus, is semina percarpicio tecla, fruit covered with a seed vessel, of Rivinus.

Clavis is the ordo of Tournefort; genus summum, the highest genus of Ray.

T 2 Ordô
Ordo is the sectio of Tournefort; genus subalternum of Ray.

Linnaeus has enriched botany with many new terms; as involucrum, spatha, corolla, anthera, pollen, germen, stigma, legumen, drupa, cyma, axillus, stipula, scapus, bractea, pedunculus, glandula. Terms of art have deterred foolish and ignorant people from meddling with anatomy, mathematics, and chemistry; whereas the want of terms has well nigh demolished the science of medicine. Terms of art are very useful as they assist in just thinking, and expressing anything in the most compendious manner, providing such terms have true and adequate definitions.

SECT. CCII.

The characters should be kept immutable and unchanged in all systems, though ever so different one from another. As long as the chief systematic botanists introduced new characters and new ideas of a genus, so long was botany exposed to barbarism in the time of Ray, Tournefort, Rivinus, Boerhaave, Knaut, and others. But now things being a little more settled, although several new methods have been introduced since their time, no detriment has ensued to botany from thence; as appears from the writings of Gronovius, Royen.
A genus may consist of one species only, though for the most part the genera consist of several species. There are many genera that consist of one species only, as *parnassia*, *epimedium*, *linnaea*, *limosella*, *valisneria*, *theophrastra*, *cannabis*, *humulus*, *butomus*, *subularia*, *nepenthes*, &c.; and there are many genera that consist of a great number of species, as *sedum*, *convolvulus*, *saxifraga*, *antirrhinum*, *aster*, *carex*, *euphorbia*, *geranium*, *campanula*, *silene*, *hypericum*, *gnaphalium*, *salix*, *allium*, *potentilla*, *centaurea*, *aloe*, *gentiana*, *ranunculus*, *chenopodium*, *buphthalmum*, *lichen*, &c.

What has been said of the generic characters (164—202) holds true also of the classic; though this last allows of greater latitude in all respects.

The classes are less natural than the genera, and the orders less than either. From the affinity of some genera to natural tribes or orders, we frequently incur the danger of throwing all into
into confusion, by reducing to one genus a whole natural tribe or family. In some of the natural orders the genera have a very similar appearance. Many genera of the mallow tribe, as the common mallow, 
malva, marsh mallow, 
ätibæ, hollyhock, 
aloæa, tree mallow, 
lavatera, Indian mallow, 
urenæ, and Syrian mallow, 
hibiscus, are of this kind. The following genera, taken from three other natural orders, are very similar in their appearance, and might, by an inaccurate observer, be confounded under three genera only.—1. The house-leek, 
sempervivum, lesser houseleek, 
śedum, navel-wort, 
cotyledon, lesser orpine, 
raffula, rose-wort, 
rkodiola, and small annual house-leek, 
tillæa. 2. The torch-thistle, 
cælus, figmarygold, 
mesembryanthemum, 
aizoon, and 
tetragonia. 3. The campion, 
lychnis, cockle, 
agrostemma, viscidous campion, 
śilene, carnation, 
dianthus, fope-wort, 
aiponaria, mouse-ear chickweed, 
cerasium, spurrey, 
śpergula, sand-wort, 
arenaria, mountain chickweed, 
mæbringia, and 
śagina. In this manner several natural orders might each be reduced to a single genus; and thus the science be as effectually destroyed by the enormous size of the genera, as formerly by the unnecessary multiplication of their number. Thus, for example, the starry plants, umbelliferous, podded, and verticillate
cillate plants, the orchises, &c. might each be reduced to a single genus.

SECT. CCVI.

The more natural the classes are (all other circumstances being alike), so much the better and more excellent they are. Those plants that are of the same natural order, tribe, or family, agree in habit, manner of growing, properties, virtues, and uses. The three principal obstacles that have hitherto stood in the way of the natural method, are, 1. A neglect of the habit of plants, particularly the foliation, ever since the doctrine of the fructification has been cultivated. 2. The want of many foreign genera not yet discovered. 3. An affinity of the known genera to two or more natural orders; e.g. the juncus, to the calamarae, gramina and coronariae, which are the third, fourth, and tenth of the natural orders; see sect. 77. and so in many others.

SECT. CCVII.

Classes and orders which are too numerous, or too long, create great trouble and difficulty; ex. g. the pentandria and syn-genesia, where the genera are very difficult to distinguish.

SECT. CCVIII.

In every order, the genera which have the greatest affinity one to another, ought to
to be placed next one another. Thus, for example, in the *tetrandria monogynia*, there are plants of three natural orders, (one example or two of each will be sufficient to illustrate our meaning); of the *aggregatae*, which is the 48 natural order, *scabiosa*, *leucadendron*; of the *stellatae*, which is the 47 natural order, *rubia*, *asperula*; and of the *calycanthemae*, which is the 17 natural order, *epilobium*, *ludwigia*; now *leucadendron* should be placed first, and then all those of the *aggregatae*, to which order it belongs, should follow; then *asperula*, and all those of the *stellatae*; then *ludwigia*, and all those of the *calycanthemae*.

**Sect. CCIX.**

Adhering to the habit for a character of plants, and wholly laying aside or neglecting that of the fructification, the only true principle of systematic arrangement, is so far from true science, that I cannot help pronouncing it great folly. The great usefulness of an accurate knowledge of the habit of plants has been already allowed, and sufficiently insisted upon, in some of the foregoing sections; but Linnaeus will not allow it any place in determining the generic characters, which, according to him, ought to be derived from the fructification only. This being granted, botany (says Linnaeus) depends on, is supported or
or upheld by, fixed genera; the progress of which is as follows:

Tournefort, who first formed the generic characters according to the rules of art, constituted about 632 genera.

Plumier added to them 92 genera.

Boerhaave 16.

Petit 3. and the Members of the royal academy at Paris 8.

Vaillant 26, and also began the reformation of botany.

The two Jussieus 4.

Ruppius and Dillenius in Germany, 45; afterwards Dillenius, when professor at Oxford, added 16 new genera.

Pontedera, in Italy, 4.

Micheli, also in Italy, 21.

Buxbaum, a German, 1.

Amman, in Russia, 5.

Houston, in America, 15.

Haller, in Switzerland, 1.

Gmelin, in Siberia, 1.

Monti added one genus.

Linnæus examined all these genera according to the rules of art, reformed the characters, and, as it were, formed them all anew in his Genera Plantarum, first published in 1737, and several times since. He added besides 261 genera of his own, viz.
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viz. 69 genera of European, 69 genera of Asiatic, 73 genera of American, and 50 genera of African plants, making in all 1136 genera.

In the Systema Natura, 12 Edit. there are 1288 genera, and 7783 species of plants,

CHAP. VII.

NAMES of the GENERA, &c.

SECT. CCX.

AFTER a regular distribution, the next part of practical botany is deno-
mination, or naming the plants: for without names the knowledge of things is en-
tirely lost. Here Linnaeus observes, that the names of the antient Greek and Roman writers are generally preferable to those of the moderns.

SECT. CCXI.

To give true and proper names to plants belongs to the genuine systematic botanists, and to them only. For such only are able to distinguish the genera, and to know the names which were formerly in use. Many foolish people have given the most absurd names
names to plants; as Paternoster for cyperus, bonus Henricus for chenopodium, noli me tangere for impatiens, morsus diaboli for scabiosa, filius ante patrem for tussilago, mater barbarum for artemisia, surge et ambula for gentiana, fuga daemonum for hypericum, oculus Chriśli for afer, palma Chriśli for ricinus, spina Chriśli for rhamnus, calceus Mariae for cypripedium, chlamys Mariae for alchemilla, fragula Mariae for gallium, labrum Veneris for dipacum, umbilicus Veneris for cotyledon, calceus Veneris for cypripedium, pecten Veneris for scandix, barba Jovis for sempervivum.

**SECT. CCXII.**

All names used to express vegetables are either those of the classes, orders, genera, species, or varieties. Every plant ought to have both a generic and specific name. But the name of the class and order should never make a part of the name of any plant, but always be understood.

**SECT. CCXIII.**

All plants of the same genus ought to have the same generic name. The citron, orange, and lemon, are all of the same genus; yet Tournefort gives each of them a different generic name, viz. citrus, aurantium, and limon. The apple, the pear, and the quince, are all of the same genus; yet
yet Tournefort gives each of them a different generic name, viz. *malus*, *pyrus*, and *cydonia*; and thereby transgresses against this rule.

**SECT. CCXIV.**

On the contrary, all plants of a different *genus* ought to have a different generic name. Authors have greatly transgressed against this rule; for instance, they have given the name of *consolida* to many different genera; thus they have called *symphytum*, *consolida major*; *ajuga*, *consolida media*; *brunella*, *consolida minor*; *bellis*, *consolida minima*; *tomentilla*, *consolida rubra*; *cistus*, *consolida aurea*; *delphinium*, *consolida regalis*; *solidago*, *consolida sarracenica*; *comarum*, *consolida palustris*. In like manner they have given the name of *trifolium* to many different genera; thus they have called *cythrus*, *trifolium arborescens*; *oxalis*, *trifolium acetosum*; *lotus*, *trifolium corniculatum*; *medicago*, *trifolium falcatum*; *hepatica*, *trifolium hepaticum*; *menyanthes*, *trifolium palustre*, &c.

**SECT. CCXV.**

The same *genus* shall have no more than one generic name. Contrary to this rule, authors have given to many plants two different names; as *aconitum caeruleum*, or *napellus*; *aconitum salutiferum*, or *anthora*. 
All botanists shall call the same genus by one and the same generic name. In contradiction to this rule, we find the *asclepias* of Tournefort called *vincetoxicum* by Hk., and *hirundinaria* by Ray; the *limosella* of Pontedera called *plantaginella* by Dillenius, and *menyanthoides* by Vaillant; the *botonia* of Boerhaave called *stratiotes* by Vailant, and *myriophyllum* by Ray; the *rha-diola* of Dillenius called *linoides* by Ray, and *chamælinum* by Vaillant.

One and the same generic name, used for the designation of two or more different genera, is to be excluded from all but one. Thus the *aconitum* of Tournefort is the generic name, and should be retained; but the *aconitum* of Ray is an *helleborus*, and should be rejected: so also the *asclepias* of Tournefort is the generic name for the swallow-wort, and should be retained; but the *asclepias* of Hk. is the *fiapelia*, another genus, and consequently this name of *asclepias* should not be used for it.

He who constitutes a new genus, ought also to give it a name. For it is highly absurd and ridiculous to say with Pluk.*methonicae*
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methonisae folio planta; or with others, to give a plant no other name or title but anonymos, that is to say, the plant without a name.

SECT. CCXIX.

The generic name should be immutably fixed, before any specific name is given; that is, before we give names to any of the species. For a specific name without a generic, is like a clapper without a bell, or a pestle without a mortar.

SECT. CCXX.

Primitive generic names ought not to be introduced into botany. Such are many of the barbarous Indian names.

SECT. CCXXI.

Generic names, consisting of two entire and distinct words, ought to be banished from the science of botany. Such are the bella donna of Tournefort, for atropa; centaurium majus of Tournefort, for centaurea; crista galli of Dillenius, for rhinanthus; corona folis, for helianthus; dens leonis, for leontodon, &c.

SECT. CCXXII.

Generic names, compounded of two entire Latin words joined in one, are scarcely tolerable. Such compound words are most beautiful
beautiful in the Greek language, but the Latin does not often admit such, as *comarrea*, *chrysocoma*. Linnaeus has admitted a few such compound Latin words, as *rosmarinus*, *cornucopiae*, *sempervivum*, *sanguisorba*, but forbids the imitation of them in future.

**SECT. CCXXIII.**

Generic names consisting of a Greek and Latin word, or two words of different languages, are mongrels, and ought not to be employed or used. Such are, *e.g.* *morinda*, *cardamindum*, *sapindus*.

**SECT. CCXXIV.**

Generic names compounded of two generic names, the one whole, and the other mutilate, as for example, *linagrostis*, are unworthy of a place in botany, except they are both of Greek extraction, as *elaeagnus*.

**SECT. CCXXV.**

A generic name having one or two syllables prefixed, in order to make it signify a quite different genus from what it did before, ought to be wholly excluded; as, for example, *bulbocastanum*, *chamaenerium*, *chamapithys*, &c.
THE ELEMENTS Part II.

SECT. CCXXVI.

Generic names ending in *oides* ought to be banished from the science of botany; such as *agrimonoides*, *abyssoide*es, *cyperoides*, *nymphoides*, *pentaphylloides*, *rhamnoides*, *ricinoides*, *telephbioides*, *tribuloides*, &c.

SECT. CCXXVII.

Generic names, made by the addition of one or more syllables at the end of other generic names, are very improper; such as *napellus*, *myrtillus*, *lappula*, *lupinsafrir*, *alsinastrum*, *rapiforum*, *limonium*, *fabaria*, *bal-samita*, *camphorata*, *lapathum*, *erucago*, *sal-inca*, *linophyllum*, *fagopyrum*, *morocarpus*, *cotylisfolia*, &c.

SECT. CCXXVIII.

Generic names beginning or ending with the same sound, occasion great confusion; as *alpine*, *alpinoides*, *alpinella*, *alsinastrum*, *alsinastroides*, *juncus*, *juncoides*, *juncago*, *scirpus*, *scirpoides*, *cyperus*, *cyperoides*, *lycogala*, *lyco-periscon*, *lycoperdon*, *lycopodium*, *nymphaea*, *nymphoides*, *micronymphae*, *leuconymphaed*, &c.

SECT. CCXXIX.

Generic names, which are not of Greek or Latin extraction, are to be rejected; such as *bovista*, *beccabunga*, *brunella*, *perce-
pier, orvala, sarsaparilla, galega, ketmia, alhagi, ribes, doricum, tenga, adhatoda, jabctapita, &c. Yet Linnaeus has admitted many barbarous names by forming them like to some Latin or Greek word; thus, thea, tea, from the Greek word ΘΕΑ: coffea, coffee, of the Arabians, from ΚΩΦΕΩ, obmuteo; musa of the Arabians, plantain tree (Anton. Musa), the name of a Roman physician, with many others.

**SECT. CCXXX.**

Generic names of plants borrowed from the nomenclatures of zoologists, lithologists, or any other, if henceforth assumed by botanists, ought to be given up to their respective sciences; such as elephas for rhinanthus, erinaceus for bydnum, lagopus for trifolium, meleagris for fritillaria, natrix for ononis, buglossum for anchusa, ephemerum for com melina, locusta for valeriana, balanus for nepthes, granatum for punica, sol for helianthus, china for cinchona, patientia for rumex, concordia for agrimonia.

**SECT. CCXXXI.**

Generic names used in anatomy, pathology, therapeutics, or mechanics, ought to be exploded; such as auricula for primula, epiglottis for astragalus, umbilicus for cotyledon, paralysis for primula, sphacelus for salvia, ptarmica for achillea, cardiaca for U leonurus,
leonurus, serra for bisserrula, muscipula for silene, corona for helianthus, solexa equina for hippocrepis.

SECT. CCXXXII.

A generic name, which is contrary to any species of that genus, is a bad one; such as cyanus luteus, convolvulus erectus, pilosella glabra, unifolium diphyllum; blue bottle with a yellow flower, &c. the absurdity of which is evident.

SECT. CCXXXIII.

Generic names, borrowed from the nomenclatures of the natural classes and orders, ought to be laid aside; such as fungus, alga, muscus, filix, palma, lilium, planta, arbor, frutex, suffrutex, herba, vegetable.

SECT. CCXXXIV.

Many of the modern diminutive generic names, formed of Latin words, though none of the best, are nevertheless tolerable; as pulsatilla (pulsare, to beat); from its flowers being beaten and tossed with the wind; nigella (niger, black), from the blackness of its seeds; gratiola (gratia, favour, efficacy), from its use in medicine; mitreola (mitra, a mitre), from the shape of its fruit; pyrola (pyrus, a pear), from its pear-shaped leaves; phaselus (phaelus, a boat, or small ship), from the hulk of the seeds resembling a ship; gladiolus (gladius, a sword),
a sword), from its sword-shaped leaves; 
spinacia (spina, a thorn), from its prickly fruit; 
tussilago (tussis, the cough), from its great efficacy in coughs; with about 70 more names of the same sort, which Linnaeus has retained.

**SECT. CCXXXV.**

Generic names, which are adjectives, are not so good as substantive nouns, and therefore none of the best; as arenaria, convallaria, clavaria, capraria, cochlearia, eriophorum, echinophora, imperatoria, hepatica, scabiosa, angelica, impatiens, gloriosa, mirabilis, pedicularis, Parnassia, Smyrnium, Colchicum, Samolus, carica, &c. with above 60 more of the same sort; all which, however, are retained by Linnaeus.

**SECT. CCXXXVI.**

Generic names should not be abused, by giving them to saints, or men renowned in any other art or science, in order to preserve the memory, or court the favour, of such; as for example, herba S. Alberti, for arabis; Antonii, for epilobium; Benedicti, for geum; Christophori, for aethaea; Gerardi, for agopodium; Georgii, for valeriana; Guilelmi, for agrimonia; Jacobi, for senecio; Johannis, for hypericum; Kunigundis, for eupatorium; Ladislai, for gentiana; Laurentii, for sanicula; Pauli, for primula; 

Petr

U 2
Petri, for parietaria; Philippi, for isatis; Quirini, for tussilago; Ruperti, for geranium; Simeonis, for malva; Stephani, for circæa; Valentini, for pæonia; Zacharia, for centaurea; Barbaræ, for erysimum; Catharinae, for impatiens; Clara, for valeriana; Crucis, for nicotiana; Marie, for tanacetum; Othilie, for delphinium; Rosæ, for pæonia; Divines, as uvedalia, for osteospermum; or Great Men, as bonarota, for veronica.

SECT. CCXXXVII.

The generic names borrowed from the fables of the poets, fabulous names of their heathen deities, or those consecrated to the memory of antient kings, or other great men, who have promoted the knowledge of botany, ought to be retained. The names common among the antient Greek and Roman poets are the following; viz. Ambrosia, Nepenthes, Cornucopiae, Protea, Aétæa, Narcissus, Hyacinthus, Adonis, Crocus, Centaurea, Chironæa, Achillea, Pæonia, Cerbera, Amaryllis, Phyllis, Circæa, Andromeda, Daphne, Canna, Syringa, Medeola, Smilax, Mentha, Myræna, &c. From the names of heathen deities the following genera are denominated; viz. Asclepias, from Æsculapius, the god of physic; Mercurialis, from Mercury, the messenger of the gods; Hymenæa, from Hymen, the god of marriage; Serapis, from Serapis, an Egyptian
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Egyptian deity; Satyrion, from the Satyrs, or woodland deities; Tagates, the name of Jupiter's grandion; Nymphæa, from the nymphs who presided over waters; Naias, from the Naiads, or goddesses of rivers and fountains; Nysa, the name of a nymph; Dryas, from the Dryads, deities of woods and trees; Atropa, the name of one of the Furies, &c. From names of antient kings and queens; as, Eupatorium, from Eupator, king of Pontus; Gentiana, from a king of Illyria; Lysimachia, from Lysimachus, king of Sicily; Telephium, from a king of Mylia; Teucrium, from Teucer, king of Troy; Pharaceum, from Pharnaces, king of Pontus; Artemisia, the wife of Mauflus so called; Alliæa, wife of Oeneus so called; Helenium, from Helen, wife of Menelaus, &c. From the names of the improvers and patrons of botany; Eugenia, from prince Eugene; Petrea, from Lord Petre; Sherardia, from William Sherard, Esq; Cliftoria, from Geo. Clifford, J. U. D. Stewartia, from the right hon. John Earl of Bute, &c.

SECT. CCXXXVIII.

Generic names, made to preserve the memory of any excellent botanists, ought to be kept sacred. For as this is the only and highest reward of their labour, it ought to be of sacred estimation, and only dispensed to those of great merit in this de-
apartment, that others may thereby be incited to cultivate and adorn the science. Of such generic names Linnaeus has upwards of 200, but I shall only mention a few; as Aldrovanda, Alpinia, Bauhinia, Boerhavia, Casalpinia, Catesbaea, Dillenia, Dodonaea, Frankenia, Fuchsia, Gerardia, Hermania, Houstania, Jungermannia, Kempferia, Linnaea, Martynia, Morifona, Ovieda, Parkinsonia, Raiana, Sherardia, Sibbaldia, Sloanea, Theophrasta, Tournefortia, Valisneria, Waltheria, Ximenia, Zanichellia, Zinnia, &c.

SECT. CCXXXIX.

Generic names in use, and not contrary to the foregoing rules, other circumstances being equal, should be retained. Now generic names are faulty, or contradict the rules before laid down, in three several respects; 1. In being contrary to the genus: see what has been said above in sect. 215, 216, 217. 2. In being ill-constructed, or badly formed: see sect. 220—229. 3. In being given improperly: see sect. 231, 232, 233, 236. There are many obscure Latin and Greek names of plants, the origin or derivation of which is not known, or at best but dubious; and also several which are considerably altered from the original words, arising from the erroneous reading of the ancient manuscripts. All these, which
which are above 200, ought to be retained according to this aphorism, as they are not contrary to the rules before laid down. I shall mention a few examples of each fort; as aloe, borassus, cactus, daucus, eryngium, fucus, geum, bibiscus, isatis, lichen, melica, nardus, oryza, peziza, rhambus, sina-pis, taxus, vella, ulex, xyris, zea.—Acer, bellis, carex, cervum, ficus, genista, hedera, ilex, laurus, malva, opulus, panicum, quercus, rosa, sambucus, filia, verbena, ulmus, ulva.—Agri monia for argemonia, aquilegia for aquilina, betonica for vettonica, brassica for ПРАΣΙKH, coriandrum for coriannum, diapensia for dia penthes, euphrasia for euphrassyne, gonophrena for gromphena, P. lupulus for upulus, malope for malache, borrago for corago, betula for betulla, equisetum for equifelis, P. myrisme for myrsinum, P. melothria for melothron, P. phleum for phleos, P. spiræa for spiræon, P. &c.

SECT. CCXL.

Generic names, which exhibit the essential character or habit of plants, are preferable to all others. The essential character can but seldom be expressed in the names; as beliæteres, the screw tree, from 'ΕΛΙΔΙΣ a screw, and some others. 1. The habit indicates some similitude or likeness, by which the idea is excited in the mind, and from the idea the name is derived. Of this fort there are near 400 generic names. I shall give a few
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few examples to illustrate the meaning of this aphorism. 1. From the habit; as glycyrrhiza, literally, the sweet root; liriodendrum, the lily tree; baëmatoxylum, red wood; eriocauleon, woolly stem; hydrophyllum, water leaf; chrysocoma, yellow top; galanthus, milk-white flower; melanthium, black flower; xeranthemum, dry flower; trichofera, capillary stamina; dianthera, double antheræ; ceratocarpus, horny fruit; tetragonotheca, quadrangular capsule; lithospherum, hard or stoney feed; melampyrum, black grain; chrysobalanos, golden drupa or stone fruit; echinops, like a hedge-hog; eriocephalus, woolly head; leontodon, lion's-tooth; cynoglossum, hound's-tongue; melastoma, black mouth; buphthalmum, ox eye; myosotis, mouse ear; tragopogon, goat's-beard; anthoceros, horned flower; alopecurus, fox-tail; polygonum, many joints; ornithopus, bird's-foot; chrysosplenium, golden spleen; bupleurum, ox rib; dioöma, Jupiter's perfume. 2. From animals; as tragacanthæa, goat's-thorn; geranium, like a crane; orichis, a testicle; pteris, winged. 3. From instruments or utensils; as lycnitis, a lantern; othonna, flaky. 4. From the structure; as adoxa, inglorious; aizoon, live for ever; gnaphalium, downy; drofera, like dew. 5. From the medicinal virtue; as panax, universal medicine; poterium, a cup; oxalis, four; picris, bitter. 6. From the foil, or place
place of growth; as origanum, mountain’s joy; hydrocharis, delight of the water; potamogeton, near the river. 7. From various circumstances; as theobroma, food of the gods; cypripedium, Venus’s thoe; onithogalum, bird’s-milk; anemone, wind flower; crategus, strong; scandix, shepherd’s needle, &c.

Sect. CCXLI.

The Greek names of plants, made use of by the antients, are to be found in the writings of Hippocrates, Theophrastus, and Dioscorides, &c. and the Latin names in Pliny, the writers on husbandry, and the poets.

Of the former sort Linnaeus has given us about 362, and of the latter 427. I shall give a few examples of each; as acanthus, bromus, cannabis, Daphne, elymus, gentiana, Helenium, isatis, lathyrus, mentha, Narcissus, ononis, panax, rhamnus, Smyrnium, velia, xanthium, zea.—Acer, bellis, caltha, dactylus, ervum, ficus, genista, hedera, ilex, lilium, malva, nepeta, ophrys, panicum, quercus, rubia, salix, tilia, vaccinium, ulva, zofler.

Sect. CCXLII.

An antient generic name agrees best to an antient genus. This Linnaeus has done, when the generic name consisted of two Latin words, by changing the name into one Greek word of the same import; as
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Dens leonis into leontodon, ferrum equinum into hippocrepis; or by changing two words into one thus, gramen. parnassii into parnassia, lilium convallium into convallaria; or by shortening the name when too long thus, instead of calophyllo dendron, calophyllum, for iaphyllo dendron, iaphylda, for tetragonocarpus, tetragonia, for hydroceratophyllum, he has put ceratophyllum, &c.

SECT. CCXLIII.

A generic name, that is worthy to be retained, ought not to be changed for any other, though more fit and proper. Thus menyanthes, on account of its woolly flower, might more properly be called erianthus, woolly flower, or lasianthus, hairy flower. But such innovations ought by no means to take place, because new names more fit might be every day invented without end.

SECT. CCXLIV.

New generic names ought not to be made, so long as there are any of the synonymous names that deserve to be retained. When new genera are discovered, new names ought to be given them; but if an antient genus must be divided into two or more, it is proper not to coin new generic names, so long as there are any of the synonymous names belonging to any of the species.
species of that genus, worthy to be re-
tained.

SECT. CCXLV.

The generic name of one genus, unless it be superfluous, ought not to be transferred or given to another genus, though it would suit it better. For who at this time would change the names which have been long in use among the moderns, for those of the antients, supposing we certainly knew what plants they gave such names to, which is often not the case? Thus the hyacinthus of the antients is the delphinium of the moderns, and the tribulus of the antients is the fagonia, and the opulus of the antients is the humulus, of the moderns, &c.

SECT. CCXLVI.

If any genus, received according to the rules of nature and art, ought to be divided into two or more genera, then the original name shall be given to the most common and officinal plant. Thus, supposing the genus cornus were to be divided into three genera, viz. the cornus mas for one genus, the cornus mesomora for the second, and the cornus offea for the third; the original generic name of cornus should be given to the most common, which is the cornus mas.
Generic names are to be written in Roman and not Greek characters; as androsae-mum not ANDROΣAIMON, &c.

The termination and sound of generic names ought to be made as easy as possible. There are some unusual terminations, as tetrabib, bedypnois, &c. and some ill-found-ing words, as caraxeron, &c. which should be wholly rejected.

Generic names that are too long, very difficult to pronounce, or disagreeable in sound, are to be rejected. Too long, as kalophyllo-dendron of Vaillant, which is the calophyllum of Linnaeus; the hydrophyllocarpo-dendron of Boerhaave, which is the protea of Linnaeus. Difficult to pronounce, as acro-chordodendros of Plumier, i.e. cephalanthus of Linnaeus; the stachyarpogophora of Vaillant, i.e. achyranthes of Linnaeus. Disagreeable sound, as galeobdolon of Dillenius, i.e. leonurus of Linnaeus, &c.

To make use of terms of art in the room of generic names is very wrong, and highly improper, as tuberosa H. for polianthes, gra-minifolia
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minisola R. for subularia, spica H. for laven-
dula, &c.

SECT. CCLI.

What has been said of generic names holds true also of the names of classes and orders; each of which ought to have a name proper to itself, one and the same name always, not a primitive, foreign, mongrel, barbarous, nor equivocal word, not contrary to the class or order, not derived from any man's name, not too long a word, not difficult to pronounce, &c.

SECT. CCLII.

Names of classes and orders, taken from the virtues, root, herb, and habit, are bad, and very improper; as cordialis, capillary, bulbosae, tuberosae, asperifoliae, succulentae, verticillatae, filiflorae, dorsi ferae, arbores, frutices, &c.

SECT. CCLIII.

Names of classes and orders should include the essential and characteristic mark of each respective class and order; as papilionaceae, T. cruciformes, T. syngeniferae, L. &c.</br>

SECT. CCLIV.

Names of classes and orders taken from the name of any plant, by which the antients meant a whole tribe, are excluded from the genera, and ought only to be used in the natural orders; as palma, filix, &c.
The names of classes and orders should consist of a single word; as *campaniformes*, *monopetali*, *monandria*, *personati*, *tripetali*, *triandria*, &c.

CHAP. VIII.

Of Specific Differences.

A plant is said to be compleatly named when it has got both the generic and specific name. A young botanist should know all the classes; a candidate should be acquainted with all the *genera*; and a master in the science should know the greatest part of the species: for the greater number of species he knows, so much the better botanist he is. And it is a certain truth, that all solid erudition and true natural knowledge depends upon knowing the species. Now the knowledge of a species consists in some essential mark or character, by which alone it may be distinguished from all other species of the same genus. Without the knowledge of the genus there is no certainty of the species. The specific difference contains the marks wherein
wherein one species differs from others of the same genus. But the specific name contains only the essential marks of the difference.

SECT. CCLVII.

The true or legitimate specific name ought to distinguish a plant from all its congeneres, i.e. from all the other species of the same genus; but for the trivial name there are not hitherto any fixed rules. This rule is the foundation of the specific names; and if this foundation is neglected, all will be full of uncertainty. For all specific names, which do not distinguish a plant from its congeneres, are false; and all specific names, which distinguish a plant from others besides its congeneres, are also false. It follows, therefore, that the specific name is the essential difference. Trivial names, consisting of a single word, taken from any remarkable circumstance whatever, may, and ought, to be used, being very convenient on account of their brevity. Thus pyrola, with ascending stamine, and a declining pointal, is the pyrola irregularis; pyrola, with the flowers in scattered clusters, and the stamina and pistilla upright, is the pyrola balleriana; pyrola, with clusters on one side of the flowering stem only, is the pyrola secunda; pyrola,
with flowers growing in an umbel, is the *pyrola umbellata*; *pyrola*, with a naked stem bearing only one flower, is the *pyrola uniflora*. But the consideration of trivial names is no part of our intention here, being at present only to treat concerning specific differences.

**SECT. CCLVIII.**

The specific name ought to discover the plant to which it belongs at first sight, since it contains the specific difference inscribed upon the plant itself. The names of the old botanists, and especially of the most antient, were trivial, or rather trifling and insignificant. The natural character of a species is the description; but the essential character of a species is the difference. Linnaeus was the first who began to form the essential specific names, there being no specific distinctions formed before his time worthy of notice. Many of the most excellent modern botanists have followed the same method, as Royen, Gronovius, Guettard, Dalibard, Haller, Gmelin, Burman, &c. Linnaeus's specific names have extracted the differences out of the description, and out of the differences have investigated the most select essential character peculiar to each. All accidental marks, which do not exist in the plant itself, or
are not obvious to our senses, such as time, place, duration, use, ought to be wholly excluded from the specific name. All specific names also are erroneous, which are derived from the order of our ideas, or from supposition; as *tinus prior*, *tinus alter*, *tinus tertius*, *meum spurium*, *acorus verus*.

SECT. CCLIX.

The specific name ought to be taken from such parts of plants as are not subject to variation. Among former botanists the species were multiplied by reckoning up all the varieties as real species. This proceeded either from the fear of confounding different species, or from the want of essential differences or distinctions, or from the ignorance of the continued generation of the species (see sect. 79. 132.), or from the obscure knowledge of a distinct species, or from the contagious folly of florists, and a study of minute distinctions, &c. The colour, smell, taste, roughness, crispsation, impletion, and monstrous structure of plants are very variable, seldom permanent. The patrons of varieties, who have adopted them in the room of real species, were principally some very late botanists, viz. Barrelier, Tournefort, Boerhaave, Pontederia, and Micheli. There is not any one thing which has done more discredit to botany.
botany than the introduction of the varieties, and thereby confounding the synonyms. Micheli has reckoned up no less than 16 varieties of the common Dutch clover, and described them as so many species.

SECT. CCLX.

Magnitude or largeness doth not properly distinguish the species one from another; for it varies according to the place, soil, climate, and quantity of nourishment, in the same manner as in animals. And if the magnitude is variable, and yet does not change the species, it cannot give to the specific name any essential difference. Therefore all specific names, taken from the largeness of the plant, leaves, or fructification, are erroneous; as alpíne altíssima, nicotiana latifolia, magnolia flore ingenti, &c.

SECT. CCLXI.

Comparative marks with other species of a different genus, are false distinctions. Former botanists pre-supposed beginners to have an empirical knowledge of most European plants, and therefore their writings were rather proper for the perusal of expert botanists; but Linnaeus's whole endeavours are to teach the principles of the art
art scientifically to the ignorant. According to the rules of art, a plant should be mutually known from its specific name, and the name from the plant, and both from their proper character, written in the former, and delineated in the latter; any other character besides cannot be admitted. For names presupposing the knowledge of other plants have led men round in a circle; as for example, Jacobaea hieracii folio, hieracium blattariae folio, blattaria verbaschi folio, verbaschin cum conyzae folio, conyza salviae folio, salvia hormini folio, horminum betonicae folio, betonica scrophulariae folio, scrophularia melissae folio, melissa plantaginis folio, plantago coronopi folio, coronopus senecionis folio, senecio Jacobae folio. All specific names, which include a similitude or likeness to the leaf, flower, or habit of any other plant, Linnaeus pronounces false and erroneous; as for instance, Jacobaea betonicae folio, adonis buphthalmi flore, clinopodium origani facie, adonis belleborides, brassica asparagoides, cirsi um bellebore nigri radice.

SECT. CCLXII.

Comparative marks with other species of the same genus are not good, or proper distinctive marks. A specific name cannot be made true and permanent, unless all the species of the same genus are present,
since it must contain that mark or character which is not to be found in any other of the species of the same genus; it therefore belongs to a master in the science to make a specific name, and to the learner to know a plant from such a name. Now a learner cannot collect the species; but should endeavour to know one after another, since they neither grow together, nor exist together. Therefore all specific names are erroneous, which suppose another species of the same genus known; as orchis flore candidissimo, campanula angustifolia, magno flore, minor. Campanula, flore minore, ramosior.

SECT. CCLXIII.

The name of the first finder or discoverer, or of any other person whatsoever, should never be admitted into the specific difference. Names are, as it were, the hands of plants, of which the generic is the right, and the specific name the left hand; they may be compared to those who will give no credit nor trust to any thing but what they see; let those therefore be presented to a botanist, which are incapable of deceiving him. For we hold all such specific names to be erroneous, which are formed from the name of the first discoverer or describer, or from something in the history of the plant, or given
given as a memorial of any one; e.g. *trifolium Gaiatonium*, *conyza tertia Dioscoridis*, *conyza media Matthioli*, *campanula a Carolo Tosiano missa*, *amanita divi Georgii*.

**SECT. CCLXIV.**

The place of growth does not distinguish the species. The place of growth ought not to make a part of the specific name, for the following reasons.

1. No one would readily go to Japan, the Cape of Good Hope, or Peru, in order to know a plant. 2. The place of growth is often changed; and all the Alpine plants, and those that grow on very high mountains, out of the Alps become marshy plants. 3. The same species has not one place of growth only; for Lapland, Siberia, Canada, Asia, America, often produce the same species. 4. A botanic garden, well furnished, often contains plants from all parts of the globe. 5. Who would not endeavour to know or find out a plant that was given him, without knowing the place of growth? 6. Botanists love to know the species in a *hortus ficus*; physicians and apothecaries, in the shops. 7. The place of growth is only relative to us, and our knowledge here in Europe. So that a place of growth (which every plant must have) is accidental, and very changeable; and therefore
therefore ought not to make a part of the specific name. For all such names are false and erroneous distinctions, whether taken from the soil, country, frequency or scarcity of plants; as valeriana sylvestris, palustris, campana, montana, Alpina, cochlea-aria Anglica, pulmonaria Gallica, after Atticus, enanthae rara, hydrocotyle vulgaris, muscus vulgarissimus.

SECT. CCLI.

The time of flowering of plants, and their springing out of the ground, are most fallacious distinctions. Time is accidental with respect to a plant, for it existeth not in a plant, but rather a plant existeth in time; the times of plants are no constituent parts, and are very liable to change. Pluquenet and his coetemories introduced from both the Indies an amazing number of plants, which were not properly defined either as to the genera or species, for which reason I cannot say whether this tended more to the advantage or disadvantage of botany. A house built upon a bad foundation should be pulled down, and rebuilt on a sure and solid one; whatever is serviceable of the old materials should be used, and the rest rejected; though the work should be slow in coming to a conclusion: so also should it be with regard to specific names, that botany may at last be esta-

bled
blifhed upon a firm foundation. All specific names therefore, taken from the time, whether the year, month, day, or hour, are false and erroneous; as *tulipa* *praecoax*, *tulipa* *serotina*, *crocus* *vernus*, *geranium* *afivale*, *crocus* *autumnalis*, *aconitum* *hyemale*, *rosa* *omnium* *calendarum*, *viola* *Martia*, *rosa* *Maialis*, *boletus* *Julii* *mensis*, *boletus* *Augusti* *mensis*, *lychnis* *noctiflora*, *althaea* *horaria*.

**SECT. CCLXVI.**

The colour, which varies amazingly in the same species, can be of no service in specific distinctions. The inconstancy of colour may be plainly seen in our domestic animals. Nothing is more mutable and inconstant than the colour in flowers; the red and blue flowers, of all others, most readily and frequently change into white. The flowers of Marvel of Peru and sweet Williams, have the *corolla* of different colours even in the same plant. The colour wonderfully attracts and delights the eye; the most noble and penetrating of our senses. Botanists therefore, through great carelessness and indolence, were easily attracted by colours, but there is no dependance on them. Hence the labours of florists took their rise, to the great disgrace and discredit of botany. For none ever ran to such extravagant lengths as they have done; witness
witness in the tulip, anemone, ranunculus, hyacinth, polyanthus, &c. Tournefort, who joined the florists, saw, as it were, through a multiplying glass 63 species of hyacinth in one, and 93 species of tulip in one, more than there really were. All specific names therefore, taken from the colour of the flower, fruit, seeds, root, plant, leaves, or any imaginary quality, are false and erroneous. Leaves are said to be coloured when they assume any other colour than green. These vary exceedingly, and often lose that strange colour, which in some is variegated with white spots; as in the low-bread, creeping ranunculus, Dutch clover; in others, with black spots, as in the cuckoo-pint, ivy-leafed ranunculus, and some orchises; in some, with red spots, as the amaranthus tricolor; in some, checkered, as in Venus's slipper, and some of the fatyriums; in some, dotted on the underside of the leaf, as in pimpernel, and sea plantain; in some, with a white line, as in the striped Canary grass, and empetrum on the underside of the leaf; in some, with a white margin, as in the holly and box, &c. But to return: we will now give a few examples of such erroneous specific names as are taken from the colour, 1. of the flower; as primula veris flore luteo, rubro, albo, ferrugineo; auricula ursi flore coccineo, purpureo, violaceo, variegato.
gato. 2. Of the fruit, as melo fructu luteo, cucumis fructu albo, pepo fructu variegato; prunus fructu atro-caeruleo, flavo, cerei coloris. 3. Of the seeds, as papaver semine albo, nigro, sinapi semine rufo, luteo. 4. Of the root, as daucus radice atro-rubente, aurantii coloris, lutea. 5. Of the plant, as brassica viridis, rubra, alba; marubium album, nigrum, hyoscynamus niger, martagon cruentum. 6. Of the leaves, as agríoliwm foliis ex luteo variegatis, &c. ocymum maculatum. 7. Or from any imaginary quality, as alypum f. frutex terribilis, campanula pulchra, filix saxatilis elegantissima.

SECT. CCLXVII.

The smell can never clearly distinguish the species. The smell is, of all other qualities, the most variable; different in different subjects. As many individuals, so many different smells, even in the same species sometimes. This appears from dogs finding out their masters in a crowd. Smells admit of no determined limits, nor can they be defined; and therefore all specific names are deservedly exploded as erroneous, which admit of smell as a mark of distinction; e. g. hypericum bircinum, melo moschatus, hesperis noéto olens, caryophillus inodorus, ocymum citri, anisi, fæniculi, melissœ, cinnamoni, rutæ odorœ, &c.
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SECT. CCLXVIII.

The taste, which often varies in respect of the person who tastes, should wholly be excluded from specific distinctions. At different times of life people judge differently of tastes, which we also know are much altered by diversity of soil and climate; and many plants, by nature sour, austere, harsh, bitter, and disagreeable, are rendered mild, sweet, pleasant, and wholesome by culture; witness the cichoreum sylvestre, endive, which is very bitter; laētua sylvestris, narcotic and poisonous garlic, which in Greece has not that strong smell as with us; apium palustris, very disagreeable, wild crab apple, extremely sour: but culture has multiplied that and the pear into such a number of varieties, that Boerhaave reckons 172 of the latter, and 200 of the former; each of which, on account of something peculiar in their taste, hath got a distinct proper name. All specific names then, derived from the taste, are ridiculous, and ought to be excluded from specific distinctions; as apium ingratius, dulce, laētua opii succo viroso, laētua mitis, pīsum cortice eduli, pyrus fruēti succharato ore deliquescente.

SECT. CCLXIX.

The medicinal virtues and other uses of plants afford vain and erroneous distinctions
tions to a botanist. For by this method of
distinguishing the species, experiments must
be tried in order to ascertain their virtues;
so that, in tasting the mancheneel, e. g. one
would try the most dangerous experiment,
and the slightest taste of one species of arum,
mentioned by Sir H. Sloane, instantly
takes away the use of speech. The medi-
cinal plants, and their names, should be
placed among the synonyms. And physi-
cians have no right to prescribe names to
botanists, seeing they themselves do not
recede from the use of their own officinal
names. Are we, on their account, to make
of the turbith, scammony, mechoacan, eneo-
rum, soldanella, &c. so many distinct gene-
ra, contrary to the laws of nature, which
has comprehended them all under one, viz.
the convolvulus; or of one and the same ge-
rus Punic a are we to make several genera of
plants, viz. of the flowers one, under the
name of balaustium; another of the fruit,
by the name of granatum; and a third of
the peel, under the name of malacorium?
Wherefore we pronounce all such specific
names as the following to be false and er-
roneous, viz. agrimonia officinarum, solan-
um lethale, aconitum salutiferum, genista sco-
paria, rubia tintoria, dipsacus fullonum, me-
nyaethes antiscorbutica, rhammus catharticus,
solanum somniferum, pisum cortice eduli, Pu-
lica que malum granatum fert.
The sex can never in any case constitute different species. Here we understand males and females in the *dioecia* class, or in distinct individuals of the same species. Many authors have constituted distinct species of males and females, which differed in nothing but the sex, and therefore ought not to be distinguished into two separate species; *e.g.* *urtica mas*, and *femina*, *humulus mas*, and *femina*, *cannabis mas*, and *femina*. Nay, the more antient botanists distinguished many plants into males and females, where there were not distinct sexes, but very different plants; as the male and female *anagallis*, *aristolochia*, *abrotanum*, *abies*, *amaranthus*, *balsamina*, *caltha*, *cisus*, *cornus*, *crista-galli*, *ferula*, *filix*, *mandragora*, *nicotiana*, *orchis*, *paeonia*, *pulegium*, *quercus*, *symphytum*, *tilia*, *veronica*.

Monstrous flowers and plants all have their origin from simple and natural ones, and are therefore never to be taken for distinct species. Of multiplied, full, and proliferous flowers, all which are monstrous productions, we have spoken under sect. 119, 120, 121, 122, and also in sect. 150. These monstrous productions are frequently owing to culture, and too much nourishment.
nourishment. No one ever reckoned monsters in the animal kingdom for distinct species; and for the same reason monstrous plants ought not to be taken for distinct species. Let your large, multiplied, full, and proliferous flowers be banished from botany, and an amazing number will thereby be cut off, which has long been a burden to the science.

SECT. CCLXXII.

Pubescence, or the armature of plants, is a ridiculous distinction, since plants often lose it by culture or change of place. The most fierce animals by culture are made surprizingly tame; and we also see the same thing in plants very common. Trees cultivated in gardens often lose their spines, and instead of a sour and harsh fruit, produce mild and agreeable fruit; witness the pear, citron, lemon, orange, medlar, gooseberry, artichoke. Wild fuc-cory or endive has rough leaves, with large sinuses and teeth, of a very bitter disagreeable taste; but the cultivated sort has its leaves more entire, very smooth, and of a pleasant taste. Plants also very often lose their roughness by age or change of place. The beech at first springing up out of the ground is very rough, and soon after becomes smooth; the young plants of the
the **heliocarpus** have hairy leaves, but the full-grown, smooth ones; the **triumfetta** when young is downy, the old plants quite rough; the woodroof in the woods is hairy, in open places rough; the perennial arsîmart growing in wet places is very smooth, in dry places rough; mother of thyme in open fields is smooth, on the sandy sea-beach rough; the devil's-bit in open places is smooth, in woods a little rough; buckthorn plantain in a moist soil has smooth whole leaves, in dry soil rough leaves with teeth; the martagon lily in the woods is rough, in gardens exceedingly smooth; the palmated lady's-mantle in open dry sunny places is smooth and yellowish, in spongy and shady ground its leaves are green and hairy. A mild climate often renders plants more mild; and on the contrary, a severe cold climate renders them more harsh. We are not therefore to have recourse to the roughness or spines of plants for a specific character, unless we are obliged thereto by the greatest necessity.

**SECT. CCLXXIII.**

Duration often respects the place of growth more than the plant, and therefore should not be admitted into specific distinctions. Warm countries, which enjoy perpetual
petual summer, produce plants which scarcely suffer any decay the whole year round; hence it is, that very many plants in those countries are perennial and shrubby, which with us become annual; as the *tropæolum*, or Indian cress, the beet, marjoram, and tree mallow, &c. Cold countries make perennial plants become annual; as the marvel of Peru, *Ricinus* or *palma Christi*, &c. From the duration of plants therefore no specific difference should be taken, unless it is manifestly unchangeable.

**SECT. CCLXXIV.**

A multiplication, or great increase of the parts of plants, often varies according to the place of growth, and is therefore no proper distinctive mark of the species. A creeping stem, by putting out roots at every joint, generally multiplies exceedingly. Plants are multiplied either by the soil, or in the root, stem, leaves, or fructification. A plant is said to be frequent and common, which in a proper soil grows spontaneous and plentiful. A plant is called *caespitosa*, which has a number of stems coming from one and the same root. This circumstance is not constant, for such a plant in a poor thin soil can hardly produce one stem; and on the contrary, a stem lopped off near the root
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root in a plant which commonly produces but one, shall in that case put forth many stems. A plant is called *fasciata*, when several stems grow close together in a bundle or packet, so as to appear like one. The same may be done by art, if several stems are forced to penetrate through a narrow hole or space. This is frequently done in the *ranunculus*, beet, *asparagus*, dame's-violet, pine, *celosia*, or cock's-comb, goat's-beard, *ftinking May-weed*, *amaranthus*. A plant is called *plicata*, when a tree or arm of a tree grows up with very small twigs, interwoven, plaited, or matted like a magpye's nest, which the vulgar think is the work of some demon. It is common in the birch of Norland, and in the hornbeam of Scania, and is often seen also in the pine. Curled leaves (lect. 63. 83.) are those whose circumferences are increased, so that their edges flow like waves. Blistered leaves are when the disk is increased, so that the substance of the leaf on the upper side rises like cones, hollow below; as in the basil, and many of the fages. That multiplied, full, and prolific flowers, have their origin from simple ones, has been already explained, 119. 122. 150. and 271. Several plants are no more than varieties multiplied in some of their parts instead of real species; as *ophio-glossum lingua bifida*, *plantago spica bifida*.
The root often affords a true and real distinction, but we must not have recourse to it till every other method has been tried in vain. If there is any other distinguishing mark, which is constant and permanent, we are not to have recourse to the root, for we are not often at liberty in gardens to take up plants by the root; in a hortus fic cus the root is not easily preserved; and in fresh specimens, or plants growing, we seldom see the root. The more easily and readily plants can be distinguished, so much the better; but necessity has no law. It is very difficult to distinguish the different species of scilla by the herb or grass, but very easy by the root or bulb, which is either coated, or solid, or scaly. The different sorts of orchis cannot rightly be distinguished without having recourse to the roots, which are either fibrous, roundish, or testiculated.

The best distinctive marks are often-times taken from the trunk or stalk. The stalk or stem in many plants affords such essential distinctions or differences, that without it there is no certainty of the species. The angular stem distinguishes many plants, which are otherwise scarcely distinguishable.
The hypericum hirsutum, tuftan, or hairy St. John's-wort, hypericum perforatum, common St. John's-wort, and hypericum quadrangulum, St. Peter's-wort, are distinguished by the first having a round, the second a two-edged, and the third a quadrangular stem. The convallaria polygonatum, sweet smelling Solomon's seal, and convallaria multiflora, common Solomon's seal, by the first having a two-edged, and the second a round stem. The pyrola rotundifolia, common winter-green, and pyrola minor, lesser winter green, are distinguished from all the other species of pyrola by their naked three-cornered stem.

**Sect. CCLXXVII.**

The leaves furnish the most elegant and most natural specific distinctions. Nature is nowhere more various than in the leaves, the different sorts of which are exceedingly numerous, and ought to be carefully learned by every student of botany. The leaves recommend themselves to our notice, because they are most beautiful and shewy, have the greatest diversity of species, and most easily afford specific distinctions; hence Linnaeus has taken very many of his specific distinctions from the leaves, as may be seen in his Sp. Pl. and Fl. Suec. &c. There are some species of leaves, which rarely occur, besides those mentioned in
The fulcra, or props, (viz. the stipulae, bracteae, or floral leaves, spines, prickles, tendrils, glands, hairs), and the hyberna-cula, or winter quarters, (viz. the bulbs and buds) commonly leave the best specific distinctions. Without the assistance of those marks it is scarce possible to distinguish the species of some genera. The prickles in the rubus, the spines in prunus, and the bracteae in fumaria, and some others, are very remarkable. Cona, or tuft, cons.
sifts of *bracteae* remarkably large at the extremity of the stem, as in the crown imperial, lavender, sage. The glands in the *padus, urena, mimosa, cajia*, afford essential marks of distinction. The glandular ferratures at the base of leaves, in *heliocarpus, salix, amygdalus*, the back of the leaves full of glands, in *padus, urena, pas- fiora*; the glandular prickles which separate a fluid from the substance of the leaves, in *baubinia aculeata*, are all so many examples of distinctive marks afforded by the glands, without the knowledge of which the species cannot rightly be distinguished in many genera, particularly *mimosa, cajia*, and some others. The almond can only be distinguished from the peach by the glands in the ferratures of the leaves. The species of *urena* cannot be determined till we have examined the glands of the leaves. The *convolvulus*, with a tubercle on the calyx, would be divided into several species by reason of the different figure of the leaves, did not the glands join them into one. The *monarda*, with glands on the corolla, is thereby clearly distinguished from the other species of that genus. The *stipulae* are of great consequence in some large genera, where there is a doubt about the species. One species of *melian-thus* has single, and another double, *stipulae*. The
The *caffia*, with kidney shaped bearded *spinae*, is by that mark clearly distinguished from all the other species of that *genus*. The buds in the same *genus* are often widely different, as appears in *rhamnus*, where the buckthorn, *alaternus*, *palirus*, and *franga*, have very different buds. The species of *salix*, which are very numerous and intricate, may most easily and certainly be distinguished by the buds and foliation. The bulbs are the best and almost the only distinctive marks of the *genus* *scilla*. The bulbs in the bosom of the leaves on the tooth-wort, lily, *star of Bethlehem*, *faxisfrage*, and bistort, afford a most singular mark to determine the species.

**SECT. CCLXXIX.**

The mode of flowering (whether verticillate, corymbiferous, spiked, panicled, or axillary,) is a most real, certain, and true distinctive mark of the species. Inflorescence is the mode or manner in which the flower-stalk produces the fructification, either as to the structure, or place, or situation. In many genera this mode of flowering affords the most beautiful distinctions. Some of the *spiraesus* have flowers doubly clustered, others corymbiferous, and others umbelliferous, that without knowing the mode of flowering there is no certainty of the
the species. A peduncle produces the flowers in various ways. It is said to be flaccid, when it is so weak as to hang drooping down only by the weight of the flower; nodding, when bent at top, and the flower hangs a little to one side; as in the bidens radiata, carduus nutans, scabiosa Alpina, helianthus annua, cnicus Sibiricus. Flowers are called fastigiate, when the partial flower-stalks are all of an equal height, and bear the fructifications in a bundle, as in the dianthus and silene. When the flowers stand remote from one another, the flower-stalks are said to be spreading; and close, when the contrary; flowers are conglomorate, when the branched flower-stalk bears the flowers without any order, very close and compact. The reverse of this, is a spreading panicle; a jointed flower-stalk, which has one joint, as in oxalis, fida, bibiscus; sometimes two, and sometimes three flower-stalks come out together at the same place, as in capraria, and one species of the impatiens. The flower-stalks in the atra flexuosa are waved or bent in serpentine turns; sometimes the flower-stalks remain on the plant after the fruit is fallen off, as in the jambolifera, ochna, justicia; sometimes the flower-stalks are thicker towards the flower than at the other extremity, as in cotula, tragopogon, and most of the nodding flowers.
The parts of fructification (viz. the calyx, corolla, stigma, pistilla, seed vessel, and seeds) often afford the most constant and invariable specific distinctions. For there are in the fructification more parts than in the whole plant besides, and therefore more marks of distinction may be derived from thence. The marks of fructification are to be distinguished into essential, natural, and specific; which last only belongs to the species, and the two former to the genera. If you take away the flower, the gentians are not to be distinguished, as appears by the observations of Haller; but the corollas being in some of them bell-shaped, wheel-shaped, tunnel-shaped; in others cut into four, five, or eight segments, afford very easy distinctions. St. John's-wort with three styles is easy to be distinguished from that with five. The African geraniums are to be separated from the European by an irregular flower and stigma connected together. Here Linnaeus gives definitions and explanations of several technical terms, which frequently occur in specific distinctions derived from the fructification, and which had not been before explained in his chapter of the fructification.

In the lichens, a tubercle is that sort of
fructification which consists of rough points or dots, like dust thrown together. A shield (*scutellum*) is an orbicular concave fructification, with the margin elevated quite round. A target (*pelta*) is a flat fructification, for the most part glued to the margin of the leaf.

In mosses, the little head (*capitulum*) is the *anthera*.

In funguses, the hat (*pileus*) is the round horizontal top, which bears the fructification underneath.

In grasses, the *spicula* is the partial spike, which former botanists called *locustia*. The beard is called *tortilis*, when bent and twisted in the middle, as in oats. *Articulus* is that part of the stem between two knots (*genicula*).

A compound radiated flower consists of a *disk* and *radius*. The *radius* of the irregular petals in the circumference. The *disk* of the smaller and generally regular petals in the middle. A flower *doubly compounded* contains within a common *calyx* lesser *calyces* common to many flowers, as in *Sphaeranthus*.

A *corolla* is *equal* when its parts are equal in figure, magnitude, and proportion. *Unequal*, where the parts do not correspond in magnitude, but in proportion, so that the flower becomes regular, as in *Butomus*.
A regular corolla is equal in figure, magnitude, and proportion of parts. Irregular, is different either in the parts, figure, magnitude, or proportion. Riétus, is the gaping between the two lips of a flower. Faux, is the aperture of the tube of the corolla. Palatum, the hump or prominence in the aperture. Calcar, or spur, is the nectarium, a part of the corolla stretched out into a conical shape behind the flower. An urceolate corolla is inflated or blown up, and convex all round like a little bottle or pitcher. Cyathiformis is a corolla, shaped like a wine glass. Connivens is that sort of corolla, the extremity of whose lobes converge or approach each other. Lacera, a torn corolla, which is cut into very small parts.

Anthera versatilis and incumbens, is that which is fixed on the side to the filament. Anthera erecta is fixed by the base.

A seed vessel is called inflated, when hollow like a bladder, and not distended with seeds, as in the funaria cirrhosa. It is termed prismaticum, when it is narrow, and conflits of several angles and plain sides. Turbinatum, when shaped like a top, as in the pear. Contortum, when twisted like a screw, as in ulmaria, heliceteres, and thalictrum. Acinaciformpe, when the fruit is compressed like a knife, with one longitudinal angle.
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sharp, and the other blunt, as in *mesembryanthemum*. It is said to have its seeds nestling (*seminibus nidulantis*), when they are dispersed without any order in the pulp of a berry. It is called *echinatum*, when every where armed with prickles or spines, like a hedge-hog. *Torosum*, when protuberant on both sides, with little knobs or prominences, as in *lycopersicum, phytoleacca*.

Sect. CCLXXXI.

It is absurd to make use of the generic marks of the natural characters in specific distinctions; as *ranunculus calycibus pentaphyllis, floribus pentapetalis, petalorum unguibus nectariferis*. For they can never distinguish the species, because in every genus they agree through all the species, and consequently cannot be marks of any specific difference.

Sect. CCLXXXII.

All specific distinctions must necessarily be taken from the number, figure, proportion, situation, and connection, of the various parts of plants.

We have already laid down the fallacious and true, or constant distinctive marks of the species. They are fallacious, when not sufficient; when merely accidental; when variable; when derived from the magnitude of the plant; or comparative with
with other species of a different genus; or comparative with other species of the same genus; or taken from the name of the first finder, or any other person; or from the place of growth; time of flowering or springing; colour; smell; taste; medicinal virtues, and other uses; the sex; monstrous flowers and plants; pubescence; duration; and, lastly, from a multiplication, or great increase, of the parts of plants. The true, constant, and faithful marks are taken from the parts of a plant, as the root, stem, leaves, fulcra, or props, the mode of flowering, and the different parts of fruitification, according to the number, figure, situation, connection, and proportion, as in the genera. These are everywhere constant, both in the fresh plants, dried plants, and figures.

SECT. CCLXXXIII.

We ought always to be careful not to substitute a variety in the room of a species. This is a difficult point, and requires the greatest care. The cause of our running into so many errors in this particular, is owing to nature's appearing in so many different forms; to the different and singular nature of countries and climates; to the places of growth being sometimes very remote; and lastly, to the shortness of human life.
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Life. Now that which promises certainty in distinguishing the species from the varieties, is to cultivate them in the most different and various soils; to examine attentively all the parts of a plant; to examine the fructification in all its parts, even the most minute; to inspect the other species of the same genus; to attend to the constant laws of nature, which proceeds by slow degrees; to observe the remote modes of varieties; and, lastly, to place the species under the next different genus.

SECT. CCLXXXIV.

The name of the genus must be prefixed to every one of the species. After the species are reduced to their genera, every one of them should have the name of the genus prefixed to which they belong.

SECT. CCLXXXV.

The specific name ought always to follow the name of the genus. Since without knowing the genus, there is no certainty, it necessarily follows, that the name of the genus should begin the sentence or specific distinction, and this last immediately follow the generic name.
The specific name without the generic is like a bell without a clapper. A specific difference is only a distinction of the genus into two or more species, and therefore without the genus no difference can be conceived. Names are made by art, that we may be enabled by them scientifically to determine plants. Differences without a generic name are like animals without heads; as for example, *myagro affinis herba*, *capsulis subrotundis*. J. B.

The specific name should not be a part of the generic, by adding a syllable or two to the end, and thereby making a diminutive word; as *gentianella* instead of *gentiana parva*, or little gentian.

The genuine specific name is either synoptical or essential. The specific names should distinguish the species readily, surely, and easily. Every possible distinction of a species should be collected, and from them the best should be taken, that we may at last know the species with certainty. The mode of specific names is either synoptical or essential, or a mixture of both.
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SECT. CCLXXXIX.

The synoptical specific name gives to plants of the same genus distinctive marks, branched into divisions and subdivisions. When the essential marks of the species cannot be traced, the synoptical specific name is often made use of to distinguish them, and is therefore a succedaneum to the essential name. In genera, where the species are very numerous, we are often obliged to give the specific distinctions in a synopsis; thus, *salix foliis serratis glabris ovatis acutis subsessilibus*. Now the essential specific character of the same plant is, *salix flosculis pentandris*; sweet willow.

SECT. CCXC.

The essential specific name gives one striking distinctive mark peculiar only to that species to which it is applied. The essential specific name consists generally of one or two words, or one idea. After the genera are established, and the species determined by their essential differences, we are got to the ne plus ultra of botany. For if botanists had once arrived so far, that they could determine every species by an essential name, they could proceed no farther towards perfection in the art. The excellency of a name consists in its brevity, facility, and certainty. After the essential name
name is discovered, a *synopsis* should not be admitted into the specific difference. Botanists ought therefore to endeavour to find out the essential specific names of as many species as possible, because they are on all accounts the most excellent.

**SECT. CCXCI.**

The shorter the specific name or difference is, it is so much the better, providing it be sufficient to distinguish the species in question from all other of the same *genus*. For it is folly to use a great many where few words are quite sufficient. And we see that nature herself also is very compendious in all her operations. The number of words in a specific difference ought not to exceed twelve; and in like manner, a generic name for the most part should not exceed twelve letters.

**SECT. CCXCII.**

The specific name should admit no more words than are absolutely necessary to distinguish the species from all other of the *genus*. There ought not to be one superfluous word in a specific difference. And that specific distinction, which is expressed in the shortest way, and fewest words, is the best.
No specific name can be given, or is wanted, to a species, which is the only one of the genus. Therefore where no specific difference is expressed, we are to suppose there is no other but that one species of the genus hitherto discovered.

He who discovers a new species, should give it a specific name, unless it be the only one of the genus. He should not only give its specific difference, but also increase, diminish, or alter those of the other species of that genus, that all of them may be sufficiently distinguished for the future.

The words made use of in a specific name or difference should not be compound ones, like the names of the genera, nor Greek, but only Latin; for the more simple, clear, and evident, so much the better.

The specific name must not contain figures of rhetoric, much less should it be erroneous, but faithfully describe things as nature exhibits them. We shall give a few examples of such erroneous specific names.
as are here meant; as salicaria purpurea, instead of corollis purpureis; lupinus flore luteo, instead of floribus luteis; limon incomparabilis, instead of maximus; narcissus calyce luteo, instead of nectario luteo.

**SECT. CCXCVII.**

The specific name should not be a word either of the comparative or superlative degree; for such suppose the knowledge of another plant. And all specific names, which have a comparison to any thing without the plant, are erroneous; as equisfatum lœvius. But the superlative degree, applied to a part within the plant, is very proper, frequently used, and an excellent specific mark; as lobelia pedunculis brevissimis, tubo corolla longissima.

**SECT. CCXCVIII.**

The specific name should always be in positive, not negative, terms. For negatives express nothing, or only inform us what is not, but not what is. When we have positive, we should never make use of negative, terms; and thus proper words will be always ready at hand to express opposite meanings; as rotundatum and angulatum, obtusum and acutum, ferratum and integerrimum, tomentosum and glabrum, petiolatum and sessile, aristatus and muticus, remoti.
moti and congesti, herbaceus and fruticosus. The most tedious description of a plant in negative terms conveys not the least idea of it to any one; therefore all such specific names are erroneous; as lysimachia non papposa, instead of feminibus nudis; hippuris non aspera, instead of glabra; bidens folio non dissecto, i.e. integro; phalangium non ramosum, instead of caule simplici, lychnis petalis non bifidis, instead of integris.

Every similitude used in a specific name should be common and obvious to all, though even these should be used but sparingly. Similitude expresses that in one word, which otherwise would require a long description to demonstrate it; but we are to observe, that every similitude is lame, and therefore it is disgracing of botany to use any obscure similitude, or which is not clear and obvious to the lowest capacity. And indeed no other similitudes should be used but such as are taken from the external parts of the human body; as the head, the ear, the hand, foot, &c. Many obscure similitudes have been introduced by botanists; as agaricus tubae fallopianae inflat, orchis simiam referens, orchis cercopithecum referens, hemionitis foliis securos Romanè figura, &c.
A specific name should admit no adjective without its corresponding substantive. And all specific names are erroneous which admit adjectives without their corresponding substantives; as *millefolium cornutum*, *nigella cornuta*, *lysimachia corniculata*, *viola tricolor*, *myrtus cristata*, *amaranthus cristatus*, *gra- men cristatum*.  

Every adjective in a specific name should follow its own substantive. As in the generic character, the part to be described is always first mentioned; so also in a specific difference, the substantive, to which the adjective agrees or belongs, should always be first mentioned, that the meaning may be very distinct; and left, by an error of the press in placing the points wrong, a quite different sense should be given to the words; as *corona folis parvo flore*, *tuberosa radice*, instead of *corona folis flore parvo*, *tuberosa*.  

Adjectives used in a specific name are to be taken from the select terms of art (80—86), providing those are sufficient to express...
press the meaning. If botanists could agree in the terms of art, and constantly use the same terms, the science would become very easy. A paraphrase should never be used, so long as there are terms of art properly defined; e.g. conyza humidis locis proveniens, instead of palustris. Synonymous terms should be excluded, and one select term constantly used to express the same thing; as, e.g. instead of caryophyllus supinus, caryophyllus procumbens, ligustrum folis piétis, ligustrum folis variegatis, hieracium radice succisa, hieracium radice præmorsa.

SECT. CCCIII.

Conjunctive or disjunctive particles should never be used in a specific name. Conjunctive and disjunctive particles, such as, et, atque, simul, vel, five, seu, should be excluded; and all specific distinctions expressed in the ablative case, without any preposition. When any of the conjunctive or disjunctive particles are wanted, they should be added in the end of the following word, as carduus foliis lanceolatis ciliatis integris laciniatisque.

SECT. CCCIV.

Distinctive points should be placed after the parts of plants in a specific name, and not after the adjectives. These points are (,) (;)
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(, ) (; ) (:) () by which, properly placed, a specific difference becomes very clear. Linnaeus uses the comma to distinguish the parts, and the colon where there is a subdivision of a part, and the punctum, or full stop, at the end of the sentence; thus, *bauxinia inermis, foliis cordatis semilibidis: laciniiis acuminato-ovalis erecto-dehiscentibus.*

SECT. CCCV.

A parenthesis ought never to be admitted into a specific name. For a parenthesis, either expressed or understood, argues either an exception or want of order; thus, *spinipistrum pentaphyllum, flore carneo, minus; androstenum maximum (quasi frutescens) bac-ciserum; dens leonis qui pilosella folio minus villoso.*
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CHAP. IX.

VARIETIES.

SECT. CCCVI.

To the generic and specific names should be added those of the varieties, if there be any. Varieties are plants of the same species, which are changed by some accidental cause. The great usefulness of many varieties in domestic economy, diet, and medicine, has made the knowledge of them necessary in common life; otherwise varieties belong not to botanists as such, but so far as they should take care that the species be not unnecessarily multiplied or confounded. A botanist should insert, when it is necessary, such varieties as are clear and evident, at the end of each specific distinction to which they belong, on account of their common utility.

SECT. CCCVII.

The names of the genera, species, and varieties, should be written in different characters, the first in Roman capitals, the next in the common Roman letters, and the last in Italics. The generic name should always
always be in great letters or Roman capitals, the specific in common or small Roman letters, and the varieties in Italics; as CONVALLARIA scapo nudo; corolla plena.—CONVALLARIA scapo nudo; corolla rubra.

SECT. CCCVIII.

The sexes of plants constitute the natural varieties; all other varieties beside these are monstrous. Plants of the dioecia class constitute one mode of varieties truly natural, distinguished into males and females; to know which, and to add them to botanic differences, is very necessary. But we should take care not to be misled by the antient botanists; who, being ignorant of the fecundation of plants, took the males for females, and the females for males; as for example, their mercurialis mas, cannabis mas, and lupulus mas, are the female plants.

SECT. CCCIX.

The monstrous varieties are the mutilate, multiplied, full, and proliferous flowers; as also luxuriant stems bundled, plaited or twisted, and mutilate; luxuriant leaves curled, bladdery or blistered, in number, figure, proportion, situation, and connection of all the parts; and lastly, these
these varieties often consist in the difference of colour, smell, taste, magnitude, time, and duration. The primary modes of varieties are here enumerated, viz. 1. The corolla is either mutilate, that is, wanting where it ought naturally to be. This often happens in ipomæa, campanula, ruellia, viola, tussilago, cucubalus. 2. The corolla multiplied, as in campanula foliis urticae, flore duplici and triplici, &c. 3. The corolla full, as in aquilegia flore roseo, C. B. where the impletion is by the petals multiplied, and all the nectaria excluded; aquilegia flore multiplici, C. B. where the impletion is by the nectaria being multiplied, and all the petals excluded. 4. The corolla proliferous, as in ranunculus radice tuberosa, flore pleno and prolifero, T. where the prolification is from the center of the flower; bellis bortensis prolifera, C. B. where the prolification is from the sides of the flower. 5. Luxuriant stems are either bundled, that is, when several stems grow close together in a bundle or packet, so as to appear like one. This is frequently effected by art, as in ranunculus, asparagus, &c. See sect. 274. Or, 6. Luxuriant stems are plaited or twisted, as in birch and hornbeam, &c. See sect. 274. Or, 7. Stems are mutilate or wanting in some plants, which ought naturally to have them. Of this Linnaeus gives
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SECT. CCCX.

The lightest varieties are not worth the care of a true systematic botanist. The florists, by an over-great study and assiduous inspection, have discovered such amazing wonders in flowers, as no man, the most clear-sighted in the world, could ever discern, but those who are versed in this study. The grand objects of their attention are the most beautiful flowers, such as tulips, hyacinths, anemones, ranunculuses, pinks, carnations, auriculas, and polyanthuses. To the hidden varieties of these flowers they have given such names as excite wonder and astonishment. These men cultivate a science peculiar to themselves, the mysteries of which are only known to the adepts; wherefore let no found botanist ever enter into their societies. Their pom-
pous names are such as the following: Phæbus, Apollo, Dædalus, Cupido, the Triumph of Flora, the Glory of Flora, the Splendor of Asia, the Crown of Europe, the Pearl of Holland, Alexander the Great, Charles the XIIth, Julius Cæsar, Emperor Augustus, the Cham of Tartary, the Grand Signior, the Great Mogul, Scipio Africanus, Milton, Tullius Cicero, with 1000 other ridiculous appellations. The common gardeners also have given names, which are neither explained by them, nor capable of explanation, to their almost endless variety of fruits, apples, pears, and stone-fruit, &c. But the order of fungi, to the disgrace of the art, remains to this day a heap of confusion, botanists not knowing in them which is a species, or which is a variety.

**SECT. CCCXI.**

The luxuriance of leaves in opposition and composition very easily happens. The curled and blistered leaves are all monstrous. Opposite leaves in pairs often become starry or whorled, consisting of three or four leaves surrounding the stem in rings, and in that case a quadrangular stem becomes a many-angled one; as *lysimachia lutea major foliis ternis, quaternis, quinins, T.; anagallis caerulea foliis binis ternis fivex adverso nascentibus,*
nascentibus, R.; anagallis Phœnicia fol. amplioribus ex adverso quaternis, T.; salicaria trifolia caule hexagono, T. Fingered leaves often add one or two segments to their usual number, as trisfolium quadrifolium hortense album, C. B. Plants with curled leaves are all monstrous varieties, in the same manner as multiplied corollae in flowers; and therefore no plants furnished with such leaves are natural, but have their origin from waved leaves preternaturally extended, as abium f. petroselinum crispm, C. B. nasturtium hortense crispm, C. B. malva crispa, f. B. laëtuca crispa, C. B. cichorium crispm, T. lapsana folio amplissimo crispo, B. tanacetum folis crispis, B. matricaria crispa, mentha crispa danica, Park. The smell in tanfy, mint, basil, and feverfew, is increased with the curled leaves, which is a singular circumstance. Bladdery or blistered leaves take their rise mostly from wrinkled ones, having the substance of the leaves increased and multiplied, and consequently greatly elevated on the upper side, as ocymum folis bullatis, C. B. laëtuca capitata folis magis rugosis, B. The sapo-naria concava anglica has a singular embossed leaf without the wrinkles, for the margins are contracted, and the leaves become hollow like a spoon. Small cut leaves sometimes take their rise from broad ones,
ones, but this sort of variety is not very common; as *brassica angusto apii folio*, *B. sambucus laciniato folio*, *sonchus asper laciniatus*, *valeriana sylvestris foliis tenuissimè divis*.

**SECT. CCCXII.**

It is generally superfluous to reckon morbid plants, or even the ages of plants, among the varieties. There are different morbid plants mentioned by botanists, according to their different diseases. *Eripylle* of Theophrastus is a white mould, with small brown sessile heads, which is spread over the leaves of plants. This is common in the hops, *lamium purpureum*, *galeopsis retrahit*, *lithospermum arvense*, *acer platanoides*. *Rubigo* is a powder like the rust of iron on the under side of leaves. It is to be seen in *alchemilla vulgaris*, *rubus saxatilis*, *senecio sylvaticus*, and some others. *Clavus* is that disease where the seeds are prolonged into a black horny appearance; as in rye, some of the grasses, and *carexes*. *Ustilago* is that disease by which the flowers and seeds of several plants are reduced into a black powder. Examples of this may be seen in wheat, barley, rye, oats, *marsh scorzonera*, goats-beard, &c. Insects laying their eggs on several plants give rise to various excrescences; as the galls of oak, those of *cistus*, aspen tree, several of the willows,
willows, elm, lime, ground-ivy, and *hieracium myophorum*; those of the *salvia baccifera*, called sage apples, the pulp of which is of a sweet and very agreeable taste; and lastly, those of the scarlet oak, called *kermes*, or scarlet paste. Of the same nature are those substances on the briar called *bedeguar*, covered with green, red, or yellow fibres; and likewise the small bladders on the surface of elm leaves and black poplar; the contorsions of some of the *veronicae*, *cerasiferae*, and *lotus*; the scaly appearance of the fir and rose willow. Insects often cause an impalement and prolification of flowers, as we see the corn feverfew becomes proliferous by means of certain small insects; and the *carduus crispus*, or thistle upon thistle, by the same means bears large full florets, or rather proliferous and leafy, the *pistilla* or pointals growing up into leaves.

**SECT. CCCXIII.**

The colour is very subject to vary, especially from blue or red to white. The principal colours enumerated by botanists are the following: water colour, *hyalinus, aqueus, vitreus*; white, *albus, laeves, niveus*; lead colour, *cinereus, incanus, lividus, plumbaeus*; black, *niger, pullus*; brown, *fuscus, jet black, ater*; yellow, *luteus*; straw colour,
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loured, flavus, sulphureus; flame coloured, ful-
vus, croceus, flammeus; iron coloured, gil-
vus, teplaceus, ferrugineus; red, ruber, jau-
gineus; flesh coloured, incarnatus; scarlet,
coccineus, puniceus; purple, purpureus, Phœ-
niceus; violet coloured, cæruleo-purpureus,
vilaceus; blue, cæruleus; green, viridis,
prasinus. The various colours of plants are
mostly appropriated to particular parts;
thus, black is common in the roots and
seeds, rarely in the seed vessel, scarce ever
in the corolla; green, in the leaves and ca-
lyx, very rarely in the corolla; water colour
common in the filaments and styles; yel-
low in the antheræ, and also in the petals
of autumnal flowers, and the semifloscu-
lous flowers of Tournefort; white is com-
mon in the petals of spring flowers, sweet
berries and roots; red, in the petals of sum-
mer flowers, and in acid fruits; blue and
violet, common in the petals. The co-
lours of flowers are often changed; red into
white, in the flowers of ling, mother of
thyme, betony, pink, viscous campion,
cockle, trefoil, orchis, fox-glove, carduus,
faw-wort, cudweed, rose, poppy, fumito-
ry, and geranium; blue into white, in cam-
panula, Greek valerian, convolvulus, hepata-
tica, colombines, violet, vetch, goats-rue,
milk-wort, viper's-bugloss, alkanet, com-
frey, borrage, hyssop, scabious, blue bot-
tle,
tle, succory; yellow is changeable into white in melilot, agrimony, mullein, tulip, moth mullein, alcea cyanus Turcicus, and corn marygold; white is changed into purple in wood forrel, thorn apple, pease, and daisy; blue into yellow in commelina and crocus; red into blue in pimpernel. Several different changes of colours happen in the petals of some plants; as in comelines the blue is liable to change into red, and also into white; in milk-wort, hepatica, and blue bottle, the same; in marvel of Peru, and primrose, red into yellow and white; in touch-me-not, tulip, and lady’s-finger, yellow into red and white; in wallflower, yellow into blue and white. The same mutability is observable in other parts of plants. Berries change from green to red, and from red to white; and in ripe fruit, whether red, white, or blue, the colour is subject to vary, especially in apple, pear, plum, and cherry trees. Seeds, though rarely, are subject to vary; and such variations in colour are often seen in the seeds of poppies, oats, pease, beans, and kidney beans. The root, though not very subject to change, is found to vary in the common carrot and radish. The leaves frequently become spotted, as in arsmart, some orchises, ivy-leaved ranunculus, Alpine hawk-weed and lettuce; and those of amaranthus,
amaranthbus, or flower-gentle, change their green altogether, and assume another beautiful colour. The whole plant often assumes a colour which is unnatural or foreign to it, as may be seen in some species of eryngo, mug-wort, orrach, amaranthus, purslane, and lettuce.

SECT. CCCXIV.

Aquatic plants commonly have their lower or bottom leaves; and mountain plants, on the contrary, their upper leaves, much cut or divided. Leaves of a different shape or figure are rarely seen on the same plant, yet it happens sometimes, as in euphorbia heterophylla, rudbeckia triloba, lepidium perfoliatum, and balsam virginius. Water plants have their lower leaves, which are under water, finely cut; as in water crowfoot, and some species of stitchwort, cicuta, fium, phellandrium, oenanthe. Mountainous plants, on the contrary, have their lower leaves mostly entire, and the upper ones more cut; as in some species of saxifrage, parsley, anise, and coriander.

SECT. CCCXV.

A natural plant or species should not be marked or distinguished by a name opposed to the varieties. Since varieties are superfluous in botany, this rule is strictly to be observed,
observed, left distinctive marks should be increased without end; for there is surely no occasion to distinguish a natural plant from monsters.

SECT. CCCXVI.

Culture, from whence so many varieties have their origin, is also the best examiner of varieties. The superabundance of nourishment occasioned by culture, has produced your full flowers, sweet, cooling, and agreeable summer fruits, delicate shoots, large and luxuriant herbs, and tender faldads and pot herbs; all which, left to themselves in a poor and meagre soil, do again assume their wild and natural habit. Thus the sweetest grapes become sour, the most agreeable apples become harsh and crabbed, the most grateful pear austere, the mildest and softest almonds bitter, the juicy and succulent peach hard and dry, the smoothest lettuce prickly, the tender pulpy asparagus woody, the most delightful and best tasted cherries exceedingly sour and disagreeable; in fine, corn, and all farinaceous grain, herbage, and fruit of every kind, dwindle and become of no value without culture. The soil changes plants, and from thence varieties arise; and the soil being changed, they return to their original form. This is examplified in the *buxus arborescens,*
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arborescens, box-tree, and buxus humilis, dwarf-box, which, however different in appearance, yet are of the same species; as are also the acanthus mollis and acanthus aculeatus, the soft and prickly bear’s-breech; the cynara aculeata and cynara non aculeata, the artichoke with and without spines, &c.

SECT. CCCXVII.

To collect the different varieties under their respective species, is a task of no less merit, than to place all the species under their respective genera. The strenuous endeavours of the moderns, about the end of the last century, to increase the number of plants, far exceeded the constancy of the antients in distinctly laying down the species; and, like a contagion, infected the science, by the introduction of varieties in the room of species; while on account of the slightest difference a new species was made, to the great detriment of botany; and so far did this method prevail, that varieties were turned into species, and species into genera. This erroneous method of proceeding was first opposed by Vaillant, then by Linnaeus, afterwards by Jussieu, Haller, Royen, Gronovius, and several others; and their opposition prevented the ruin of the science. Several varieties are easily explained and reduced, by comparing the variable
Chap. IX. OF BOTANY.

riable marks of the variety with the natural plant; yet there are many varieties that require both knowledge and experience, e. g. that the *fumaria bulbosa radice cava* and *non cava*, *major* and *minor*, are of the same species, appears by their exceedingly minute *calyx*, by being of the same *genus*, by the scale of the bud, the *structure* of the *leaves*, the *situation* of the *branches*, the *place* of the *bractea*, the *corolla*, the *pod*, the *seeds*, and *stigma*; but the variation is in the *bractea* being divided, and the *root* more or less hollow. There are nine or ten varieties of the *valeriana locusta*, or lamb's lettuce, all which are very different in the *fruit*, and *leaves*, which are more or less cut; yet that they are all of the same species appears by the *forked stalk*, the annual *root*, the *structure* of the *leaves*, *corolla*, and *seed*. There are fifteen or sixteen varieties of the *medicago polymorpha*, being to many different forms of the *fruit* in distinct *varieties*, yet the same species. To conclude, we may truly say that a botanist, who will exercise himself in finding out the varieties, shall never be able to come to the end of the various forms of sporting nature.
SYNONYMS are the different names given to the same plant by different botanists; and these are either of the genera, or species, or varieties. The most antient and original writers among the Greeks and Romans generally agreed in the names of plants, being content with generic names only. The commentators, on account of lame or no descriptions, and a want of figures, in the writings of the antient botanists, have applied their names, I mean the same identical names, to various plants. Those who have given descriptions of plants, when a far greater number were discovered, have given them names also, according to every one's own particular fancy. C. Bauhine, in his Pinax published in 1622, a work which cost him 40 years labour, has collected and joined together all the names of his predecessors, reducing them to 6000 species. Since his time, many curious botanists, by diligent searching, have discovered new plants in every part
part of the world, and have thereby augmented them to double their former number. The systematic botanists, at first disagreeing greatly in the construction of the genera, established many false ones; which occasioned very false names to be given to plants. While as yet there were no rules laid down for specific distinctions, botanists gave such differences or distinctions to the species, as were partly trivial, partly variable, and all of them fallacious. William Sherard, Esq; a great botanist, laboured in the continuation of Bauhine's Pinax; and dying in the year 1728, left the work to Dillenius, who continued this work of Sherard to the year 1747, in which he died. Dr. Sibthorp, successor of Dillenius, is now in possession of this work in manuscript, and continues to augment the same. Haller, in several works of his, has endeavoured to give a compleat list of all the synonymous names of the Swiss plants. Such a compleat list of the synonyms is very necessary and useful to botanists; for, having found the author's name only for the plant in question, we have along with it the names which all other botanists have given to the same plant, and by the references may turn to all the figures and descriptions of the same; and may from thence learn every particular hitherto known concerning...
ing the plant; and lastly, the plurality of names given to one and the same will no longer give us the idea of different plants. The synonyms of the species chiefly belong to botanists; but those of the varieties, which are often superfluous, any one may add them who pleases, that the number of false species may be lessened.

SECT. CCCXIX.

Among synonymous names the best should take the lead, whether it be the select name given by any other botanist, or the writer's own name for the plant. Among synonyms the author's shall stand first, whether it be properly his own, or borrowed from any other. The first then shall be the select name of the species, and the best among all the synonyms. Therefore I think it is wrong for any author to place his own select name of a plant the last among the synonyms, and also the true specific differences after the false and fallacious ones; instances of which may be seen in Haller.

SECT. CCCXX.

The synonyms of the same species are to be joined all together. Botanists lay down their synonyms either by beginning with the most antient, and bringing them down
in the order of time, to the modern ones; or, by beginning with the modern generic names, and ending with the most antient, which LINNAEUS says is his most usual way.

**SECT. CCCXXI.**

Each of the synonyms should begin a new paragraph.

The synonyms are recited in the following different ways by different authors.

1. According to the genera, thus,
   - *Parthenium foliis ovatis crenatis*, Hort.
   - *Ptarmica Virginiana; foliis helenii, Moris. Blaces. 297.*
   - *Ptarmica Virginiana, scabiose austriacae foliis dissectis, Pluk. Alm. 308. tab. 53. fig. 5. and tab. 219. fig. 1. &c.*

2. By blanks beginning the line.
   - *Parthenium foliis ovatis crenatis, &c.*
   - *Ptarmica Virginiana, folis helenii, &c.*
   - *Scabiose austriacae foliis dissectis, Pluk. Alm. 308, &c.*

3. In a continued series without paragraphs.
4. By not repeating the generic name.


5. By an abbreviation with a parenthesis.


The first method is the best, and that which is always used by Linnaeus.

SECT. CCCXXII.

After each synonym the author, book, and page, are to be quoted. It will not be sufficient only to quote the author's name, since one and the same man has often been author of several different works; and there have been often two or more of the same name, as e.g. two Gelners, two Bauhines, two Millers, &c. Neither is it sufficient to quote the work only without mentioning the author, since many have been published under the same title by different authors; as, e.g. Hort. Lugd. by Vorstius, Pavius.
Pavlius, Herman, Boerhaave, Royen; *Hort. Patavin.* by Cortusus, Guilandinus, Schenkius, Veslingius, Marcellus; *Flor. Pari- sian.* by Cornutus, Tournefort, Vaillant, Dalibardus, &c. Authors in quoting their own works commonly omit their own name, and only mention the name of the book, or sometimes only the initial letters of the same; as (Dill.) *Catal. Giff.* or *C. G. Hort. Eltham.* or *H. E. Histflor. Musc.* or *H. M.* The name of the work should be comprehended in one word, and written with a small initial letter, the name of the author beginning with a capital letter. The page should be added in the last place, that the plant may be readily found.

**SECT. CCCXXIII.**

In a compleat enumeration of the synonyms, it is proper to mark the name of the first discoverer, if known, with an asterism.

**SECT. CCCXXIV.**

The vernacular names of different countries are either wholly to be excluded, or placed together at the end of the synonyms.
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CHAP. XI.

HISTORY OF PLANTS.

SECT. CCCXXV.

The history of plants should contain their names, etymologies, classes, generic characters, specific differences, varieties, synonyms, descriptions, figures, places, and culture; times, virtues, uses, when, where, and by whom discovered, &c. From this aphorism we learn, that the history of plants should contain every thing pertaining to them, such as their names, signs, outward appearance, nature, and use. In a word, the history of plants should comprehend,

1. The select or chosen name of the genus to be treated of or described.

2. The etymology or derivation of the generic name, with the proper and literal sense of the original.

3. The class and order to which this genus does belong, according to one or more select systems. The genera to which this particular one has been referred by the different systematical writers.

4. The
4. The natural character of the genus, giving all the possible characteristics or distinguishing marks. The essential character, laying down the most peculiar mark of that genus. The artificial character, distinguishing the genera which are conjoined in that system. The mistakes of authors in their referring this to other genera, to be deduced from the natural character. The genus to which it naturally belongs. A confirmation of the select name of the genus, and why the others are rejected.

5. Next should follow the specific differences or distinctions of each species in their order from others of the same genus.

6. Then all the principal varieties of each species that are to be found in authors, reduced to their proper place; that is, to the respective species to which they do belong.

7. Then all the synonymous names of the chief systematic writers, and all other authors antient or modern, under each plant. The Latin, Greek, English, French, Spanish, Italian, and German names, &c. with their meanings and derivations.

SECT. CCCXXVI.

8. Next should follow a description, which is the natural character of the whole plant, and should describe all its external parts;
parts; and that not in the common way, by barely describing the root, stem, leaves, and fructification, but also particularly noticing the leaf and flower-stalks, the stipulae, bracteae, glands, hairs, buds, foliation, and the whole habit of the plant.

SECT. CCCXXVII.

And such a description should be delivered in the most compendious, yet perfect, and compleat manner, couched only in terms of art, if these are sufficient, according to the number, figure, proportion, situation, and connection of all the parts.

SECT. CCCXXVIII.

Again, a description of a plant should follow the order of its growth, beginning at the root, and so proceeding to the stem, footstalks, leaves, flowers, &c.

SECT. CCCXXIX.

A description should delineate the distinct parts of plants in separate paragraphs; the parts of the plant should be printed in Roman characters, and the description in Italics.

SECT. CCCXXX.

A description should not be too long, tedious, and prolix, nor too short and imperfect;
perfect; for the first includes many vain, superfluous, and variable circumstances; and the other excludes some singular marks, and essential, though small, parts of a plant; as the *stipulae*, *bracteae*, glands, hairs, and such like.

**SECT. CCCXXXI.**

In the description of plants the measure of magnitude is most conveniently taken from the parts of the human body. In describing the parts of plants, Tournefort introduced a measure laid down according to an accurate geometrical scale, which many of his followers have retained; so that the essence of the description consisted in an accurate mensuration of the whole. But as every one conversant in botany very well knows that the parts of plants vary in nothing so much as in that of dimension, Linnaeus very rarely admits any other measure than that arising from the respective length and breadth of the parts compared together. In cases that require actual mensuration, he recommends, instead of Tournefort's artificial scale, the following natural scale of the human body, which is much more convenient, and not less accurate. This scale consists of the following degrees. 1. A hair's breadth (*capillus*), which is the twelfth part of a line. 2. A
line is the length of the crescent at the root of the nail of the finger (not thumb), measured from the skin towards the body of the nail, and is equal to the twelfth part of a Paris inch. 3. A nail (unguis) is the length of a finger nail, and equal to six lines, or half a Paris inch. 4. A thumb (pollex) is the diameter of the first joint of the thumb, and equal to an inch, Paris measure. 5. A palm (palmus) is the diameter or transverse breadth of four fingers extended, or the palm exclusive of the thumb, and equal to three Paris inches. 6. A span (spathama) is the distance between the extremity of the thumb and that of the fore finger, when extended, and equal to seven Paris inches. 7. A great span (dodrans) is the distance between the extremity of the thumb, and that of the little finger, when extended, and equal to nine Paris inches. 8. A foot (pes) is the measure from the bending of the elbow to the base of the thumb, and equal to twelve Paris inches. 9. A cubit (cubitus) measured from the bending of the elbow to the extremity of the middle finger, and is equal to seventeen inches. 10. An arm-length (brachium) from the arm-pit to the extremity of the middle finger, and is equal to twenty-four Paris inches, or two feet. 11. A fathom (orgya) the measure of the human
human stature; the distance between the extremities of the two middle fingers, when the arms are extended, equal, where greatest, to six feet.

SECT. CCCXXXII.

9. Figures of plants should be drawn of the natural size and situation. There should be annexed accurate figures of all the plants, which should represent them in their natural situation and magnitude. The figures of the old botanists often represent the largest trees and smallest herbs of the same bigness; procumbent and creeping plants for the most part erect; which faults ought carefully to be avoided. In large plants, when their true magnitude cannot be represented in the figures, it is proper to exhibit a small branch, and the whole plant in miniature adjoining thereto. Figures consisting only of the outlines, such as those of Fuschius and Plumier, are most easily executed, and represent the plants exceedingly well. The wooden cuts, formerly so much in use, such as those of Rudbeckius, Matthiolus, Gerard, and others, were as good as copper-plates, and of much easier purchase; but are now entirely out of use, to the great detriment of botany. The knowledge of drawing, engraving, and botany, are necessary and requi-
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requisite in finishing good figures of plants; and as any of these accomplishments are more or less wanting, so the figures will be more or less perfect. Hence it is, that botanists, who were well skilled in drawing and engraving, have left the most excellent figures, as Dillenius.

SECT. CCCXXXIII.

The best figures should exhibit all the external parts of plants, even the smallest also of the fructification. For in the smallest parts, especially those of the fructification, there are the most numerous and excellent distinctions, by which to characterize the species. The hairs, glands, stipulae, floral leaves, staminas, and pointals, which were neglected in the figures of the old botanists, should never be omitted in a good figure.

SECT. CCCXXXIV.

10. The native places or stations of plants respect the country, climate, soil, and situation, nature of the ground, earth, and mould. The only true foundation of gardening, and the right cultivation of plants, depends on the knowledge of the native places of their production, from whence the rules and principles of the art ought to be derived. Miller's Gardener's Dictionary
Dictionary lays down the particular culture of every plant; but this method of gardening through all the known species of plants would be too tedious, diffuse, and burdensome. From the natural place of their growth we know where to find the different species of plants for gardens, herbals of dried plants, medicinal and economic uses. The country respects the kingdom, provinces, districts; and, when the plants are very rare and scarce, the places of their growth ought to be most particularly mentioned. The climate respects the latitude, longitude, and altitude of the place, which last is its perpendicular height above the level of the sea. Vaillant was the first who introduced the climates in describing the native places of plants, and this he did with regard to the latitude only. But that the latitude alone is not sufficient, and much less the longitude, appears from this; that places very remote from each other, but under the same latitude, produce plants very different. Rome in Italy, Pekin in China, and New York in America, are situated nearly under the same degree of North latitude; Rome being 41° 51'. Pekin 39° 55', and New York 41° 0'. In like manner Palestine and Florida on the North, and the Cape of Good Hope and Chili on the South, are nearly under the same latitudes; but those countries produce Bb plants
plants very different from one another. It is much more proper to observe the altitude of the place in describing the habitations of plants; thus the aquatic plants of India often agree with those of Europe, as the hooded milfoil, the sun-dew, the water-lily, the arrow-head, and *aldrovanda*. The Alpine plants of Lapland, Greenland, Siberia, Switzerland, Wales, Scotland, the Pyrenean mountains, Olympus, Ararat, and Brazil, are often the same, though growing in places so remote from each other. Suppose a meadow a little higher than the sea, and full of such plants as commonly grow in meadows, and the adjacent ground a little higher still, and further from the sea; this last will produce other plants very different from the meadow: examples of which may be seen everywhere. In describing the habitations of plants, we ought always particularly to mention the soil, situation, nature of the ground, earth, mould, &c. in which they grow. This is very various, being either in the sea, on the sea shore, about fountains or springs, in rivers, or on the banks of rivers, in lakes, ditches, water-pits, ponds, pools, fens, marshes, bogs; on the tops of very high mountains, and in thick forests on their sides; on little hills, declivities, cliffs, rocks, stones, caverns, old high walls; groves, woods, hedges, and shady places.
places; heaths, commons, fields, fallows, closes, plowed lands, gardens, dunghills, rubbish; meadows, pastures, loam, sand, gravel, clay, chalk or marl; or lastly, on the roots, trunks, and branches of trees or other plants. In this respect plants may be arranged into six general divisions, according to their places of growth above recited, viz. aquatic, Alpine, hilly, shady, campaign, and parasitic plants, each of which contains several subdivisions. We shall give examples of each in their order.

1. In the sea, many of the conservas, some charas, ulvas or lavers, all the fucuses, zoster marina, gras wrack; potamageton marinum, sea pondweed; rupia marina, sea gras. On the sea shores, hippocrae rhamnoides, sea buckthorn; atriplex portulacoides, sea purslane; atriplex laciniata, bastard, serrata, littoralis, pedunculata, jagged sea orrache, wild orrache, indented sea orrache, gras-leafed orrache, stalked sea orrache; scirpus maritimus, round-rooted bastard cyperus; rumex maritimus, golden dock; after tripolium, sea star-wort; glaux maritima, sea milk-wort, or black salt-wort; eryngium maritimum, sea holly; arenaria peploides, sea chickweed; stafice limonium, sea lavender; artemisja maritim, sea wormwood; plantago maritima, sea plantain; plantago coronopus, buckthorn plantain; triglochin maritimus, sea spiked gras; crambe maritima, sea colewort; lotus maritimus,
maritimus, sea lotus; pisum marinum, sea pea; ligusticum Scoticum, Scottish sea parsley; salicornea Europaea, marsh samphire; salicola kali, prickly glass-wort; chenopodium maritimum & fruticosum, sea blite and shrub stonecrop; bunias cakile, sea rocket; arena-ria rubra marina, sea spurrey; cochlearia Anglica & Danica, English and Danish scurvy-grass; with many others. In lakes, &c. Isoetes lacustris, quill-wort; Sparganium natans, leaf bur-reed; Nymphaea lutea & alba, yellow and white water lily; Potamogeton natans, perfoliatum & lucens, broad-leaved, perfoliate and long-leaved pondweed; Myriophyllum spicatum & verticillatum, spiked and verticillated water milfoil; Ceratophyllum demersum, horned-leaved pondweed; Scirpus acicularis & lacustris, leaf upright club-rush and bull-rush; Typha latifolia & angustifolia, great cats-tail, and narrow-leaved cats-tail; Arundo phragmites, common reed grass; Equisetum fluviatile, river horse-tail; Lobelia dortmanna, Clusius’s water gladiolus; Subularia aquatica, awlwort; Limosella aquatica, bastard plantain; Plantago uniflora, grass-leaved plantain, &c. In more shallow waters; Potamogeton crispum & compressum, greater water caltrops, small branched pondweed with a flat stalk; Potamogeton pedinatum, gramineum, pusillum, fennel-leaved, grass-leaved, and small grass-leaved pondweed; Zanichellia palustris, horned fruited
fruited pondweed; callitriche verna & autumnalis, vernal and autumnal star-wort; utricularia vulgaris & minor, greater and lesser hooded milfoil; stratiotes aloides, water soldier; hydrocharis morsus, frogs-bit; ranunculus aquatilis, various leaved water crowfoot; sagittaria sagittifolia, arrowhead; butomus umbellatus, flowering rush; alisma plantago aquatica & ranunculoides, greater and lesser water plantain; bottonia palustris, water violet; hippocastanum vulgaris, mare's-tail; phellandrium aquaticum, water hemlock; oenanthe fistulosa & crocata, water and hemlock drop-wort; cicuta virofa, long-leaved water hemlock; fium latifolium & nodiflorum, great and creeping water parsnip; fison inundatum, least water-parsnip; iris pseudacorus, yellow water flower-de-luce; polygonum amphibium, perennial arsmart; fontinalis antipyretica, greater water moss; acorus calamus, sweet flag; menyanthes trifoliata, water trefoil; ranunculus lingua, great spear-wort; aira aquatica, water hair-grass; poa aquatica, reed meadow-grass; festuca fluitans, flote fescue grass; montia fontana, water chickweed; veronica beccabunga, brooklime; nasturtium aquaticum, water cressles; pilularia globulifera, pepper-grass; rumex aquaticus, water dock; phalaris arundinacea, reed canary-grass; scirpus palustris, club-rush; othonna palustris, marsh fleabane; osmunda regalis, osmund royal; B b 3 lythrum
lythrum salicaria, purple spiked loose-strife; lycopus Europæus, water horehound; senecio paludosus, bird's-tongue; arundo calama-gratis, branched reed-grasfs; lysimachia thyrsiflora & vulgaris, tufted and yellow loose-strife; eupatorium cannabinum, hemp agrimony; centella vulgaris, tufted and yellow loose-strife; menlha aquatica, water mint; hydrocotyle vulgaris, marsh penny-wort; teucrium scordium, water germander; carica pseudo-cyperus, bastard carex; sparganium erectum, great bur-reed; acrosticum thelypteris, marsh fern; sambthrium amphibia, marsh fern. In places that are overflown in the winter, such plants as the following; betula alnus, the alder; salix pentandra, fragilis, aurita, repens, sweet, crack, round-leaved, and creeping willow; juncus articulatus & bulbosus, jointed leaved and bulbose rush; triglochin palustris, arrow-headed grass; sanguisorba officinalis, burnet; cornus succisa, dwarf honeysuckle; epilobium palustre, marsh willow-herb; veronica scutellata, narrow-leaved water speedwell; alopecurus geniculatus, flote fox-tail; carex caespitosa, acuta, &c. turfy and brown carex; caltha palustris, marsh marygold; ranunculus auricomus, sweet wood crowfoot; gentiana pneumonanthe, calathian violet; equisetum palustre, marsh horse-tail; trifolium fragiferum, strawberry trefoil; lathyrus palustris, marsh chickling-vetch; inula·
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1. In spongy and spouty ground; 
   *Linum rhodiola*, all seed, &c. In spongy and spouty ground;
   *Viburnum opulus*, marsh elder; *Myrica gale*, gale, or Dutch sweet willow; *Geum rivale*, water avens; *Parnassia palustris*, gras of Parnassus; *Spiraea ulmaria*, meadow sweet; *Comarum palustre*, purple marsh cinquefoil; *Carex flava*, yellow carex, &c.; *Angelica sylvestris*, wild angelica; *Gallium palustre*, white lady's-bedstraw; *Nardus stricta*, mat-grass; *Pedicularis palustris*, marsh lourewort. In bogs and turfy ground; *Sphagnum palustre*, common bog-moss; *Sphagnum amphilaceum*, common sphagnum; *Scirpus caespitosus*, dwarf club-rush; *Eriophorum polystachion*, cotton-grass; *Carex pulicaria*, flea carex; *Juncus effusus*, common soft-rush; *Erica tetralix*, cross-leafed heath; *Vaccinium oxycoccos*, cranberries, sun-dew, butter-wort; *Equisetum limosum*, smooth horse-tail; *Ophrys paludosa*, the least orchis.

2. On or near the tops of very high mountains, or growing in forests on the sides of such high mountains. These are called Alpine plants; *Betula nana*, dwarf birch; *Salix herbacea*, herbaceous willow; *Arbutus Alpina*, mountain strawberry tree; *Dryas octopetala*, mountain avens; *Sibbaldia procumbens*, baf tard cinquefoil; *Alchemilla Alpina*, cinquefoil lady's-mantle; *Rhodiola rosea*, rose-wort; *Saxifraga nivalis*, oppositifolia, *Aizodes*, *Cae spitosa*, mountain, mountain heath—
like, yellow mountain, small mountain fengreen; *trollius Europaeus*, globe flower; *rumex digynus*, round-leafed mountain forrel; *draba incana*, wreathen podded whitlow-grass; *viola biflora* & *montana*, Welsh and yellow violet; *anthericum calyculatum*, Scottish asphodel; *tussilago frigida*, mountain colts-foot; *sonchus Alpinus*, mountain sow-thistle. 3. In groves and woods grow the shady plants; as *fagus sylvestris*, beech tree; *fraxinus excelsior*, ash tree; *corylus avellana*, hazle nut; *tilia Europae*, lime tree; *acer platanoides*, greater maple; *ramnus catharticus*, buckthorn; *prunus padus*, cluster cherry; *euonymus Europaeus*, spindle tree; *ribes Alpinum*, mountain currants; *daphne mezereon*, spurge olive; *ramnus frangula*, blackberry-bearing alder; *rosa eglanteria*, sweet briar; *rubus fruticosus*, bramble; *milium effusum*, millet-grass; *cirsia Alpina*, lutetiana, mountain and common enchanter’s nightshade; *panicula Europae*, tanicle; *galeopsis galeobdolon*, yellow nettle-hemp; *convallaria majalis*, May-lily; *ornithogalum luteum*, yellow star of Bethle- hem; *fumaria bulbosa*, bulbous fumitory; *lythrus lutifolius*, broad-leaved pease everlasting; *primula veris*, cowslips; *pars quadrifolia*, herb paris; *campanula trachelium*, great throat-wort; *asperula odorata*, woodruff, hart’s-tongue; *melampyrum nemorum*, crested cow-wheat; *pinus sylvestris* & *abies*, Scotch
Scotch and common fir; *taxus baccata*, yew tree; *juniperus*, common juniper; *berberis vulgaris*, barberry; *populus tremula*, trembling poplar; *betula alba*, birch tree; *vaccinium myrtillus*, black whorts; *pyrola*, winter-green, all the forts; *anemone nemorosa*, wood anemone; *juncus pilosus*, common hairy wood-rush; *lycopodium clavatum*, common club-moss; *annotinum*, Welsh club-moss; *equisetum sylvare*, wood horse-tail; *hyemale*, shave-grass; *melampyrum sylvaticum*, yellow cow-wheat; *gla-phalium syl-vestre*, upright cudweed. 4. On heaths, commons, fields, fallows, &c. such plants as *rubus caesius*, dewberry bush; *ononis spinosa*, prickly rest-harrow; *convolvulus arvensis*, small bindweed; *mentha arvense*, corn-mint; *papaver dubium*, long smooth-headed poppy; *pium arvens*, common pea; *myagrum sativum*, gold of pleasure; *erysimum cberiantboides*, treacle worm-feed; *lapsana communis*, nipple-wort; *ervum tetraspernum*, smooth tare; *euphorbia helio-scopia*, wart-wort; *panicum crus galli*, loose panic-grafs; *dianthus armeria*, Deptford pink; *avena satua*, bearded wild oats; *lolium anuum*, annual darnel; *agrestis spica venti*, silky bent-grafs; *bromus fcalinus & arvensis*, field and corn brome-grafs. In closes, plowed lands, gardens, dunghills, rubbish, &c.; *agopodium podagraria*, herb-gerard; *leontodon taraxacum*, dandelion; *gallium*
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gallium aparine, goose-gras; æthusa cynapium, fool’s-parfley; fonchus oleraceus, low-thistle; chenopodium polyspermum, vulvaria, viride, hybridum, round-leaved blite, stinking orache, green blite, maple-leaved blite; thlaspi burfa pasoris, shepherd’s purse; lamium purpureum, red dead-nettle; veronica agrestis, germander speedwell; geranium cicutaria, hemlock-leaved cranesbill, and several others; urchica urens, common nettle; euphorbia peplus, petty spurge; amaranthus blitum, least blite; ulmus campestris, common elm; sambucus nigra & ebulus, common and dwarf elder; marubium album, white horehound; nepeta cataria, cat-mint; artemisia absynthium, common wormwood; plantago major, great broad-leaved plantain; bryonia alba, white briony; cynoglossum officinale, hound’s-tongue; leonurus cardiaca, mother-wort; datura stramonium, thorn-apple; hyoscyamus albus & niger, black and white henbane; hordeum murinum, wall barley; verbena officinalis, vervain; lamium album, white dead-nettle; veronica chamaedrys, wild germander; reseda luteola, weld; malva sylvestris, common mallow; polygnum aviculare, knot-grais; senecio vulgaris, common rag-wort; with many more. In meadows and pastures, &c. such plants as the following; pyrus malus & communis, apple and pear tree; lolium perenne, perennial darnel; campanula rotundifolia & patula, leffer
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leaff round-leafed and field bell-flower; *hypericum quadrangulare*, St. Peter’s-wort; *trifolium pratense*, meadow trefoil; *spirea filipendula*, drop-wort; *lotus corniculata*, bird’s-foot trefoil; *aira caespitosa* & *caryophyllæa*, turfy and silver hair grass; *cynosurus cristatus*, crested hair-grafs; *poa pratensis*, great meadow-grafs; *avena flavescens*, yellow oat-grafs; *carex panicea*, pink carex; *lychnis dioica*, white and red cam- pion; *phleum pratense*, meadow cats-tail; *alopecurus pratensis*, meadow foxtail-grafs; *leontodon autumnale*, yellow devil’s-bit; *linum catharticum*, purging flax; *tragopogon pratense*, yellow goat’s-beard; *melampyrum pratense*, meadow cow-wheat. In sandy ground; *salix arenaria*, sand willow; *spar- tium scoparum*, common broom; *genista tinctoria*, dyer’s weed; *ligustrum vulgare*, privet; *elymus arenarius*, sea lyme-grafs; *arundo arenaria*, sea reed-grafs; *carex arenaria*, sea carex; *dianthus arenaria*, stone-pink; *scleranthus perennis*, perennial knawel; *thymus serpillum*, mother of thyme; *antirrhinum linaria*, toadflax; *statice armeria*, thrift; *astragulus arenarius*, purple moun- tain milk-wort; *fesluca ovina*, sheep’s fescue-grafs; *ceraflium semifedendrum*, least mouse-ear chickweed; *filago montana*, least cud- weed; *arenaria purpurea*, purple-flowered spurrey; *bromus tectorum*, wall brome; *valeriana locustæ*, lamb’s-lettuce; *myosurus mi- minus,*
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nimus, mouse-tail; phleum arenarium, sea canary-grasfs; airc canescens & præcox, grey and early hair-grass. In clayey ground; tussilago farfara, common coltsfoot; anthyllis vulneraria, lady’s-finger; potentilla reptans, common cinquefoil; plantago media, hoary plantain; cichoreum intybus, wild succory; inula dysenterica, middle fleabane. In chalky ground; hippocrepis comosa, tufted horseshoe-vetch; bedysfarum onobrychis, saffron; trifolium scabrum, oval-headed trefoil; verbena officinalis, vervain; campanula glomerata, lesser throat-wort; reseda lutea, base rocket; cheiranthus luteus, wall-flower.

5. On dry, sandy, and gravelly hills, scorched with the sun, grow, jalis caprea, common fallow; prunus spinosa, floe tree; crategus oxyacantha, hawthorn; rosa canina, red flowered dog’s-rose; medicago falcata, yellow medick; trifolium repens, creeping trefoil; alchemilla vulgaris, lady’s-mantle; cucubalus behen, white corn campion; ranunculus bulbosus, bulbose crowfoot; plantago lanceolata, rib-wort plantain; avena pratensis, meadow oat-grasfs; daucus carota, bird’s-neft; gentiana campestris, vernal dwarf gentian; trifolium agrarium, hop trefoil; holsus lanatus, meadow soft-grasfs. On the declivities, or dry sloping sides, of little hills; quercus robur, oak; crategus aria, white beam tree; forbus aucuparia, mountain ash; prunus domesticus, garden plum;
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plum; lonicera periclymenum, honeysuckle; rosa spinosissima, burnet rose; carpinus betulus, hornbeam; acer campestre, common maple; trifolium montanum, mountain trefoil; hypericum perforatum, perforate St. John's-wort; geranium sanguineum, bloody cranebill; anemone pulsatilla, pasque flower; saxifraga granulata, white saxifrage; polygonum vulgaris, milk-wort; achillea millefolium, yarrow; opbiglossum vulgare, adder's-tongue; melampyrum cristatum, crested cowwheat. In rocky and stony places; rubus idaeus, raspberry bush; sedum telephium, rupestre, reflexum, album & acre, orpine, St. Vincent's rock stone-crop, yellow stone-crop, white flowered and wall stone-crop; sempervivum tectorium, houseleek; polypodium vulgare, common polypody; asplenium ruta muraria, wall-rue; acrosticum septentrionale & ilvensi, forked and hairy fern; convallaria polygonatum & multiflora, sweet smelling and common Solomon's seal; geranium Robertianum, herb Robert; potentilla rupestris, bastard upright cinquefoil; hypericum montanum, mountain St. John's-wort; rubus saxatilis, stone bramble; melica nutans, melick-grafts; poa compressa, creeping poa; silene nutans, Nottingham catchfly; aira flexuosa, mountain hair-grafts.

6. On the trunks, branches, and roots of trees and other plants; viscum album, mistletoe; cuscuta Europae, dodder; monotropa
tropa hypopytis, bird's-neft smelling like primrose roots; lathraea squamaria, toothwort; orobanche major, broom-rape; besides various mosses, lichens, and funguses. In loam, and the common black vegetable earth or mould (which is the principal food of plants), most plants will grow, as appears by gardens in which plants from various soils do thrive. From what has been said it appears, that the nature of any ground or soil may be readily known from the bare inspection of the plants that grow in the same. Thus, the potentilla argentea, tormentil cinquefoil, indicates clay under the surface; melampyrum cristatum, crested cow-wheat, grows only in hilly ground; melampyrum arvense, purple cow-wheat, in plowed land; melampyrum nemorum, wood cow-wheat, in groves or shady places; melampyrum pratense, meadow cow-wheat, in meadow or pasture ground; melampyrum sylvaticum, yellow cow-wheat, in woods; pedicularis sylvatica, common louse-wort, in spungy or spouty ground;aira cærulea, purple hair-grass, in turfy ground.

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The time of the whole duration of plants, or the years of their age, the time of their germination, that is, their sprouting or springing out of the ground after sowing, the time of their foliation, or leafing
ing, flowering, sleeping, watching, fruiting, and shedding their leaves, plainly indicates the climate, or points out to us how one climate differs from another. And first of germination, which is the time that seeds require to spring out of the ground, or to put forth their seminal leaves after sowing. And in this respect the seeds of plants differ amazingly, from one or two days to as many years. Thus, e.g. the millet and wheat come up in one or two days; the navew, rocket, blite, mustard, turnip, spinach, and kidney-bean, in three or four days; the dill, lettuce, cucumber, gourd, and cressles, in four or five days; the beet and radish in six days; barley in seven days; orach in eight days; cabbage in ten; beans require from fifteen to twenty; the onion comes up in nineteen or twenty days; the hyssop in thirty days; parsley feed in forty days; smallage in forty or fifty days; the peach, almond, walnut, chestnut, and piony, in one year; the cornel and hazle-nut in two years after sowing. The foliation or leafing of plants is the time of the spring or summer they unfold, expand, or put out their first leaves. The order of the leafing of trees at Upfal in Sweden, 1755, is as follows:

1. Red elder,
2. Honeysuckle,
3. Gooseberry,
4. Red
4. Red currant,  
5. *Spiraea frutescens,*  
7. Spindle tree,  
8. Shrub cinquefoil,  
9. Common elder,  
10. Privet,  
11. Quicken tree,  
12. The osier,  
13. Alder,  
15. Apple tree,  
16. Cherry tree,  
17. Water elder,  
18. Birch,  
19. Hazle,  
20. Elm,  
21. Dog rose,  
22. Pear tree,  
23. Plum tree,  
24. Buckthorn,  
25. Berry-bearing alder,  
26. Lime tree,  
27. Beech,  
28. *Aria Theophrasti,*  
29. Asp,  
30. Maple,  
31. Oak,  
32. Ash.

The order of the leafing of some trees and shrubs in Norfolk, in the year 1755,
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as observed by Mr. Stillingfleet, is as follows:

1. Honeysuckle, Jan. 15.
2. Gooseberry, Mar. 11.
3. Currant, Mar. 11.
4. Elder, Mar. 11.
5. Birch, Apr. 1.
7. Raspberry, Mar. 3.
8. Bramble, Mar. 3.
11. Apricot, Apr. 6.
12. Peach, Apr. 6.
13. Filberd, Apr. 7.
15. Alder, Apr. 7.
17. Elm, Apr. 10.
18. Quince, Apr. 10.
19. Marsh elder, Apr. 11.
20. Wych elm, Apr. 12.
25. Chesnunt, Apr. 16.
26. Willow, Apr. 17.
27. Oak, Apr. 18.
29. Maple, Apr. 19.
30. Walnut, Apr. 21.

C e 31. Plane,
31. Plane, 
32. Black poplar, 
33. Beech, 
34. *Acacia robinia*, 
35. Ash, 
36. Carolina poplar, 
Flowering is the time that each species of plants puts forth their first flowers. Thus at Upsal in 1755:
Common coltsfoot, 
Spring *crocus*, 
Snow-drops, 
Pile-wort, 
Yellow star of Bethlehem, *Mezereon*, 
Perfoliate honeysuckle, 
Noble liver-wort, 
Yellow water lily, 
White poplar, 
Wild black hellebore, 
Black poplar, 
Butter-bur, 
Garden *polyanthus*, 
Wood *anemone*, 
Sweet violet, 
Oxier, 
Tuberous moschatel, 
Wood-forrel, 
Bear's-ear, 
Wild English daffodil, 
Marsh marygold, 
Tulip, 

Ground-ivy,
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Globe flower, 27.
Lily of the valley, 30.
Apple tree, 2.
Buckbean, 3.
Gooseberry bush, June 7.
Dame's-violet, 7.
Barberry, 8.
Yellow water flag, 10.
White campion, 14.
Water elder, 14.
Grass of Parnassus, 16.
Ox-eye daisy, 17.
Eye-bright, 17.
Bulbose lily, 18.
Deadly nightshade, 18.
Wall pepper, 20.
Yellow day-lily, 20.
Blue bottle, 22.
Yellow loose-strife, 22.
Rose-bay willow herb, 23.
Golden rod, 23.
Mock orange, 23.
Tway blade, 26.
Yellow medic, 27.
White briony, 28.
Corn marygold, 29.
Feverfew, 29.
Maiden pink, 29.
Field scabious, 29.
Common elder, 29.
Small bindweed, July 1.

C c 2 Giant
Giant throat-wort, July 2.
Meadow rue, 2.
Purple fox-glove, 4.
Meadow sweet, 4.
Six o'clock primrose, 4.
Common yarrow, 6.
Yellow lady's-bedstraw, 6.
St. John's-wort, 6.
Common briar, 7.
Mother-wort, 7.
Deptford pink, 8.
Burdock, 9.
Mug-wort, 10.
Water betony, 10.
Tree sow-thistle, 11.
Wild succory, 12.
White stone-crop, 14.
Red-day lily, 16.
Dwarf elder, 17.
White lily, 20.
Calathian violet, 26.
Orpine, Aug. 1.
Devil's-bit, 4.
Meadow saffron, 28.

The times of flowering of some plants at Stratton in Norfolk, as observed by Mr. Stillingfleet in 1755.

Red dead-nettle, Jan. 23.
Laurustinus, 23.
Snow-drops, 26.
Common daisy, 26.
Hasel
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Hazel tree, Feb. 22.
Sallow, Mar. 11.
Scurvy-grass, 21.
Asp, 21.
Alder, 26.
Sweet violet, 28.
Pile-wort, 28.
Primrose, 29.
Yew tree, 29.
Elm tree, Apr. 1.
Apricot, 1.
Wild English daffodil, 1.
Red currants, 3.
Peach, 6.
Dandelion, 10.
Wood anemone, 10.
Dog's-mercury, 12.
Strawberry, 13.
Gooseberry, 13.
Turnips, 15.
Ground-ivy, 16.
Plum tree, 16.
Wood-forrel, 16.
Marsh marigold, 16.
White willow, 17.
Oak, 18.
Cherry tree, 18.
Wall-flower, 21.
Ash, 22.
Buckbean, 22.
Sycamore, 25.
Hornbeam, 25.

Wild
Wild cicely, Apr. 25.
Wild germander, 26.
Lilac, 27.
Birch tree, 27.
Sweet wood crowfoot, 28.
Bugle, 29.
Avens, May 1.
Water violet, 3.
Lamb's-lettuce, 4.
Cowflips, 4.
Wild valerian, 4.
White faxifrage, 6.
Woodroof, 8.
Solomon's seal, 10.
Horse-chesnut, 12.
Bulboso crowfoot, 14.
Hedge-mustard, 16.
Earth-nut, 20.
Columbines, 25.
Clover, 37.
Cuckow flower, 39.
Water elder, June 2.
Bramble, 5.
Sanicle, 8.
Field scabious, 12.
Common mallow, 15.
Yarrow, 18.
Wheat and rye, 21.
Corn marygold, 23.
Wild succory, 28.
Blue bottles, 28.
Calathian violet, July 2.
Maiden
Maiden pinks,        July  7.
Kidney-beans,        10.
White lily,          11.
Mug-wort,           16.
Water hemp agrimony, 18.
Penny-royal,          22.
Great bindweed,      27.
Tree sow-thistle,     28.
Devil’s-bit,         28.
Rue,                Aug.  1.
Tansey,             5.
Common wormwood,    9.
Burdock,             12.
Vervain mallow,     15.
Yellow devil’s-bit,  21.
Smallage,           29.
Teasel,             29.

From the blow of the snow-drops to that of the meadow saffron, at Upfal, is about 135 days, at Norwich about 190 days. The grass of Parnassus is the forerunner of hay-harvest; and the meadow saffron of sowing wheat.

The watching or vigils of plants are the precise times of the day that their flowers open and shut. Such flowers as observe a determinate time of opening and shutting are called solar; and are of three sorts, viz.

1. Meteorical, which observe the hour of expanding with less accuracy, but open sooner or later according to the degree of shade,
2. **Tropical** are those which open in the morning and shut up before night, but the time of their opening is sooner or later as the days increase or decrease; therefore they observe the Turkish or unequal hours.

3. The third sort of solar flowers is called the **Equinoctial**. These open precisely at a certain hour of the day, and generally shut up every day at a determinate hour, and therefore observe European or equal hours.

Here follow the most common solar flowers, with their times of opening and shutting.

<table>
<thead>
<tr>
<th>Solar Flowers</th>
<th>Open</th>
<th>Shut</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Leontodon taraxacum, dandelion</td>
<td>5 6 8 9</td>
<td></td>
</tr>
<tr>
<td>2. Leontodon hispidum, rough dandelion</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>3. Leontodon autumnale, yellow devil’s-bit</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>4. Hypochaeris maculata, spotted hawkweed</td>
<td>6</td>
<td>4 5</td>
</tr>
<tr>
<td>5. Hypochaeris radiata, long-rooted hawkweed</td>
<td>7 8</td>
<td>2</td>
</tr>
<tr>
<td>6. Hypo-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6. *Hypochaeris glabra*, smooth hawkweed, 9 12 1
7. *Hieracium auricula*, narrow-leafed hawkweed, 8 2
8. *Hieracium murorum*, French or golden lung-wort, 6 7 2
9. *Hieracium umbellatum*, narrow-leafed bushy hawkweed, 6 5
10. *Hieracium sabaudum*, broad-leafed bushy hawkweed, 7 12
11. *Hieracium aurantiacum*, golden mouse-ear, 6 7 3 4
12. *Crepis teetorum*, smooth succory hawkweed, 4 5 10 12
13. *Crepis Alpina*, Alpine bastard hawkweed, 5 6 11
14. *Crepis rubra*, red flowered Apulian hawkweed, 6 7 12
15. *Picros echioïdes*, ox’s-tongue, 4 5 12 9

16. *Sonchus*
16. *Sonchus arvensis*, tree sow-thistle, 6 7 10 12
17. *Sonchus oleraceus*, common sow-thistle, 5 11 12
18. *Sonchus Alpinus*, blue flower Alpine sow-thistle, 7 12
19. *Sonchus palustris*, marsh sow-thistle, 6 7 2
20. *Lactuca sativa*, garden lettuce, 7 10
21. *Scorzonera Tingitana*, Tangier viper’s-grass, 4 6 10
22. *Tragopogon pratense*, yellow goat’s-beard, 3 5 9 10
23. *Tragopogon Columnae*, Columna’s goat’s-beard, 5 6 11
24. *Tragopogon Dalechampii*, Dalechampius’s great hawkweed, 6 7 12 4
25. *Lapsana rhagadiolus*, rhagadiolus, 5 6 10 1
26. *Lapsana stellata*, starry hawkweed, 7 8 2
27. *Lapsana*
Chap. XI. OF BOTANY.

27. *Lapsana glutinosa*, glutinous nipple-wort,

28. *Cichoreum intybus*, wild succory,

29. *Nymphaea alba*, white water lily,

30. *Calendula arvensis*, field marigold,

31. *Calendula pluvialis*, violet and white African marigold,

32. *Papaver nudicaule*, yellow flower wild poppy, with a naked stem,

33. *Hemerocallis fulva*, red day lily,

34. *Convolvulus tricolor*, convolvulus minor,

35. *Malva Caroliniana*, Carolina mallow,

36. *Alyssum sinuatum*, mad-wort, with indented leaves,

37. *Anthericum ramosum*, branched spiderwort,

38. *Arenaria*
<table>
<thead>
<tr>
<th>No.</th>
<th>Flower Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>38.</td>
<td>Arenaria rubra</td>
<td>purple flowered spurrey</td>
</tr>
<tr>
<td>39.</td>
<td>Anagalis arvensis</td>
<td>pimpernel</td>
</tr>
<tr>
<td>40.</td>
<td>Anagalis Monelli</td>
<td>Monellus's narrow-leaved pimpernel</td>
</tr>
<tr>
<td>41.</td>
<td>Portulaca oleracea</td>
<td>garden purslane</td>
</tr>
<tr>
<td>42.</td>
<td>Dianthus prolifer</td>
<td>proliferous pink</td>
</tr>
<tr>
<td>43.</td>
<td>Mesembryanthemum barbatum</td>
<td>star-pointed ficoides</td>
</tr>
<tr>
<td>44.</td>
<td>Mesembryanthemum crystallinum</td>
<td>diamond ficoides</td>
</tr>
<tr>
<td>45.</td>
<td>Mesembryanthemum nodiflorum</td>
<td>fig marygold of Naples</td>
</tr>
<tr>
<td>46.</td>
<td>Mesembryanthemum linguiforme</td>
<td>tongue-leafed ficoides</td>
</tr>
<tr>
<td>47.</td>
<td>Oenothera biennis</td>
<td>night primrose, opens at</td>
</tr>
</tbody>
</table>

From the above-mentioned flowers an hour-index may be formed, or a method of
of discovering the true time of the day, after having excluded the meteorical and tropical flowers, thus:

At 3. Tragopogon pratense, No. 22. of the list.
4. Leontodon hispidum, 2.
5. Sonchus oleraceus, 17.
10. Malva Caroliniana, 35.
  1. Dianthus prolifer, 42.
  2. Sonchus palustris, 19.
  3. Leontodon hispidum, 2.
  6. Oenothera biennis, 47, opens.
  7. Papaver nudicaule, 32.
  8. Hemerocalis fulva, 33, &c.

The calendula pluvialis, 31, opens between six and seven in the morning, and shuts at four in the afternoon, if the weather is dry; but if it opens not its flowers at seven in the morning, you are sure to have rain that day. There is but one exception from this rule, and that is, if there comes
comes rain with thunder, the prognostic from this flower is then not to be depended on. If the *fonchus Sibiricus*, or Siberian sow-thistle, shuts up its flowers in the night-time, the following day is generally fine; but if its flowers keep open all night, the following day is generally rainy.

Of the sleep of plants (as we may call it) in the night, we have spoken somewhat in chapter V. sect. 133. This sleep of plants is a certain position or situation of their leaves very different from that they have by day, and takes place almost in every species of plants. In those with simple leaves it is in the four following ways. 1. By conniving, when two opposite leaves are so closely applied to one another by their upper surface, as if they were but one leaf, by which means the tender buds of the future leaves and fructification are preserved as under a cover from the injuries of the night air; as in garden orache, and common chickweed. 2. By including, when alternate leaves during the night lie close to the stem, and thereby include and guard the tender buds, boughs, or flowers; as in *œnothera mollis*, or hairy tree primrose. 3. By surrounding, when the leaves, which by day have a horizontal position, are raised upwards in the night, and surround both the stem and tops of the young shoots,
Chap. XI. OF BOTANY.

hoots, in form of a tunnel, under which the tender flowers and young leaves are covered and preserved from being hurt or injured; as in mandrake and thorn-apple.

4. By guarding, when the uppermost leaves with their long footstalks, which stood before in a horizontal position, now hang down quite round, and form as it were a vault, to preserve the flowers and tender leaves from the wind, dew, rain, and other external injuries; as in impatiens noli tangere, or quick-in-hand. In the plants that have compound leaves this night position of their leaves is in the six following ways.

1. By folding together, when the partial leaves are laid close to one another, like the leaves of a book, thereby covering their upper surfaces; as in sweet pea, or painted lady, and common bean.

2. By involving, when the partial leaves only connive, or come close together at top, and all of them together form a cavity to include and guard the tender flower; as in bladder trefoil, and heart trefoil.

3. By diverging, when the partial leaves approach one another at the base, but spread open at their extremities or tips; as in common melilot.

4. By hanging down of the partial leaves, that the young shoots be not too much loaded by the dew or rain, or shaken by the wind; as in white lupine.

5. and 6. By inverting and imbricating, or lying over
one another like tiles, that the upper and more tender surface of the partial leaves may be covered, and the common footstalks defended from wind, rain, and storms; as in almost all the species of *caffia*, tamarind tree, logwood, most species of the *mimosa* or sensitive plant, and triple-thorned *acacia*.

Now this nocturnal change in the position of the leaves of plants, which we call sleep, may be ascribed by some, partly to the darkness, and partly to the cool air, of the night. But that these are not the sole cause of this phenomenon appears from hence, that the same plants, though placed in a stove, where the degree of heat is the same both day and night, do notwithstanding at their usual hours in the evening contract their leaves, and go to sleep, and open or expand them again very early in the morning; and, which is very remarkable, that they observe the same vicissitudes of contracting and expanding their leaves, whether the window shutters of the stove are shut or open. Let it be observed, that as animals while young and tender sleep most, so also do plants in their young state, but when grown up they indulge less in this respect.

The next thing to be observed, is the time that plants ripen their fruits and seeds. Common barley sown in Lapland May 31, 1732, was cut July 28, consequently

\[ \text{ripened} \]
ripened in 58 days. The same sort of barley sown at Upfal Mar. 6, 1750, was cut Aug. 4, and ripened in 151 days. And we find that at Upfal the medium is 110 days, in Scania 90 days, and in Lapland 60 days. For as eggs require a fixed time for the exclusion of the young, so the barley does in different provinces to ripen the seed, as appears by the above examples. And thus should observations be made on other plants as to the time of ripening their seeds.

Defoliation is the time of autumn, when trees shed their leaves, and thereby point out the progress of autumn, and the approach of the ensuing winter. The ash is among the first that sheds, and the last that puts out its leaves. The first fall of the leaves of trees with us is about the autumnal equinox. We ought carefully to observe also the first blowing of the meadow fassion.

The time of the duration of plants comprehends the years of their age; which in many are easily reckoned from the internal concentric circles or rosy rings in the trunk when felled. Here Linnæus gives an example, from his journey through Oeland, of an oak, which had 260 of those internal concentric circles, by which it appeared to have been sown in the year 1481. And another example is produced, from his
journey through Westrogothia, of a pine town in the year 1337, and 409 years old when felled. The ages of the pine, cedar, apple tree, pear tree, &c. may be known also from their annual boughs or branches. The time when the most severe or most mild winters happened, may also be made out from the internal rings of many trees, particularly the oak.

Botanists, having been hitherto taken up in acquiring the knowledge of plants, and confounded, or as it were overwhelmed, with the prodigious number and vast variety which nature every where presented to their view, have not been at leisure to make a regular course of observations in the manner of astronomers, although, in my opinion, such observations would have been of far greater utility to the public. Calendars of Flora should be made out in every province yearly, according to the time of plants coming into leaf, flower, fruit, and shedding their leaves; observing also the climate, that the difference of one country from another might from thence appear. The time also of solar flowers opening and shutting should be made out in every climate, that any one, without the help of a clock, or seeing the sun, might know the time of the day. Maps of the plants also should be formed, which
which would point out every where the country, climate, and soil. Such observations would be highly useful in discovering more clearly the nature of the earth in general. The progress of the year from the putting out to the fall of the leaves of trees would shew the climate, and also the greatest heat and cold of the place. In our botanic thermometer the freezing point is 0, and that of boiling water 100. The autumnal plants are those of Virginia, which flower kindly with us in Sept. and Oct. but rarely produce ripe seeds. The winter plants are those of the Cape of Good Hope, that flower with a gentle heat in the middle of winter, which is Midsummer time in their native places. The spring or vernal plants are all those called the Alpine, which produce their flowers and fruit very early. The plants which flower twice a year, to wit, in spring and autumn, are all the Indian ones between the Tropics. The cold plants, such as the Alpine, &c. will scarcely bear the heat of 30 degrees on our thermometer. The temperate plants, such as those of Spain, Italy, &c. will scarce bear the cold of 8 degrees. The warm plants will bear the heat of 40 degrees, but the cold of 10 degrees will kill them. The cold plants placed in a stove, at first grow very luxuriant, but in a short
short time grow weak and die. The warm plants in a cold situation do first cease to grow, then lose their leaves, and produce neither flowers nor fruit.

CHAP. XII.

Of the Virtues and Uses of Plants.

SECT. CCCXXXVI.

The virtues of plants ought, by the true systematic botanist, to be derived from the fructification, observing at the same time the taste, smell, colour, and place of growth. The different sects of physicians have been in every age solici-
tous to trace and discover the virtues of plants. The empirics were the first: they built their rules and maximons on experience alone. Of this number were Dioscorides, and all the antient physicians and botanists who lived before the revival of learning. After which period, physicians attempted by some different and shorter ways to dis-
cover the virtues of plants, all which proved false and delusive theories (except the me-
thod here proposed), as we shall see in the sequel. And first of astrologers, who supposed that the stars had a certain influence upon every plant, by which each produced its effect upon that part of the human body over which such stars presided like tutelar deities. Thus they supposed certain stars presided over the heart, and that the plant, which was subject to their influence as well as the heart, was an useful and proper medicine for disorders of the heart, &c.

2. The next were those who from some external signs or marks on plants endeavoured to ascertain their virtues. They knew that certain medicines of a yellow colour, such as saffron, turmerick, rhubarb, celandine, were given with success in that yellow disease called the jaundice. They found also that medicines of a red colour, such as dragon's-blood, Japan earth, tormentil, bloody-dock, were used in the cure of the bloody flux; hence they were persuaded there was a great mystery in the colour. Moreover, they thought proper to consult the figure also. Thus they imagined they saw in the flowers of the orchises the figures of the male and female parts of generation, and hence concluded that those plants must be provocatives to venery. So the oriental anacardium from its figure must strengthen the heart.
heart; and the occidental, for the same reason, the kidneys. The large round-headed common white cabbage must be good for disorders of the head, &c. 3. The chemists thought proper to examine plants according to the principles of their art. They saw that they could separate all the principles of minerals and fossils, and that they could also by the help of fire separate certain parts of bodies, which being exhibited in small quantities, would produce wonderful effects, such as the oil, spirit, water, salt, and earth; and thus they gave us all the constituent parts of plants separately, and hence concluded in what way plants compounded of those parts would produce their effect. The members of the royal academy of sciences at Paris thought proper to make a farther enquiry into this subject, about the end of the last century, as Geofroy and Tournefort inform us. The members of this illustrious society, after long and laborious researches on this subject, were at last obliged to own, that although in many plants the end seemed to be attained pretty clearly, yet in many others they were far from the end proposed. For they observed, for example, that the ginseng produced the same chemical principles as the common hepatica. Hence they were led to conclude, as Chomel
Chomel tells us, who was himself a member of the society, that though they had chemically analyzed almost 2000 plants, no other certain discovery was made, but that from all those they could commonly extract a small quantity of an acid liquor like vinegar, a greater or lesser quantity of essential or fetid oil, a certain quantity of fixed or volatile salt, insipid phlegm and earth; and very often that all these were contained in the same quantity and proportion in plants which had the most different effects. Thus they found that their labour was vain and useless: yet it had this good effect, to take off people's prejudices concerning the usefulness of chemistry in ascertaining the virtues and powers of medicines. We grant that chemistry, which furnishes us with very efficacious and compendious medicines, is of the greatest use to physic; but we deny that the virtues of plants can be demonstrated \( \textit{a priori} \) by means of chemistry. Nor is it indeed clear, that the chemists by their art alone ever discovered any virtues of plants which were unknown before. These methods therefore here mentioned of determining the virtues of plants proving ineffectual, let us next examine the method here proposed from the fructification.
Plants which are of the same genus, agree in their medicinal virtues; those of the same order in the natural method, are nearly of the same virtues; and those which are of the same natural class, have in some measure the same virtues. And here we shall first observe, that such plants as agree exactly in fruitification, or, in other words, are of the same genus, have very seldom hitherto been found to differ in medicinal virtues; e.g. all the species of *convolvulus*, viz. the scammony, turpeth, jallap, mechoacan, *foldonella*, &c. have the same virtues. The same may be said of the species of *allium*, viz. garlick, onion, leeks, moly, cives, eschalots, rockambole, &c. And also of the species of *laurus*, viz. cinnamon, camphire, *faflafras*, benzoin, &c. And also of the species of *euphorbia*, viz. the pine spurge, broad-leafed or garden spurge, German spurge, the *euphorbium* of the shops, &c. And also of the species of *artemisja*, viz. lavender cotton, worm-seed, common wormwood, sea wormwood, Roman wormwood, sea wormwood with a lavender leaf, &c. The systematic botanists endeavoured long since to determine the virtues of plants according to the classes and orders of their several systems; but seeing there was no natural system then constructed,
fructified, and botanists were obliged to take the foundation of their systems, which were partly natural and partly artificial, from some part or other of the fructification, and by that means either to break the natural classes, or transgress the rules of their systems, and by so doing frustrate the design of them, which was, according to certain principles, to lead to the knowledge of any genus; this being the case, I say, it was no wonder the virtues of plants in some classes seemed to differ widely from one another. That there are natural classes or assemblages of plants truly natural we have already seen in the first chapter; for although botanists have not hitherto found out any system which could comprehend all the natural classes entire, nevertheless the fragments of a natural method, as far as hitherto discovered, have been laid down in the chapter above quoted. As all plants were found to have a fructification, botanists justly concluded that this was the only essential part of all vegetables. They had indeed long endeavoured to find out a systematic arrangement of plants, and to this end had attempted to form such an arrangement from the various parts of plants, viz. the root, the stem, the leaves, but in vain. At last they betook themselves to the fructification, and in this they could not
not agree in opinion, some taking the seeds, others the fruit, and others the flower, as the foundation of their system, not considering that all the parts of fructification ought to coincide, to constitute one certain systematic genus. These difficulties being now got over, we shall lay it down as a rule, that plants which agree in flower and fruit are of the same genus; and that those which agree in genus have an affinity one to another, and agree also in their medicinal virtues, in such a manner that we may in a great measure à priori determine the effects of any plant in this way. For in the fructification the internal essence of a plant is set before us, by viewing of which we may read its characters; and in them the All-wise Creator has clearly pointed out its nature, manner of growth, and medicinal virtues. We see then that there are natural genera throughout the whole vegetable kingdom; and we see also, that while we collect the natural genera into one natural class, their limits approach so near to one another, that it is difficult to distinguish the genera one from another, so great is their affinity; as may be seen in the umbelliferous, compound, papilionaceous plants, and several others. We contend therefore, that the virtues of plants are best and most safely determined according to
to the natural classes, providing we are acquainted before hand with the virtues of one or two plants of the same class; for if this is wanting, in vain shall we also expect any assistance even from these means. And beside this way, there is no other by which we can arrive at the sure knowledge of the virtues of plants, but only by experience. Let us then try this botanical method according to the natural orders, and see how far the plants contained in them agree in virtues and uses.

SECRET. CCCXXXVIII.

The leaves of the grasses afford nourishment and support to our flocks, herds, and beasts of burden; the smaller seeds of grasses serve for food to birds; and the larger, called esculent seeds, to man. The grasses are all those plants which in the sexual system are comprehended under the triandria digynia, with a few others, and constitute the fourth order of the natural method. All these are eaten by such animals as we mentioned, and are indeed the principal part of their food, though some are more fond of one grass than another. The seeds of many grasses, as the millet, canary, fescue, panic, and others, are greedily devoured by turkies, geese, chickens, and small birds. The larger seeds or grain, as rice,
rice, wheat, rye, barley, oats, millet, panic, mayz, &c. do all make part of man's daily food; but the annual darnel, which is a large grain almost like wheat, intoxicates in beer, though it even loses this quality when made into bread; and has been used in time of scarcity. And among all this numerous tribe there is not to be found one poisonous species.

sect. cccxxxix.

The starry plants are chiefly diuretic. They are of the tetrandria monogynia, and 47 order of the natural method. Of these, the madder and woodroof are officinals, well known for their diuretic virtues. Akin to them are the goose-grass, lady’s-bedstraw, &c. which also promote urine pretty powerfully.

sect. cccxl.

The rough-leafed plants are more or less of the oleraceous kind, and also mucilaginous and glutinous. They are of the pentandria monogynia, and 41 order of the natural method. Of the oleraceous kind, are the alkanet, borrage, &c. Of the mucilaginous and glutinous, the principal is the comfrey root.
The lurid plants, \textit{i.e.} of an ugly, disagreeable, or forbidding aspect, taste, and smell, are of a suspected nature. They are of the \textit{pentandria monogynia}, mostly berry-bearing plants, and constitute the 28 order of the natural method. The \textit{capsicum}, or Guinea pepper, is highly corrosive. All the nightshades more or less poisonous, not excepting the potatoes, though in a very small degree. The winter cherry a most violent diuretic, and unsafe. The mandrake, mad apples, deadly nightshade, henbane, and thorn apple, bring on madness, and even death. Tobacco highly narcotic, emetic, and purgative. The mullein kills fishes, and intoxicates them so, that one may take them with their hands; hence physicians, though they apply it often outwardly as an emollient, never use it inwardly.

The umbelliferous plants which grow in dry soils are aromatic, heating, and driving; but those that grow in watry places are often poisonous. The virtues of umbelliferous plants reside in their roots and seeds; they are of the \textit{pentandria digynia}, and 45 order of the natural method. Those especially which are officinal plants do grow in
in dry soils, as the spignel, lafer-wort, wild carrot, hog's-fennel, *opoponax*, *galbanum*, *asa fetida*, *angelica*, lovage, cumin, master-wort, dill, fennel, caraway, anise, parsley, &c. All these have an aromatic smell, are hot to the taste, resolvent and carminative, diaphoretic and diuretic. On the other hand, those which grow in watry places are poisonous, as the long-leaved water hemlock, hemlock drop-wort, common water hemlock, *phellandrium aquaticum*, wild smallage, *apium palustre*, leaft water parsnip.

SECT. CCCXLIII.

Plants of the hexandria class have roots according as their smell and taste are either esculent or noxious. They are of the 9 and 10 orders of the natural method. So we find the root of *narcissus*, snow-drops, fritillary, crown imperial, squill, lily of the valley, hyacinth, aloes, autumnal snow-drop, lily *narcissus*, *fucubea* lily, superb lily, asphodel lily, spider-wort, to be all poisonous or hurtful, having a strong disagreeable smell; especially the crown imperial, hyacinth, and *narcissus*. Garlick, onion, leek, &c. contain a great deal of volatile *alcali*, are acrimonious, and often corrosive, if taken in too great quantity; but roasted or boiled, they lose their acrimony,
mony, and become esculent and agreeable. The roots of martagon, tulip, and star of Bethlehem, are eatable, having no smell. The tulip root is eaten in some places of Italy; and the martagon lily makes part of their daily food in Siberia.

SECT. CCCXLIV.

The plants with horned antherae (Bicornes, Cl. 8. and 10. Ord. Nat. 18.) are astringent, and their acid berries are esculent. Marsh cistus, winter-green, ling, whorts, bearberry, are all astringent; among which the most remarkable are the ling, whorts, and bearberries, the leaf of this last being used in Sweden for tanning of leather. The acid and esculent berries of this tribe are the black and red whorts, cranberries, bearberry, strawberry tree, American gooseberry, &c.

SECT. CCCXLV.

All the pulpy fruits of the icosandra class (Ord. Nat. 19. 35, 36.) are esculent and wholesome. The pulpy fruits of this are the apple, pear, pomegranate, wild service, medlar, true forb, hips, bramble, raspberry, strawberry, almond, peach, plum, apricot, cherry, prickly pear, guava, &c. all which are esculent. Nor is there any plant in this class whose fruit or any other
other part is poisonous. For it is much to be doubted, whether the laurel or cherry-bay has such a noxious quality as has been ascribed to it.

Sect. CCCXLVI.

Plants of the polyandria class (Ord. N. 26 & 27.) are chiefly poisonous. The wolf-bane or monk's-hood, columbines, trailing-spur, hellebore, pasque-flower, piony, virgin's-bower, water lily, nigella, ranunculus, marsh marigold, poppy, celandine, herb Christopher, prickly poppy, gamboge, wild Syrian rue and spurge, &c. are all more or less hurtful or unfriendly to nature. And even tea is not to be used when fresh cured. The anthora, or wholesome helmet-flower, has been by many reckoned an alexipharmic, and even its root an antidote for the poisonous wolf's-bane, which is of the same genus; but this is much doubted by Clusius Bauhine and Lobel; and Solerius affirms, that the bigness of a kidney-bean of this root, taken inwardly, purges both upwards and downwards. It is certain, this species is less hurtful than the other aconites; and may be given in a small dose, and be serviceable in eruptive fevers. For all medicines of the vegetable kingdom, which we are acquainted with, and which kill worms and
Chap. XII. OF BOTANY. 417

and promote eruptions, have something in them noxious, as appears by the seeds of colombindes. There is besides a remarka-

ble bitterness and acrimony in the root of anthora, from which one would readily
guess it to be hurtful and corrosive.

SECT. CCCXLVII.

The verticillate plants (didynamia gymnospemia, Ord. Nat. 42.) are fragrant, nerve, 
resolvent, and deobstruent; their virtues are 
chiefly in the leaves. For the root of none 
of them is used in medicine; the stem has but little smell, is dry and woody; hence many of them were called undershrubs by 
the old botanists; the calyx also, which 
constitutes the greatest part of the flower, is dry and sapless, and the seeds rarely used; but their virtue is chiefly in the 
leaves, as in the Syrian marum, whose 
leaves are so fragrant, that in the whole 
vegetable kingdom there is scarce any thing to parallel them, not even in the draco-
cephalum Canariense, or balm of Gilead. 
There is no poisonous or hurtful plant of this 
order. The following plants are highly fra-
grant, and by their action on the nerves 
resolvent, and expel wind, promote the 
menes, &c. viz. marum, dittany, savory, 
thyme, origanum, marjoram, bafil, penny-
royal, mint, baum, lavender, rosemary, 
sage, clary.
The podded plants (*tetradyedamia* class, Ord. Nat. 39.) which grow in moist or watry places, are acrid, inciding, abftrgerant, and diuretic; but when dried are good for nothing. The principal plants of this class for these purposes are the pepper-wort, scurvy-grafs, horse radifh, lady's-smock, mustard, water-crefles, winter-crefles. In all the others the taste is much weaker, though of the fame fort. The virtues of these plants is loft by drying. There is no noxious or hurtful plant in the whole class.

The pillar-bearing plants (*columniferae*, Ord. Nat. 39. *monadelphia polyandria*) are mucilaginous, lubricating, and obtund acrimony; externally applied to tumours, they are ripening. All these plants have an emollient or softening quality; and he that is acquainted with the nature of malloys and marsh-mallows, knows the effects of them all. The fame lubricating virtues are found in every part of these plants. They lubricate and obtund acrimony in coughs, stranguries, nephritic disorders, colics, and excoriations, and by that means ease pain. They mature or ripen tumours by their softening quality. Nor is there any
any hurtful or poisonous plant in this whole tribe or natural order.

SECT. CCC.

The leaves of papilionaceous plants (*dia-
delphia decandria*, Ord. Nat. 32.) are eaten by cattle and other beasts of burden; their feeds, which are farinaceous and flatulent, are the food of various animals. Every one knows that those animals are fond of the trefoils and clovers, yellow medick, lucern, black nonesuch, bird's-foot trefoil, saffron, vetches, tares, fenugreek, &c. all which are cultivated for their use. Horses are particularly fond of lentils, and soon grow fat by eating them. The seeds of the papilionaceous plants are eaten by various animals, especially boiled; though chickens are not fond of the seeds of kidney-beans and lupines. It is well known that the seeds of pea, beans, vetches, kidney-beans, chiches, and lentils, are esculent, farinaceous, and flatulent; and not proper for those of weak stomachs, except they be exceedingly well boiled. Among all the leguminous or papilionaceous tribe there is no deleterious or hurtful plant to be found.

SECT. CCCLI.

Plants of the *fyanrjetia* class, many of which are officinal, are commonly bitter.
This is the 49th order of the natural method. There are many plants of this class used in the shops; as burdock, carline thistle, coltsfoot, butterbur, pellitory, _arnica montana_, leopard's-bane, Asiatic centory or Behen, succory, viper's-grass, dandelion, several of which are reckoned deobstruent. Among the bitters are the following, common wormwood, sea wormwood, Roman wormwood, sea wormwood with a lavender leaf, lavender cotton, southern wood, costmary, tansy, feverfew, chamomile, hemp agrimony, _verbesina acmella_, or water hemp agrimony of Ceylon, cudweed, golden rod, daisy, sneez-wort, yarrow, _stechas_, or French lavender, maudlin, May-weed, milky thistle, carline thistle, blessed thistle, mouse-ear hawk-weed. And in the whole class there is not a poisonous plant, except the wild lettuce with a milky juice, the leopard's-bane, _doronicum_, and the _carthamus_, or safflower.

**SECT. CCCLII.**

The tribe of _orchises_ (_gynandria diandria_, Ord. Nat. 7.) are provocatives to venery. The roots of _orchis, satyrium, salep, ophrys_, bastard hellebore, lady's-flipper, _vanilla_, and some others of this order, are universally acknowledged to have these virtues and properties. These roots have also a strong
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strong or rank smell when fresh; and the stronger they smell, the more efficacious they are reckoned.

SECT. CCCLIII.

The cone-bearing plants (Ord. Nat. 51.) are resinous and diuretic; as the pines, firs, junipers, cypresses, tree of life, turpentine tree, savin, olibanum, &c. all which are ever-green, resinous, warm, stimulating; and diuretic, communicating to the urine the smell of sweet violets.

SECT. CCCLIV.

The cryptogamia class (Ord. Nat. 55, 56, 57, 58.) contains mostly suspected or dangerous plants. Of the silices, there are scarce any esculent, and but very few medicinal plants; the same may be said of the mosses and algae, of which some are purgative; and as to the tribe of funguses, they are at best but dangerous plants either for food or physic. Many plants of this class, particularly the ferns, mosses, and funguses, have a very disagreeable flavour or bad smell.

SECT. CCCLV.

Plants which have a nectarium distinct from the petals are commonly poisonous. Such are the barren-wort, nigella, colom-
bines,aconite, dog's-bane, stapelia, narcissus, honey-flower, grass of Parnassus, hellebore, most of the swallow-worts, horned wild cumin, quick-in-hand, monotropa, or bird's-neft smelling like primrose roots, hyacinth, oleander, white dittany, clutia, kiggleria, marvel of Peru, zygophyllum, or bean caper, all which are of a poifonous nature. But the white swallow-wort, or filken cicely, which is not milky, is the only officinal species of the genus asclepias.

Sect. CCCLVI.

Milky plants are mostly poifonous, except the semiflofocal plants of Tournefort. Such are of order 30, in the natural method, as raucwolfa, cerbera, plumiera, or red jasmine, tabernamontana, periploca, or Virginian silk, apocynum, or dog's-bane, cynanchum, ceropgia, asclepias, or swallow-wort, stapelia, vinc a, the periwinkle, nerium, the oleander, &c. And also order 27, as the bocconia, argemone, or prickly poppy, chelidonium, celandine, papaver, common poppy, sanguinaria, the puccoon, podophyllum, May-apple. As also order 38, the fpurges, gamboge, dalechampia, jatropha, the casflava, &c. and some others of different orders, as rubus, fumach, fig, maple, melia, the bead-tree, and many of the agaries. But the semiflof-
semifloccular plants of Tournefort are not dangerous or noxious, 
viz. prenanthes, ivy-leaved wild lettuce, chondrilla, gum succory, 
hieracium, hawk-weed, crepis, ditto, hypocærís, ditto, picris, ox-tongue, hyosêris, 
fwine’s succory, leontodon, dandelion, trago-gogon, goat’s-beard, lactuca, garden lettuce. But there are some species of the 
wild lettuce very poisonous. Of the campanaceæ order 29, there are some that can 
scarcely be said to be noxious, as the campanula; and others are poisonous, as the 
lobelia, cardinal-flower.

SECT. CCCLVII.

A dry soil renders plants more aromatic, 
a moist soil more insipid, a watry soil generally corrosive.

The beft aromatic plants grow in dry 
places; as cinnamon, cloves, rosemary, 
fage, thyme, favyory, basil, origanum, lavender, hyflop, baum, nep, &c. All aromatics have the beft taste when dried; and medicinal plants when green are more insipid, but their taste is improved by dry- 
ing. Plants that grow in a moistish, succulent soil, and also in shady places, are 
more insipid, as most of the oleraceous tribe; and thus the leaves of navew, turn- 
nip, endive, that grow in cellars, become white and watry. So all fruits growing 

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in moist and shady places are harsh and crude; but in dry warm soils, exposed to the sun, are sweet and agreeable to the taste. Very many of the aquatic plants are acrid and corrosive, as *ranunculus*, water lily, long-leaved water hemlock, hemlock drop-wort, common water hemlock, smallage, arsimart, &c. And many of the vernal plants for the same reason are acrimonious, as the pasque flower, *anemone*, golden saxifrage, spurge olive, and spurge laurel. But all aquatic plants lose their acrimony amazingly by being cultivated in a more dry place; e.g. skirrets, the only species of *fium* which grows in dry places, is not only esculent, but very sweet and pleasant. And the sweet smallage, called *celleri* by the Italians, is a most agreeable esculent plant; but when it grows spontaneously in watry places, it is acrid, nauseous, and hurtful, being made mild and esculent only by culture in a dryer soil.

**SECT. CCCLVIII.**

The qualities of plants, in which their medicinal virtues consist, are discovered also by taste, smell, and colour. The external senses are the natural instruments by which animals are to explore the qualities of plants and other substances; and we see how by the help of smell and taste, cattle and
and other animals for the most part browse safely among noxious and salutary plants, cautiously avoiding the one, and choosing the other. Of those substances that are less volatile the taste is the best examiner, as the smell is of those that are more volatile. Horses will carefully shun the phellandrium aquaticum, or common water hemlock, while it is yet green, it being a deadly poison to them; and this they are warned to by their smell and taste: but oxen, enticed thereto by the same sense of smell and taste, will eat the plant in question, it being to them both wholesome and agreeable. And it is highly worthy our observation, that the Author of Nature has appointed certain plants for the food of certain animals, left those of different kinds should deprive one another of subsistence; and hence some plants are poisonous to certain animals, so that they are not to touch them but at their peril, of which they have sufficient notice from their smell and taste. Nor is it less worthy our attention, that the taste is greatly changed or altered in certain circumstances; e.g. in a putrid fever the patient cannot endure the smell or taste of roast meat; but at such a time acids are highly agreeable. In the green sickness, and that disorder of infants where their stomachs are oppressed with an acid, earthy and
and absorbent substances, charcoal, chalk, tobacco pipe clay burnt, &c. are both agreeable and useful. Those species of plants that have the most taste and smell are the most efficacious of all others of the same genus, and possess the greatest medicinal virtues; e.g. the true Turkey rhubarb far excels the Rhapontick, &c. And we find that plants deprived of taste and smell, are also deprived of the virtues and qualities which they originally were possessed of, whether good or bad; as cassava, calla, arum, yucca, when deprived of their succulent juice, wherein their pungent and acrimonious taste consists, either by drying or otherwise, become mere inert, farinaceous, and even esculent substances.

SECT. CCCLIX.

Sapid and sweet-smelling plants are good; nauseous and stinking ones are often poisonous or hurtful. All animals, as well as man, are guided and directed by their senses of smell and taste to the choice of proper food or aliment. In the same manner as any plant acts on the nerves of smell and taste, so it also acts on the nerves of every part of the body. We ought however always to consider the nature of other plants that have an affinity to the plant in question; and if we find by experience that they are
are innocent, we may safely trust to our taste and smell for the use of any such plant. Sweet-smelling plants are the following, viz. *milium effusum*, millet-grass, *bolcus odoratus*, sweet-smelling soft-grass, woodroof, melilot, mock orange, jasmine, white lily, tuberose, citron, orange, lemon, bean, oleander, *crocus*, violet, lime, especially the flowers of all these, which diffuse a most agreeable odour. Plants that are disagreeable to the smell are the following, viz. the fungi, flinking May-weed, dwarf elder, bane-berries, aconite, black hellebore, white hellebore, *asarabacca*, roots of *narcissus*, crown imperial, superb lily, leaves of flinking bean trefoil, flowers of *stepelia*, some of the *chenopodiums*, nightshade, thorn apple, tobacco, henbane, hedge hyssop, flinking horehound, leopard's-bane, bitter apple, coriander, rue, box, hound's-tongue, *opium*, walnut, *convallaria*, aloe, African marigold, dill, valerian; all which are pernicious, emetic, or purgative, except the three last, which are anodyne.

**SECT. CCCLX.**

Contrary qualities produce contrary effects: e.g. binding and loosening medicines have contrary qualities, and produce contrary effects. Diseases in the human body arise from the solids being too rigid or
or too flaccid, or from the fluids being too thick or too thin. This contrariety ought to be well attended to, otherwise there can be no success in the cure of diseases. If, e.g. the fibres are too rigid, they should be softened: if the fluids are too much attenuated, they should be thickened in order to bring about a cure. Hence diseases are often cured by contrary diseases. Thus an haematomegaly, or flux of blood from the nostrils, for example, cures inflammatory fevers; hence phlebotomy or bleeding is proper in such fevers. A flux, or looseness, is cured by costiveness, which last is brought on by astringents. Convulsive disorders are cured by sleep, which last is procured by opium. Sleepy disorders, on the contrary, are cured by convulsions; e.g. by sneezing, which is a violent convulsion; this is caused by medicines which stimulate the nostrils, called errhines: and so of many others. Now all medicines act by bringing about some change in the body. Every change is a disease, and therefore there are as many diseases as modes of change. Hence it appears, that by the use of medicines contrary diseases are excited. We are also to observe, that the same plants have different qualities in their different parts, as the root, leaves, stem, flowers, seed, and fruit; e.g. the milky
milky juice of the fig tree is caustic and corrosive, but the fruit is emollient, sweet, and agreeable. The fruit of the peach tree is pleasant and agreeable; the seeds bitter, and will kill horses and dogs in the same manner as bitter almonds. The seeds of the citron and lemon are bitter, the peel aromatic, and the pulp acid, &c. We are also to observe, that the self-same medicines given in greater or lesser quantities produce very different effects.

SECT. CCCLXI.

All plants act either by their effluvia on the nerves, or by their rapid part on the muscular fibres, or by both on the fluids. That medicines act not only in the first passages, but also on the most remote parts of the body, daily experience evinces: for we find that the most solid parts of animals have the smell and taste of those things they have fed on. The flesh of some birds that feed on small fishes, and cattle that feed on turnips, taste of those several substances. A remarkable smell is communicated to the urine from turpentine, nutmeg, mace, asparagus, garlick, and carduus. Some fungi give a nauseous taste to cow's milk; and goat's milk is purgative, after those animals have been eating scammony or spurge. The milk and butter in Gothland has
THE ELEMENTS Part II.

has the taste of garlick, from the cattle's feeding on *scordium*, onions, and leeks. The milk of nurses is bitter after their taking extract of wormwood, and purgative from hedge hyslop. The flesh of hares fed on cabbage has a very disagreeable taste. The mutton about Montpelier tastes of rosemery; and the beef and mutton in England often taste of turnips. The flesh of thrushes that have fed on buckthorn berries is purgative in autumn. The bones of hogs and chickens that have been fed with madder are of a red colour. The fruit of the prickly pear makes the urine red; rhubarb makes it yellow; and the seeds of lovage black. The powder of tobacco sprinkled on ulcers or sores will cause vomiting. Hence we see it is the more necessary to be well acquainted with the virtues of simples; as it appears certain that medicines often exert their power and efficacy not only in the first passages, but through the whole body, and penetrate its most minute canals and meanders.

SECT. CCCLXII.

Perfumes are analeptic or reviving; fragrant substances orgastic, or extremely agreeable; aromatic smells are rousing; abominably stinking smells are stupifying; and nauseous ones are corrosive. The organs of
of smell, being situated so near to the brain or common sensory, are the soonest of all affected; hence volatile medicines restore life and vigour as it were in a moment to hysterical and fainting people. Every volatile smell is called by the chemists the governing spirit; this often is of so subtle a nature, that it cannot be collected or confined in any vessels. It is different in different plants; thus lavender, baum, thyme, marum, origanum, basil, savory, have all a sweet and aromatic smell; yet lavender has not the smell of baum, nor baum of marum, but every one has its peculiar smell; and therefore affects the nerves differently, and produces a different effect on them. For in the same manner as they affect the organs of smell, so they do the nerves, after they are diffused through the whole mass of blood; hence the wonderful operation of medicines on the human body, scarcely to be learned by any theory, but only by the knowledge of the simples themselves. Thus, e. g. the flowers of the tuberose diffuse such a smell through a whole house or room, that an hysterical woman on entering the same shall fall down like one dead. The smell of cinnamon excites the nerves most powerfully, insomuch that a single drop of its essential oil taken on sugar diffuses its volatile flavour
vour through the whole body, that every part smells of cinnamon. The flowers of oleander have a very strong, pleasant, and somewhat narcotic smell, which will affect one that sleeps in the same chamber where these flowers are, with a carus. This is a species of apoplexy, attended with profound sleep and a fever. The smell of musk-mallows will often cause young girls to faint. Rue recovers those that are overcome with sweet smells. All the Europeans that first landed at Surinam died suddenly, without any one being able to assign the cause, till at last it appeared to be occasioned by the smell of that poisonous tree called the man-chencel. The shade of walnut, elder, &c. is prejudicial, often causing fevers in those that sit or sleep under them. Groves of the stinking bean trefoil give people violent headaches. Cats are enchanted, as it were, with the smell of nep, marum, and valerian. The fumes of wine, during its fermentation, issuing from large vessels or casks, have proved fatal in a moment. And the smell of some fungi has also been known to be fatal. Bane-berrries, stinking May-weed, and stinking horehound, allure toads by their smell. Many have been suffocated by the fumes of charcoal. A dog by the smell will trace his master's steps in the most populous city. The very smell of
of *coloquintida* will both vomit and purge. Sweet-smelling plants, as woodroof, drive away moths and other destructive vermin; and when chewed preserve people from infectious disorders. These, and many other instances that might be produced, shew the great and singular effects of smell in plants and other substances. Perfumes act like ambergrase, musk, or civet, and are the following; woodroof, melilot, jagged-leafed vervain mallow, musky cranebill, musk-mallows, millet-grass, and *holcus odo-ratus*, sweet-smelling soft-grass. Fragrant plants are the flowers of saffron, wallflower, tuberose, Arabian and common jasmine, white lily, lime tree, violet; and also the following herbs, lavender, thyme, marjoram, basil, *origanum*, savory, baum, *marum*. Aromatics (which generally agree both in smell and taste) are cinnamon, sweet-bay, saffafras, camphire, cardamoms, spicey cloves, nutmeg, sweet-flag, bishop's-weed, *angelica*, citron, lemon. Bad smells are those of garlick, onion, leek, sauce-alone, *scordium*, *petiveria*, *assa fœtida*; all which have more or less of the garlick smell. There are besides, the *orchis*, stinking *orrache*, stinking hawk-weed, herb Robert, which have a rank odour. Heavy, stinking, and narcotic smells, are those of stinking horehound, stinking May-weed, *tagetes*. 
tagetes or African marygold, opium, hemp, dwarf elder, stinking bean trefoil. Nauseous smells, are those of black and white hellebore, convallaria, ajarabacca, tobacco, coloquintida.

Sect. CCCLXIII.

Sapid substances act both on the fluids and solids. The qualities of medicines in regard to taste are the ten following, viz.

1. Watery; as common water, tea, coffee, whey, small beer, gruel, &c. these cleanse, moisten, and dilute.

2. Viscous or gluey; as gum arabic, gum dragant, marsh mallows, quince seeds, linseed, leafeed, comfrey, and several farinaceous substances; they are mucilaginous, soften, smooth, and resist acrimony, and thicken the fluids.

3. Oily; as various oils drawn from seeds; they are obtunding and emollient, or blunting and softening.

4. Sweet; as sugar, honey, most farinaceous substances, nuts, almonds, pistachia nuts, figs, dates, &c. they nourish, sweeten the acrimonious fluids, and render them mild and soft.

5. Acid or sour; as vinegar, wines, currants, lemons, tamarinds, strawberries, cherries, and other fruits, also garden forrel and wood forrel; they dilute, cool, quench thirst, resist putrefaction, strengthen the nerves, help digestion.

6. Dry; as, in outward application, flour, powder of maflick,
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maffick, &c. and inwards, bistort, tormentil, and various astringents; they lessen the superfluous humidity. 7. Acrid; as mustard, horse-radish, scurvy-grass, garlic, arum, onion, iris, rue, squill, wall-pepper, &c. all which are possesiled of a volatile acrimony, which goes off by drying; they cut and divide tough and tenacious fluids, and even corrode the solids. 8. Salt; as common salt, marsh samphire, salt-wort, common samphire, sea arrowhead, Chenopodium maritimum; they stimulate and irritate the nerves, promote all the evacuations, resist putrefaction, and in small quantities are cooling. 9. Bitter; as gentian, centory, carduus benedictus, wormwood, chamomile, &c. they are alcaline and stomachic, cure spontaneous acids in the stomach and bowels, increase the appetite, and supply the place of bile. 10. Styptic; rough, or astringent; as galls, floes, red roses, bloody dock, tamarisk, medlar, quince, &c. they thicken the fluids, and strengthen the fibres. Those qualities that are of the same nature are watery and viscous, sweet and oily, acid and saline, acrid and bitter, dry and astringent. The same qualities contrasted run thus; watery and dry, oily and styptic, acid and bitter, sweet and acrid, saline and viscous. The opposite qualities that act on the fluids are, cleansing
THE ELEMENTS Part II.

cleansing and absorbent, cooling and balsamic, sweetening and cutting, blunting and thickening, mucilaginous and penetrating. The opposite qualities that act on the solids are, moistening and drying, attenuating and strengthening, fattening and scouring, softening and astringent, smoothing and corroding.

SECT. CCCLXIV.

A pale colour indicates an insipid substance; green, a crude one; yellow, a bitter; red, an acid; white, a sweet; and black, a disagreeable one. Many of the bitters are of a yellow colour; as gentian, aloe, centory, rhubarb, celandine, turmeric, and several of the yellow flowers. A red colour often shews an acid taste; as in cranberries, red whorts, barberries, raspberries, red currants, cherries, plums, mulberries, sea buckthorn; and also in some herbs which turn of a red colour towards autumn, as garden forrel, wood forrel, bloody dock, and some others of the dock tribe, red cabbage. Green indicates a crude taste; as in all unripe fruits, and young leaves of plants. A pale colour indicates an insipid substance; as in asparagus, cabbage, young lettuce, and endive. White indicates sweetness; as in white currants, white-
white-berried bramble, some sweet apples, and white plums. Black often indicates a disagreeable taste, and poisonous quality; as in the berries of deadly nightshade, herb Christopher, sumach, common nightshade, laurustinus, crowberries, cherry-bay, &c. The best examiners of an acid are blue or purple; such as an infusion of tournefol, or violets, which, being mixed with an acid, turns red; and with an alcali, green. Tournefort made use of a deep blue paper, which, being moistened with the juice of the plant he would examine, shewed its acid or alcaline quality.

Sect. CCCLXV.

The oeconomical uses of plants in human life are very great and many. For, besides furnishing food and medicine for man and beast, the vegetable kingdom also supplies materials for building of houses and ships, for furniture, for carriages of various sorts, for instruments of agriculture and other arts and manufactures, for hedges and fences, for dyeing and tanning, for linens and cottons, for fire and candles, for articles of commerce, for pleasure or ornament, as in painting, plants for pleasure gardens, parterres, green-houses, flowers, &c.
In every branch of natural knowledge, the first principles should be established on, and confirmed by, repeated observations and experience.

Ad utilitatem vitae omnia consilia factaque nostra dirigenda sunt.

Tacit.

FINIS.
APPENDIX.
APPENDIX;

Containing descriptions of some plants lately discovered in Norfolk and Suffolk, never found before in England, or not described as English plants; illustrated with figures of the same, taken from the life, and curiously engraved on three additional copper-plates.


Geranium sanguineum majus. Besl. eyf. vern. i. tab. 9. fig. 2? Greater geranium, with a blood-coloured flower.


The
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The root of this plant is perennial, of a brown colour, pretty thick, and sends out several large lateral fibres, which contain a ligneous pith.

From the root spring several stems, each as thick as a goose-quill at the bottom, jointed, roundish, or rather somewhat quadrangular, about two feet high, branched and much divaricated, each branch divided into three or four bifurcations, the uppermost terminating with the flowers. The stems are a little hairy, as is the whole plant.

At each joint come out two leaves, one on each side, opposite, rugged and wrinkled; the radical ones, and those at the first joint, are long and broad, consisting of five lobes each, which are cut on the edges, the two exterior lobes being deeply divided; they are also supported on very long Foot-stalks, which as well as the leaves diminish gradually to the top, the uppermost of the latter being sessile, and cut into three divisions.

Each foot-stalk has two thin smooth tapering stipule, one on each side.

The flower-stalks are long and biflorous: out of the center also of each bifurcation comes one long flower-stalk, which in like manner bears two flowers. The partial flower-stalks are recurved and pendulous before
before the flowers open; but during the time of flowering they only decline a little, and after the petals are fallen off they are erect. They are also furnished with very small stipulae of the same shape with those at the base of the foot-stalks of the leaves.

The calyx consists of five small acute bearded leaves.

The corolla is of a deep purple or blood colour at the first blowing of the flower, but afterwards turns to a pale purple.

The petals are entire, marked with three brown lines, and wooly at the base.

The geranium palustre grows in Russia, Germany, and England. It is perennial, and flowers in May and June. Found near Spixworth church about five miles from Norwich, in 1771, by Mr. Wm. Humphry. For the figure of this plant see Plate I. of the Appendix, in which letter (a) represents the front view of the flower, letter (b) the back view of the same, both of their natural size.

If the plant above described be not the geranium palustre, which I do not affirm it to be, I should be glad to know what species it is. It differs from the geranium sylvaticum in several particulars. For it is a much larger plant, the leaves are not so much divided, not so shining, but more rough and wrinkled; the flower-stalks lon-
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ger, and more reflexed; the petals at the first blowing of the flower are of a blood colour, whereas those of the *geranium sylvaticum* are of a fine blue.

**VERONICA verna.** Spring *veronica*, or speedwell.


**Veronica humilis erecta montana, flore parvo caeruleo.** *Dillen. App.* 38. Low upright mountain *veronica* with a small blue flower.

**Alfine triphyllos caerulea (foliis minoribus).** *Baub. Pin.* 250. Trifid chickweed with a blue flower and lesser leaves.

The root is small and fibrous. The stem is very slender, single; divided into two or three branches, upright, round, and about two or three inches high. The leaves are alternate, supported on very short flower-stalks: the lower leaves are divided into five parts like fingers; the upper ones, and also the bracteae, or floral leaves, are whole, acute,
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acute, and lanceolate; all of them being smooth, succulent, and longer than the flower-stalks, which come out solitary, one from the bosom of each leaf, bearing a small blue flower, which is succeeded by a heart-shaped seed vessel, as in the other veronicas. This grows in Sweden, Germany, Spain, and England, in dry, open, barren soil, on houses, old walls, and rocky places. It is an annual plant, and flowers in April and May. Found by Sir John Cullum near Bury in Suffolk. See Plate II. of the Appendix, fig. 1.

HOLOSTEUM umbellatum. Umbelliferous wild pink.

Holosteum floribus umbellatis. Læst. It. 120.
Holosteum ruellii f. gramen leucantheum. Lib. i. c. 38.
Holosteum caryophyllœum arvense. Tabernom. Icon. 233.

Caryophyllus
APPENDIX.


Lychnis graminea hirsuta umbellifera. Moris. Hist. ii. p. 546. f. 5. tab. 22. fig. 46.


134.

The root is annual, slender, a little branched, fibrous, and runs perpendicularly down.

The stems are numerous, filiform, jointed, round, perfoliate, upright, from two or three to six inches high, having mostly three joints; the space betwixt the two lowest is smooth, the others for the most part viscidous and hairy.

The leaves are set on in pairs at each joint, very entire, opposite, sessile, erect, cohering at the base, each pair crossing those above and below, smooth on the under side, the upper surface and margins a little hairy; concave at the base, keel-shaped, ovate, obtuse and fleshy. The radical
dical leaves are narrower and longer than the others.

The two external *bractea* are large, and of the form of the leaves; the internal (one to every flower-stalk) are lanceolate, and very small.

The *flower-stalks* are numerous, all from one center, viz. the extremity of the stem, unequal in length, some hanging down, some declining a little, some erect, and some bent in different directions, filiform, uniflorous, and abiding.

The *seed-vessel* is an egg-shaped capsule, of one cell, bursting at the top into six valves.

N. B. The filaments, styles, and valves of the *pericarpium* do very often exceed the number allotted to this genus.

This species of *holosteum* is a native of Spain, Italy, France, Germany, and England. Found in great plenty on the city walls of Norwich, and many other old walls of that city, and on some banks and walls in the neighbourhood. First noticed and examined by Mr. John Pitchford in Spring 1765. It is an annual plant, and flowers in April and May. See Plate II. of the Appendix, fig. 4.

*Tillaea*
APPENDIX.

Tillaea muscosa. Mossy tillaea.


Crassula foliis sessilibus connatis, floribus aggregatis in foliorum alis. Guettard. Stamp. i. p. 97. Crassula, or lesser orpine, with sessile leaves cohering at the base, and aggregate flowers coming out from the bottom of the leaves.

Polygonum muscosum minimum. Boccon. Sicil. 56. tab. 29. Leaft mossy polygonum, or knot-grass.

Sempervivum omnium minimum repens muscosum polygoni facie. Bocc. Mus. ii. p. 36. tab. 22. Leaft creeping mossy houtleleek, with the appearance of a polygonum.

The root is annual, small, and fibrous.

The stems are numerous, creeping, filiform, round, smooth, jointed, perfoliate, one or two inches high, at first nearly erect, at length procumbent, pellucid, sometimes whitish, sometimes of a red colour, as is the whole plant generally.

The
The branches come out solitary from the bosom of the leaves, and mostly opposite.

The leaves are set on in pairs at each joint, very entire, opposite, sessile, erect, cohering at the base, bent inwards, each pair crossing those above and below, smooth, shining; on the lower surface convex, gibbose, broadest in the middle, and membranaceous at the base; on the upper side concave, narrow at the tip, fleshy, semicylindrical, and obtuse; sometimes as long, sometimes half as long as the intermediate space betwixt one joint and another.

The flower-stalks, which are very short, filiform, and erect, come by two or three from the bosom of each leaf.

The bractæ are like the leaves, about half the length, two to each flower-stalk.

The calyx consists of three parts, ovate, acute, bearded, concave, conniving, and rough.

The corolla is made up of three petals, egg-shaped, acute, conniving, concave, pellucid, and less than the segments of the calyx.

The stamina are three capillary filaments, having roundish, incumbent antheræ, which open on the sides.

The pistillum consists of three ovate germina, shorter than the stamina; and three tapering erect styles, with simple stigmata.
The seed-vessel consists of three oblong capsules, which are acute, spreading, and longer than the petals, bursting longitudinally, and contain two very small ovate seeds each.

Obs. The parts of fructification in this species are trisid, seldom or never quadrifid, and, though by Linnaeus it is placed in the 4th class, comes properly under the triandra trigynia.

This plant grows in Italy, Sicily, France, and England, in dry, barren, sandy, and gravelly soil. Found on Drayton heath, and several other places near Norwich, in great plenty. It is an annual, and flowers from June to October. First examined and ascertained by the Rev. Mr. Bryant in 1766. See Plate II. of the Appendix. 2 A. The plant of its natural size. 2 B. A plant in its young state magnified. a. The flower springing from the bosom of the leaf. b. The flower expanded. c. The capsules of the seed both magnified.

Ophrys paludosa. The least orchis.


The bulb is egg-shaped, bent inwards; and terminates in a root below. The bulbs stick together downwards like a chain, having a small branch for a line of distinction.

The stalk is five-cornered, and naked the greatest part of its length, which is from three to six inches or more.

It is furnished with three or four radical leaves, which are alternate, shaped like a spathula, having their tips rough on the interior surface; and shorter on the exterior.

Several green yellowish flowers come out at the top of the stalk in a cluster.

The two lateral petals are of an oblong egg-shape, reflexed and erect. The two interior lateral petals are linear and recurved; the uppermost petal is straight, and forms a hollow vault for the stamina.

The lip of the nectarium is lanceolate and egg-shaped, reflexed and entire.

The least orchis grows in Sweden, Scotland, and England, in turfy bogs. Found on Felthorp bogs by Mr. Charles Bryant.
in 1769. It is a perennial plant, and flowers in June and July. See Plate II. of the Appendix, fig. 3.

This plant was sent to Mr. Ray by Dr. Preston, professor of botany, at Edinburgh, and immediate predecessor in that department to the late Dr. Alston.

The plant represented on Plate II. of the Appendix, at fig. 5. and 6. (the former being of the natural size, and the latter the plant magnified) has been found near Norwich for several seasons successively, and always in the same state. I know it had been said to be the juncus bufonius in a young state, but being much in doubt about it, I had it examined carefully last summer by a friend, who took up a large clod full of these minute plants, and put it into a pot, which he set in a moist place by the side of his fish-pond. The event proved them not to be compleat plants of themselves, but real seedlings of the juncus bufonius. Wherefore I thought proper to insert this account to prevent others from being misled for the future.

Genista with lanceolate obtuse leaves, and a knotty decumbent stem.


This shrubby plant grows about a foot high, or more, having a long root, which runs obliquely, and is furnished with many small fibres.

The twigs, which for the most part spread on the ground, are pliant, slender, cylindrical, and subdivided into many small, angular, striated branches.

The leaves are very small, coming out by two, three, or four, from the same point,
white and hairy on the under side, smooth on the upper.

The flowers, which are numerous, come out on the sides of the small branches, of a yellow or saffron colour, having hairy flower-cups and petals.

The pods are small, about an inch long, broadish, hairy, and contain many seeds.

Grows in Germany, Hungary, France, Sweden, and England, in dry and hilly places. Flowers in May and June. Found by Sir John Cullum about Lackford, four or five miles from St. Edmund's Bury, in July 1774. See Plate III. of the Appendix. Fig. 1. the plant in its natural size; letter (a) the flower magnified.

_Hydnium auriscalpium._ Hydnum like an ear-picker.


_Hydnium stipitatum_, pileo dimidiato. _Flor. Lap._ 524. _Flor. Suec._ 1100, 1260. _Roy. Lulg._ 519. _Hydnum with a stalk, and half a head._

_Erinaceus parvus_ hirsutus ex fusco fulvus, pileo semiorbiculari, pediculo tenuiore. _Mich. Gen._ 132. _tab. 72. fig. 8._ The small rough prickly fungus, of a brownish colour, having a semiorbicular head, and a slender pedicle or foot-stalk.
APPENDIX. 455

Fungus erinaceus parvus in conis abietis nascens. Buxb. Cent. i. tab. 57. fig. 1. Small prickly fungus, which grows on the cones of the fir-tree.

Fungus erinaceus parvus, pediculo longiore auriscalpium referens buxei coloris. Buxb. Hall. 129. tab. 129. Small prickly fungus with a pretty long stalk, resembling an ear-picker, of the colour of box.

This fungus has a thick upright stalk two inches high, covered all over with a fine soft down like velvet. It supports a small semiorbicular head, which is somewhat convex on the upper, and concave on the lower side, the latter being full of small prominences resembling prickles, whence the name of erinaceus, or hedge-hog. The whole plant is of a brownish colour, and in shape resembles an ear-picker.

Grows in pine woods on the ground, and out of dead branches or cones. Found last autumn near Norwich, in a small plantation of Scotch pines called Hardy’s Grove. See Plate III. of the Appendix, where the plant is represented in its natural size at fig. 2. and the lower concave side of its semiorbicular head at letter (b).

END OF THE APPENDIX.

Gg 4
EXPLANATION OF THE PLATES.

PLATE I.

Classes. See p. 39—43.

1. Monandria,
2. Diandria,
3. Triandria,
4. Tetrandria,
5. Pentandria,
6. Hexandria,
7. Heptandria,
8. Octandria,
9. Enneandria,
10. Decandria,
11. Dodecandria,
12. Icosandria,
13. Polyandria,
14. Didynamia,
15. Tetrodynamia,
16. Monadelphia,
17. Diadelphia,
18. Polyadelphia,
19. Syngenesia,
20. Gynandria,
21. Monœcia,

22. Dioecia,
EXPLANATION OF
22. Diæcia,
23. Polygamia,
24. Cryptogamia.

PLATE II. LEAVES.

Simple Leaves. See Sect. 83.

Fig.
1. Round—Folium orbiculatum.
2. Roundish—Folium subrotundum.
4. Oval—Folium ovale, subrotundum, ellipticum.
5. Oblong—Folium oblongum.
7. Linear—Folium lineare.
8. Awl-shaped—Folium jubulatum.
11. Moon-shaped—Folium lunulatum.
12. Triangular—Folium triangulare.
15. Spear-shaped—Folium hastatum.
16. Parted half way down—Folium fistum.
17. Three lobed—Folium trilobum.
18. Bitten—Folium præmorsum.
19. Lobed
Fig.
19. Lobed—\textit{Folium lobatum}.
20. Quincangular, with five angles—\textit{Folium quincangulare}.
21. Gnawed—\textit{Erosum}.
22. Hand-shaped—\textit{Palmatum}.
23. Pinnatifid—\textit{Pinnatifidum}.
24. Jagged—\textit{Lacinatum}.
25. Sinuated—\textit{Sinuatum}.
26. Sinuated and indented—\textit{Dentato-sinuatum}.
27. Sinuated backward—\textit{Retrorsum sinuatum}.
28. Divided to the base—\textit{Partitum}.
29. Serpentine edged—\textit{Repandum}.
30. Toothed or indented—\textit{Dentatum}.
31. Sawed—\textit{Serratum}.
32. Doubly serrated or sawed—\textit{Duplicato-serratum}.
33. Doubly notched—\textit{Duplicato-crenatum}.
34. Cartilaginous or gristly—\textit{Cartilagineum}.
35. Sharp-notched—\textit{Acute crenatum}.
36. Blunt-notched—\textit{Obtuse crenatum}.
37. Plaited—\textit{Plicatum}.
38. Notched—\textit{Crenatum}.
39. Curled—\textit{Crispum}.
40. Obtuse or blunt—\textit{Obtusum}.
41. Acute or sharp-pointed—\textit{Acutum}.
42. Tapering to a point—\textit{Acuminatum}.
43. Obtuse with a point—\textit{Obtusum acuminatum}.
44. Notched
EXPLANATION OF

Fig.
44. Notched at the tip sharp—Emarginatum acute.
45. Notched at the tip wedge-shaped—Cuneiforme emarginatum.
46. Blunted—Retusum.
47. Hairy—Pilosum.
48. Cottony—Tomentosum.
49. Bristly—Hispidum.
50. Fringed—Ciliaturn.
51. Wrinkled—Rugosum.
52. Veined—Venosum.
53. Ribbed—Nervosum.
54. Blistered—Papillosum.
55. Tongue-shaped—Linguiforme.
56. Shaped like a Persian scymitar—Acinaciforme.
57. Hatchet-shaped—Dolabriforme.
58. Deltoid, shaped like the old Greek delta—Deltoides.
59. Three-cornered—Triquetrum.
60. Furrowed—Sulcaturn.
61. Channeled—Canaliculatum.
62. Cylindrical—Teres.

PLATE III.

Compound Leaves, Sect. 83.

Fig.
63. Fingered, or compounded of two—Binatum.
64. Fingered,
Fig.
64. Fingered, or compounded of three seffile leaves—Ternatum foliolis seffilibus.
65. Fingered, or compounded of three pedunculate leaves—Ternatum foliolis petiolatis.
66. Fingered, or compounded of many seffile leaves—Digitatum.
67. Foot-shaped—Pedatum.
68. Pinnated, and ending with an odd one—Pinnatum cum impari.
69. Pinnated, and ending abruptly—Pinnatum abrupte.
70. Pinnated, and alternately placed—Pinnatum alternatim.
71. Pinnated, with every other leaf smaller—Pinnatum interrupte.
72. Pinnated, and ending with a tendril—Pinnatum cirrhofum.
73. Pinnated, and conjugate—Pinnatum conjugatum.
74. Pinnated, and decurrent—Pinnatum decursive.
75. Pinnated, and jointed—Pinnatum articulare.
76. Shaped like a lyre—Lyratum.
77. Double three-leaved—Biternatum v. duplicato-ternatum.
78. Double winged—Bipinnatum v. duplicato-pinnatum.
79. Triple
EXPLANATION OF

Fig.
79. Triple three-leaved—Trternatum v. triplicato-ternatum.
80. Triple winged ending abruptly—Tripinnatum fine impari.
81. Triple winged ending with an odd one—Tripinnatum cum impari.

PLATE IV.

Determinate Leaves, Sect. 83.

Fig.
82. Rolled back—Revolutum.
83. Reclined—Reclinatum.
84. Horizontal—Horizontale.
85. Spreading—Patens.
86. Upright—Erectum.
87. Bent inwards—Inflexum.
88. A flower leaf—Florale.
89. A branch leaf—Rameum.
90. A stem leaf—Caulinum.
91. A feed leaf—Seminale.
92. A glove-like leaf—Vaginans.
93. Two opposite leaves grown together—Connatum.
94. A perforated leaf—Perfoliatum.
95. Embracing the stem—Amplexicaule.
96. A running leaf—Decurrens.
THE PLATES.

Fig.
97. A leaf furnished with no footstalk—
   
   Sessile.
98. A leaf furnished with a footstalk—
   
   Pedunculatum.
100. Placed in bundles—Fasciculata.
101. Laid over each other like tiles—Imbricata.
102. Chaffy and evergreen—Acerosa.
103. Alternate leaves—Alterna.
104. Opposite leaves—Opposta.
105. Starry, composed of four leaves—
   
   Quaterna.
106. Starry, or whorled leaves—Stellata.
108. A frons, consisting of a branch and leaf.
109. Shaped like a spatula—Spatulatum.
110. Parabolic, or half oval—Parabolicum.

PLATE V.

Trunk, Sect. 82.

Fig.
111. A squamoso, or scaly straw or haulm—Squamosus culmus.
112. A creeping stem—Repens caulis.
113. A
EXPLANATION OF

Fig.

113. A scapus, or stalk.
114. A jointed straw or haulm.
115. A twining stem—Volubilis caulis.
117. A brachiate stem, or a stem branching in pairs—Brachiateus caulis.

PLATE VI.

Fulcra, or Props, Sect. 84.

Fig.

118. a. A clasper or tendril—cirrhus. b. A stipula, which is a scale or small leaf on each side of the base of the foot-stalks of the leaves. c. Glands on the foot-stalks of the leaves.
119. a. Glands supported on small foot-stalks.
120. a. Bracteae, or floral leaves. b. The leaves.
121. a. Simple spines or thorns. b. A triple spine.
122. a. Simple aculei, or prickles.
123. b. Triple aculei, or forked prickles.
124. a. Opposite leaves. b. The axillae, or bosoms of the leaves.

PLATE
PLATE VII.

Roots. Sect. 80, 85, 163.

Fig.

125. A. A scaly bulb, as in the white lily — Bulbus squamosus.
125. B. A solid bulb, as in the tulip — Bulbus solidus.
126. A. A double bulb, as in chequered daffodil — Bulbus duplicatus.
126. B. A globular, or round root, as in earth-nut — Radix globosa.
127. Transverse section of a coated bulb — Bulbus tunicatus.
128. A. A tuberous handed root, as in the orchis — Radix tuberosa palmata.
128. B. A bundled root — Radix fasciculata.
129. A. A granulous root, as in white folkifrage — Radix granulosa.
129. B. A tuberous and pendulous root, as in dropwort — Radix tuberosa pendula.
130. A. A simple tapering root, as in the carrot — Radix fusiformis.
130. B. A jointed root, as in wood-sorrel — Radix articulatus.
131. A. A branched root — Radix ramosa.
131. B. A creeping root — Radix repens.
EXPLANATION OF

PLATE VIII.

Parts of the Flower. See Sect. 86.

Fig.
132. B. a. A spatha or sheath, as in the narcissus.
133. a. A chaffy husk, gluma. b. The beard or awn, arista.
135. a. The capitulum, or little head of a moss. b. The operculum, or cover. c. The calyptra, hood or extinguiher.
136. A spatha and spadix, as in the palms, Sect. 86.
137. a. A common receptacle of a compound flower not chaffy.
138. The nectaria of the Parnassia.
139. A catkin, amentum.
140. A cone, strobilus.
141. a. The cap. b. The volva. c. The stipes of a fungus.
142. a. The tube. b. The limb of a monopetalous corolla.
143. a.
THE PLATES.

Fig.
143. a. The germen. b. The style. c. The stigma. d. The filaments. e. The antheræ. f. The petals of a flower.
144. a. The unguis. b. The lamina of a polypetalous flower.
145. a. A bell-shaped nectarium of the narcissus.
146. A palaeanaceous or chaffy common receptacle of a compound flower.
147. The horned nectaria of the aconite.
148. The horned nectarium in the calyx of the tropæolum.

PLATE IX.

Parts of the flower and fruit, Sect. 86.

Fig.
149. a. The perianthium. b. The germen. c. The style. d. The stigma. e. The filaments. f. The antheræ bursting and discharging their pollen. g. Two antheræ whole or not burst.
150. A feed crowned with a little calyx. a. The feed. b. The little calyx.

H h z

151. a.
EXPLANATION OF

Fig.
151. a. The pollen viewed with a microscope. b. An elastic blast discharged from it.
152. A winged seed. a. The seed. b. The wing.
154. a. The germen. b. The style. c. The stigma.
155. A legumen or cod. a. The seeds fixed along the edge of one of the valves only.
156. A folliculus, or little bag. a. The receptacle of the seeds.
157. A siliqua, or pod. a. b. The margins of both valves along which the seeds are fixed.
158. A pomum, or apple. a. The pulp. b. The capsule.
159. A drupa, or stone-fruit. a. The pulp. b. The nucleus, or stone.
161. A capsula bursting at the top.
162. a. The valves. b. The dissipimenta, or partitions. c. The columnelae, or little pillars. d. The receptacle.
163. A capsula cut down lengthways, that the receptacle of the seeds may be seen.
164. a.
T H E P L A T E S.

Fig.
164. a. Hairy pappus, or down. b. Feathered pappus. c. The seed. d. The stipes, or thread, which supports the pappus.

P L A T E X.

Modes of Flowering, Sect. 82. 86. 116. 117.

Fig.
163. A Corymbus. See Sect. 82.
164. A fasciculus, bunch or bundle, as in sweet Williams. Sect. 82.
165. A spike, as in perennial darnel. Sect. 82.
166. A racemosus, or cluster, as in currants. Sect. 82.
169. A verticillus, or whorl of the horehound. Sect. 82.
170. A panicle. Sect. 82.
171. A capitulum, or little head of field calamint. Sect. 82.
172. A cyma of the gelder rose. Sect. 86.
173. A floret of a compound flower.
EXPLANATION OF

An umbel. See Pl. VIII. fig. 134.

A spadix and spatha. Pl. VIII. fig. 136.

A compound flower. Pl. VIII. fig. 137, and 146.

An amentum, or catkin. Pl. VIII. fig. 139.

A strobilus, or cone. Pl. VIII. fig. 140.

PLATE XI.


The Leaves cut transversely.

1. Convolute, rolled together single.
2. Involute, rolled in.
3. Revolute, rolled back.
4. Conduplicate, doubled together.
5. Equitant, riding.
6. Imbricate, tiled.
7. Obvolute, rolled against each other.
8. Plicate, plaited.

More than one Leaf.

9. Convoluta, rolled together double.
10. Involuia opposita, rolled in opposite.
11. Involuta alterna, rolled in alternate.
12. Revoluta opposita, rolled back opposite.
14. Equitantia

Parts of an Egg and Seed. Sect. 137.

15. The containing parts of an hen's egg are; *A.* the shell; *B.* the exterior film; *C.* the interior film; *E.* *D.* *E.* the *chalazae*, or membrane, inclosing the yolk twisted at the extremities.

The parts contained are; *H.* the air within the exterior membrane at the obtuse end of the egg; *I.* the thinner and exterior part of the white; *K.* the interior and thicker part of the white; *F.* the yolk; *G.* the *bilum*, scar or cicatrice.

16. A seed. *I.* the shell, or exterior film; *L.* the film including the yolk; *M.* the yolk; *H.* the scar, or point of life.
APPENDIX.

PLATE I.

Fig.
   a. The front view of the flower. b. The back view of the same; both of their natural size.

PLATE II.

Fig.
2. 2 A. *Tiliae muscosa*, natural size, p. 448.
   2 B. The plant in its young state magnified. a. The flower springing from the bosom of the leaf. b. The flower expanded and magnified. c. The capsules of the seed magnified.
5. A seedling of the *juncus bufonius*, natural size.
6. The same magnified.

PLATE III.

Fig.
   a. The flower magnified.

END OF THE PLATES.