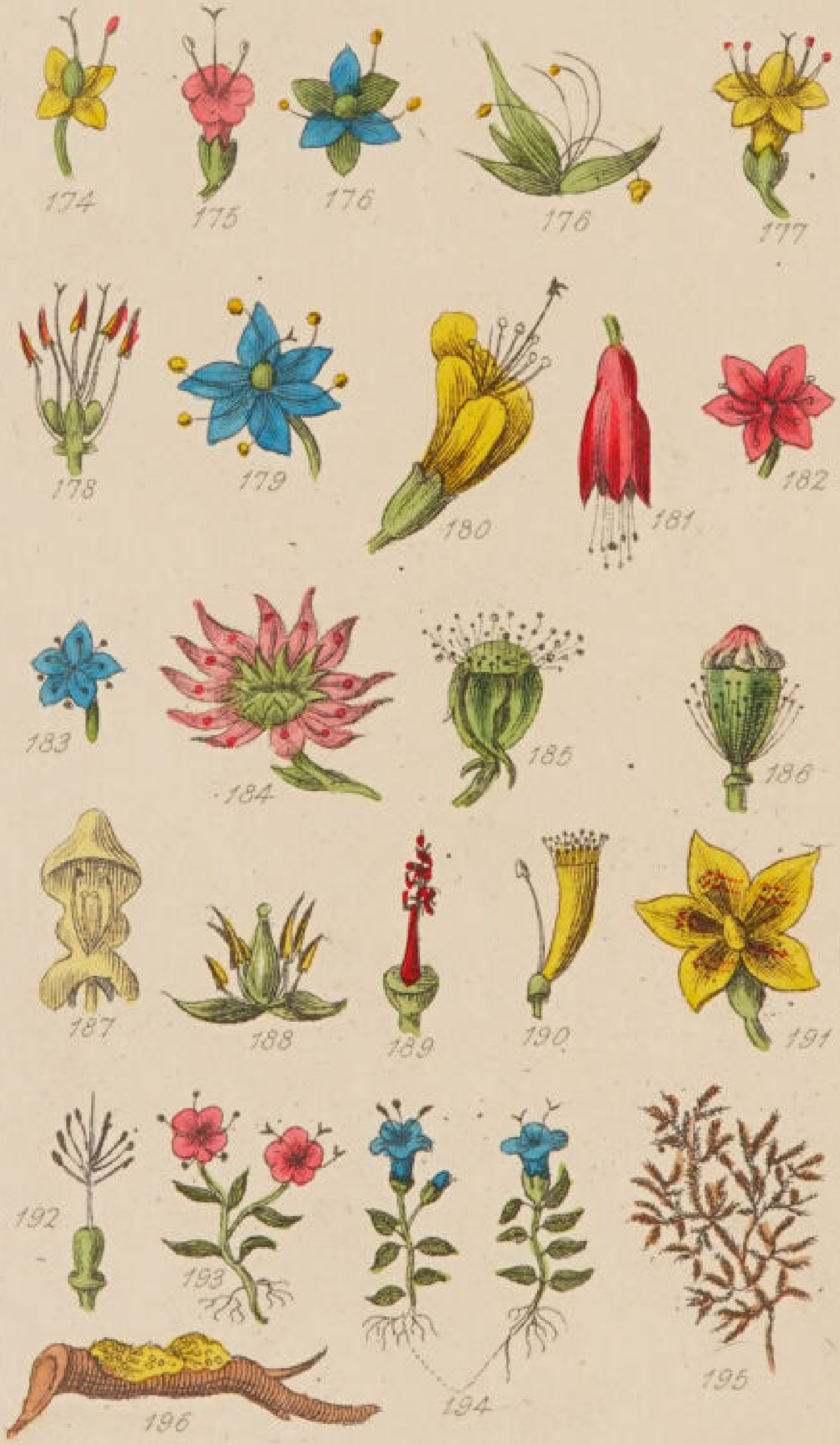
1st Edi.

AN

INTRODUCTION

TO THE

SCIENCE OF BOTANY.



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AN

INTRODUCTION

TO

SYSTEMATICAL AND PHYSIOLOGICAL

BOTANY.

ILLUSTRATED WITH EXPLANATORY ENGRAVINGS.

BY

THOMAS CASTLE, F. L. S.

MEMBER OF THE ROYAL COLLEGE OF SURGEONS, ETC.

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TO

THE RIGHT HON. LADY ELIZABETH BLIGH.

MADAM,

AT a time like the present, when rank and affluence unite to promote the best interests of science, permit me to express the pleasure I experience, in presenting to the Botanical world this testimony of my zeal, under the promising advantages of your immediate protection.

The success of young authors, unless attended with conditional recommendations, is always very precarious; but possessed, as I have the honour to be, of your Ladyship's favourable opinion, and supported with the approbation of other distinguished and literary members of society, I shall venture to publish this Introductory Work, under an assurance, that the same generous feelings which have sanctioned the undertaking will also excuse its failings, by reflecting only on the real claims of merit it may have to the confidence so freely and handsomely bestowed.

That it may prove more deserving of your Ladyship's future consideration than I anticipate, and be an acceptable offering to the Public, is my earnest and anxious desire, trusting thereby to secure a continuance of your valuable patronage, and to reap the self-satisfaction of knowing my humble labours have been instrumental to the propagation of a favourite and interesting science.

With these hopes on my part, allow me, Madam, to request your acceptance of the work, not only as an outline of Botanical study, but more particularly, as a faithful acknowledgment of gratitude and respect.

I have the honour to be, Madam,

Your Ladyship's

very obedient

and devoted humble Servant,

THOMAS CASTLE.

PREFACE.

THE science of Botany, from a rude and uncultivated arrangement of its elements, has of late years, been brought to assume considerable authority on general attention. The paths for its cultivation have been studiously displayed, and every enticement held in view, to invite the enquiring naturalists, to seek a few hours recreation, in its splendid offerings of fundamental truth and natural philosophy. Its study is no longer a labyrinth in which even men of learning might be lost; but its former clouds of confusion and error, have been gradually dispersed by the patient researches of numerous disciples, and the variable banquet is now open to all who are anxious for a familiar acquaintance with the works of nature.

It must not be thought, however, that a knowledge of the vegetable kingdom is to be acquired, without a regular attention to the rudiments on which natural and systematic botany are established. It is a study, which must continue to be nursed with innumerable technicalities, and it is only by patient perseverance, you can expect to overcome the preliminary obstacles to your progress.

The intention of the present work, is to place in the hands of the student, a comprehensive outline of the different branches of Botanical science, wherein a moderate portion of matter is included, to make each part tolerably plain, and easy of comprehension.

Of the few notes connected with the "History," a single reading will prove sufficient, as it is merely written to convey a faint memorial of the rise and progress of the science.

The second part must be attentively studied, and as far as possible committed to memory. It is the foundation of all systematic arrangements, and constitutes the true study of Botany; consequently, I have endeavoured to give it familiarity by short explanations, and common practical illustrations. The reading should be valued only as a text to Nature—seek for actual examples, and rather learn from them, than trust to descriptive facilities.

In the "Language of Botany," attention may be directed to the variety of flowers, and their inflorescence. The other parts exhibit the industry of scientific authors; and will answer the purpose of a glossary, in cases of reference.

The Linnæan Artificial System, and the two subsequent Natural Arrangements, must be left in part, to the personal views of the reader. The first, is an immortal index to plants, simple in its construction, and comprehensive in its application. The other two possess their respective merits, but are less adapted to fulfil the object for which they were framed. They are more complex in their organization, and not so easily employed as valuable directors.

Anatomical and Physiological Botany, being unavoidably very limited in so small a work, it is only purposed to give an outline of the present state of phytology. For many it will be sufficient; and to those who meditate deeper enquiries on the subject, it may not be refused as a simple introduction.

The last part, or Harmonies of Vegetation, is that department which displays the study under consideration, in its most interesting form; for here, freed from the chains of order and confusing terms, we can read the simple laws and exquisite regulations of the vegetable kingdom, and learn, in the forcible language of universal truths, that the farther we extend our enquiries into Nature, the more beautiful and benevolent do the blessings of Providence appear.

Throughout the whole work I have endeavoured to select information from the best authorities, and to convey it to others in as concise and clear a manner, as the individual subjects would admit. Whatever may be its value as an Introduction to Botany, it is offered to the general reader, with the best intentions for his advantage and the interests of the science; but how far it will benefit the one, or contribute to the reputation of the other, is only to be answered by its reception with the public.

T. C.

38, Bermondsey Square,
June 1st, 1829.

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HISTORY OF BOTANY.

WHEN we contemplate the innumerable variety of plants presented to our view, whether in the luxuriant valley, the shady forest, or on the snow-topped mountain, the mind of almost every reflecting person, must be imperceptibly led to admire and investigate so extensive a field of information; and in this, is constituted the science of Botany.

The term *Botany*, is derived from the Greek word *βοτανη*, *an herb or grass*, and that from *βοτος*, of *βοω*, *I feed*, because most animals feed on herbs, and although it is explained by some writers, as signifying only, a treatise of the nature and properties of vegetables, it is capable of a much more comprehensive meaning, and indeed, is now used with far more freedom.

2. Botany, to take it in its most extended sense, I should therefore say, is that branch of the history of nature, which relates to the vegetable kingdom, the second of the three grand divisions, into which all terrestrial objects are divided.

It is a science by no means limited, since not only the nature and properties of plants enter into its study, it likewise includes their description and classification, their anatomical structure and physiology, and in fact, every important particular relative to vegetation.

3. The science of botany, is generally divided into two parts; the one called *systematical botany*, and the other *phytology* or *physiological botany*.

That part of the science, which refers to a description of the organs which constitute a plant, and the classification of plants by their exterior characters, so that one species may be easily recognized from another, is denominated *systematical botany*, and that which treats of the structure, functions, and properties of plants, is particularly termed *phytology* or *physiological botany*.

4. Since Nature has so bountifully bestowed her blessings on the earth, we cannot be surprised that her numerous beauties and advantages, should have called forth the attention of man; but in what light plants were first considered, is a question of interesting enquiry.

That the attention of our first parents, must have been naturally directed towards plants, is very probable, in as far as they derived their subsistence from this source; so that in those days, they were only considered as supplying by spontaneous production, the indispensable necessaries of life. The next stage, was that in which men began to direct their attention to vegetables, as capable of furnishing, by means of cultivation, an increased supply of food, proportioned to an increased population. Another stage of attention to vegetation, was that in which plants began to be regarded as furnishing, not merely necessaries, but comforts; and the fourth stage, when they were cultivated, not only for comforts, but luxuries.

5. That these were the early steps, which ultimately gave rise to the science of botany, we have every reason to believe, since sacred history itself, can very effectually authenticate the justness of such a conclusion.

That the first stage corresponded to the time of Adam, is very evident; the second stage to the days of Cain, who is represented as "a tiller of the ground;" the third stage, to the period (A. C. 2349) in which we find Noah represented as "a husbandman, having planted a vineyard and drank of the wine;" and the last stage, to the time in which we find the Ishmaelites remarked, as "trafficking in spicery, and balm, and myrrh, which they carried down from Gilead to Egypt in the days of Joseph."

6. Up to the latter period in the rise of this science, it does not appear that plants were studied with any system or idea of botanical language, yet it cannot be doubted, that some considerable progress had been already made in botanical remark, from the necessity of discriminating, by some striking and peculiar character, such plants as were possessed of properties convertible to the use of man.

For as man was surrounded with such a diversity of plants, varying in form, in magnitude, in colour, and in odour, in every way calculated to delight the senses and to administer to his wants—it is but reasonable to suppose, that the umbrageous tree under which he sought shelter from the ardour of the meridian blaze, the flower which charmed his eye, and the fruit which allured and pleased his appetite, must have been natural circumstances to call forth a peculiar language, for distinguishing one plant from another.

7. That a natural languge must have been the result of necessity and convenience, is very certain; for without it, our ancestors could only have passively admired or valued the boundless gifts of nature.

If such characteristic marks had not been assigned to the different plants and their productions, it is very true, our forefathers would have been constantly open to the danger of destroying life, or injuring their health, by inadvertently partaking of deleterious vegetables, but by a simple, and, as it were, an instinctive dialect, they readily secured themselves from harm, and were capable of judging and employing the succeeding blessings of the seasons, to their necessary comfort and support.

8. The human mind, having been so far directed to discriminate the vegetable profusions of the earth, it was to be expected, (since the intellectual powers were given man, with the undoubted view, that they should be employed in exploring the wonders of the creation) that he would have more especially devoted his thoughts, to institute further enquiries and observations on this branch of nature.

Such would appear to be the consequent argument of our present knowledge of the human mind; but history says nothing which can lead us to suppose, that any thing like scientific investigations were made in the subsequent days to the period last mentioned. The first authentic account, which can be said to reflect any idea of the cultivation of *the study* of plants, is afforded by the Scriptures, where it mentions Solomon, as speaking of trees, from the cedar tree that is in Lebanon, even to the hyssop that springeth out of the wall. (A. C. 1004.) Of the character and object of Solomon's work, whether systematic or not, is a matter of conjecture; but from the short account which has been given, it was represented as a sort of natural history of all plants then known.

9. Admitting Solomon's work to have been only a natural history of vegetables, and the gloom in which the subject was wrapt from his days for near four centuries, we may, with great propriety, regard the dawn of phytological enquiry, as originating with the speculations of the Greeks. A. C. 604.

Although the study of botany was held in high estimation for a length of time in Chaldea, it was only made subservient to medicine; and the knowledge of plants among the Chaldeans, was treasured up (for their curative powers) as a rich legacy to behanded down from father to son; and in this manner, the infant science was cherished till it passed into Egypt. In Egypt, however, it remained almost stationary; but Thales, the most ancient of the Greek philosophers, and the first that travelled from Greece into Egypt, for the purpose of being initiated into the Egyptian mysteries, is supposed to have commenced some remarks on the phytology of vegetation.

10. Whether Thales did positively enter into any theory of vegetable physiology, we are not assured; but it is very certain, that the discussions of his immediate successors and of the earlier leaders of both the Ionian and Italian schools, were frequently ornamented with some very nice and subtil topics of phytological investigation.

The philosophers of this period, (A. C. 550) accustomed to rest too much upon genius and reflection and careless of facts, advanced the most absurd doctrines imaginable. They taught, that plants possess a sensible and reasonable soul, have desires and wishes, and are capable of experiencing pleasure and pain. Pythagoras, the celebrated sage of Samos, is said to have prohibited his disciples from the use of beans, on account of a supposed identity of origin between beans and human flesh. Anaxagoras, of Clazomene, maintained, that the seed of all vegetables are lodged in the atmosphere, from whence they descend with the rain and dew into the earth, where they mingle with the soil and spring up into plants. Empedocles of Agrigentum, and Democritus of Abdera, also, asserted very singular hypotheses concerning vegetable life. Such were some of the very whimsical opinions of these learned men; it is therefore very plain, they could not have been founded on accurate observations, and much less on the basis of any thing like philosophical experiments.

11. Immediately following the philosophers whom we have just considered, the science of botany met with a most liberal and fostering protector, in the venerable father of medicine, Hippocrates; but it does not seem, that even under the auspices of so great and dignified an example, the study of botany made any very great advancement towards a system of phytology.

It is true, that Cratejas, the contemporary of Hippocrates, wrote a book expressly on the subject of botany; and that the study of plants was regarded as an honourable pursuit, in the time of Xenophon, who represents it in his Cyropædia, as constituting one of the branches essential to the education of the Persian youth; but it was not yet regulated, in any wise, with system, or true philosophical discretion.

12. The first of the Greek philosophers, who appears to have made any enquiry into the economy of vegetation, upon principles any thing like scientific, was Aristotle, the father of natural history, and prince of ancient metaphysicians. A. C. 350.

Aristotle is said to have written two books, both of which were lost: however, in the works of Theophrastus, who inherited the learning of his great masters Plato and Aristotle may be seen all that was known at that time regarding vegetables. A. C. 300.

13. Notwithstanding Theophrastus devoted himself with the utmost zeal to the study of physiological botany, it was not an effectual cause to induce his successors to follow the same steps.

Though it may be suspected, that some little advancement was made after the days of Theophrastus, through the encouragement of the great, it is evident, that the study of plants began to decline among the Greeks, along with the empire, and to emigrate with the other arts and sciences, into Italy.

14. Considering that botany was well received in Italy, there are no substantial proofs that it was pursued with any great degree of interest, as the Romans, like the early Greeks, were yet too much engaged in the tumult of war, to have acquired any considerable relish for the study of natural history.

The first direct evidence of any botanical enquiry among the Romans, is that which is furnished in the works of Dioscorides and Pliny; but though these philosophers were long regarded as the best and most infallible guides in the study of plants, botany derived from their labours but little advantage; and the laudable example which they set, seems to have been as much neglected by the Romans, as that of Theophrastus was among the Greeks; for it was permitted to lay, like all other departments of science, buried in the ignorance and barbarism of the darker ages, except in as far as it was cultivated by Galen, Avicenna, and a few other Asiatic Greeks, till the period of the revival of learning in Europe.

15. During that part of history, emphatically called "the dark age," a dismal gloom enveloped the whole of the civilized world; ignorance, superstition and barbarism tyrannized over learning and genius; knowledge of any kind, was to be acquired only by searching among the rubbish of monasteries; fabulous legends supplied the place of truth, and the deception of a crafty priesthood debased, at the same time that they enslaved the minds of men.

In this long and melancholy course of years, the few scattered writings that appeared on natural history, were the productions of monks, and compiled from old authors; but even these were cloaked in almost unintelligible jargon, and it was not till the middle of the sixteenth century, that the sun of science again burst from the thick cloud, and shed its rays upon the north of Europe.

16. At the revival of the sciences, botany was exactly in the same state as the ancients left it, merely a catalogue or list of the names of about one thousand plants; for although the ancients had made numerous enquiries respecting the physiology of vegetables, they had not deduced any very scientific results.

At this memorable period, the study of plants began again to engage the attention of the learned, and to be pursued with a degree of industry unknown before; while the writings of Dioscorides and Pliny, (which with all their defects or redundancies, were still regarded as the grand standard of botanical knowledge) began to be studied and commented upon, with the most indefatigable zeal.

17. One of the first fruits of the revived taste for botanical enquiry, was the introduction of explanatory wood-cut figures, with a view to elucidate verbal descriptions.

The merit of this great and important improvement, is due to Brunfelsius, a native of Mentz, in Germany, and the justly regarded restorer of the science in Europe. He was a physician at Bern, and his work entitled *Historia Plantarum*, was published with illustrative figures; but considering that he died in 1534, we cannot wonder that they were wanting in accuracy of delineation. Like all other attempts of improvement, those of Brunfelsius excited the emulation of other botanists, and were accordingly followed by those of Bock, Cordus Fuschius, Dodonæus, and Clusius, all natives of Germany, who each added something to the number or accuracy of the figures of his predecessors in publication.

18. The flame that was thus kindled up by Brunfelsius and his successors in Germany, soon began to extend itself to surrounding nations, and to excite, in the adjacent countries, a similar attachment to the study of plants.

In Italy, the celebrated Mathiolus was the first to cherish the returning science; in France, Delachamp and the elder of the Bauhins, endeavoured to embrace in one comprehensive view, the whole of the vegetable kingdom; and in our own country, Turner and Gerard, gave most decided proofs of their zeal and interest, by the publication of their herbals.

19. That the knowledge of botany, began now to assume a very different and improved aspect, is a natural

conclusion; still, however, in all the works that were written about this time, there was no kind of system or arrangement the least calculated, to render the study of plants interesting or inviting.

The consequent inconvenience attending the want of order, began now to be severely felt, and it was soon an object worthy of the most learned, to ascertain and establish the principles of scientific arrangement.

20. The first person who gave his attention to an artificial arrangement, was the celebrated naturalist, Conrad Gesner, a native of Zurich in Switzerland, who in the middle of the sixteenth century, *suggested* the method of arranging plants into classes, orders, and genera, according to the peculiar characters of the flower.

While Gesner was employed in Germany, in maturing his plans of method, the same necessity for methodical arrangement, was also felt and pointed out by Cæsalpinus, a native of Arezzo, in Florence, and one of the Professors of the University of Padua; who, with a mind suitable to the accuracy of such an undertaking, applied himself to the purpose in view, not only with the best qualifications, but with the happiest issue: what Gesner contemplated only in theory, Cæsalpinus reduced to practice, presenting to the world *the first* specimen of a methodical arrangement of plants; and reflecting at the same time, a greater degree of light upon the structure and affinity of vegetables, than any preceding botanist. His method, which was exceedingly simple, was founded on the fruit.

21. In addition to the facility afforded in the study of plants, by the introduction of an artificial arrangement, there were also many other great and effective auxiliaries to advance the science of botany, at this period of its history.

Travels and voyages were undertaken for the purpose of making discoveries; Herbaria of dried plants, formed for preserving the specimens collected; copper-plate engravings introduced into works, which by displaying the figures of plants in a correct and natural manner, attracted men of genius in every country, to the study of the science. Another, and perhaps, the most perfect source of true information, was the institution of both public and private botanic gardens. The first public garden, was established at Padua, in 1533, which still exists; this was followed by those of Florence, Pisa, Bologna, and Leyden; and the most ancient private botanic garden, was that of William, Landgrave of Hesse, arranged, as it is said, by Camerarius, and followed by that of Gerard at London, 1596.

22. Notwithstanding the liberal means which were now adopted to improve the science, the true principles and phenomena of vegetable life, were far from having been explored with depth of judgment.

This defect in the study of plants, very soon called forth the attention of two eminent naturalists, Grew and Malpighi; the result of whose investigations, laid open many interesting facts for the consideration of succeeding botanists. A. D. 1670.

23. The path which had been pursued with so much patience and zeal by these celebrated physiologists, gave rise to the idea, that methodical arrangements might very correctly be founded on the anatomical structure of plants, and accordingly, many new systems were introduced, each professing some great advantage peculiar to itself.

The principal systems which were framed about this time, were those of Morrison, Ray, Tournefort, Rivinus, Boerhaave, Herman and Magnol; and although they have now become more or less abandoned, they were certainly beneficial as steps to future improvement.

24. Taking into account the great increase of learned botanists who flourished about the close of the seventeenth century, and the numerous sources from whence

botanical researches were continually flowing, the introduction of a comprehensive system, founded on truth and sanctioned by simplicity, was still a desideratum much sought for and required.

This herculean task, was finally completed by that great and illustrious naturalist Carolus Von Linnæus; who, deducing the observations and plans of his predecessors, established an artificial system, characterized by the simplicity of its foundation, the perspicuity of its arrangement, and the infinite extent of its application.

25. The general assent of nearly all botanists to the superiority of the Linnæan artificial system, has given it an unparallelled circulation through most of the civilized nations of the world; and it has long been justly considered, as the only practical arrangement calculated to comprehend the immensity of vegetable productions without much uncertainty and confusion.

Allowing the splendid reputation of the system in question, to be due to the memory of so great a benefactor to the science, and admitting the facility with which it is made practicable for all capacities, it is still defective, and from time to time, botanists have found it necessary to make alterations according to the calls of modern discoveries. Nevertheless, the original ground work is still the same, and as a standard arrangement, it is undoubtedly the most easy to be acquired, and the most happy in its purposes, therefore, well adapted for the wants of a general student. But the system which Linnæus adopted, is not the only labour for which he deserves the applause of posterity: he made considerable researches in vegetable physiology, and his endeavours to render botany useful to medicine and agriculture, are worthy of the highest praise.

26. Since the introduction of the Linnæan system, botany has appeared under a more clear and interesting view to its numerous admirers; the rage for making new systems and arrangements has passed away, because

they are no longer necessary; but botanists have arisen, and still live, who, besides illustrating and endeavouring to perfect systematic botany, have advanced, in a great degree, the more useful parts of the science, by inquiring into the properties of plants, the phenomena of their functions and growth, and the effects they produce on the great system of nature.

Among the eminent men who have devoted themselves to the subject of plants since the time of Linnæus, are the names of Haller, Œder, Schreber, Jacquin, Bergius, Pallas, Forster, Thunberg, Jussieu, Sir J. Banks, Miller, Hedwig, Dryander, Gærtner, Sir J. E. Smith, Willdenow, Withering, Humboldt, Roxburgh, and many others well known in the annals of botany.

27. The only system which has appeared, since the introduction of the Linnæan system, requiring our notice, is one in which that learned botanist Jussieu, has immortalized his name, by an attempt to arrange all plants in a natural order.

Of the many beauties of this natural system, and the scientific principle on which it is founded, we purpose hereafter, to give a comprehensive outline, and as much as possible, still further to display the wonderful laws and regulations of nature, on which it was so admirably established.

28. We have now taken a general survey of the rise and progress of the science of botany, and as a matter of conclusion, it may not be out of place, to recapitulate the principal points that have come under our consideration; after which, we shall treat of the elements of the study in pursuit, and make every remark worthy or suitable to our purpose.

To call to recollection what has been already said, we were first taught, how the human mind was originally directed to the consideration of plants, from natural or acquired causes;—secondly, the unaccountable theories entertained by some of the ancient writers, respecting vegetable life;—thirdly, the fate of botany during the "dark age," and its subsequent revival;—fourthly, the primary steps to systematic arrangement, and the numerous measures adopted at that period, for the advancement of the science;—and lastly, the present improved state of the physiological department, and the fortunate institution of practical systems, whereby the study is reduced to an interesting and delightful accomplishment, not only likely to attract the attention, and to expand the reasoning powers of the mind, but equally fitted, to teach us to acknowledge and adore that God, by whom all things are ruled and governed with so much wisdom and beneficence.

THE

ELEMENTS OF BOTANY.

PART II.

CONSISTING OF GENERAL REMARKS ON PLANTS: THE DIVISION OF PLANTS INTO ELEMENTARY ORGANS, WITH DELINEATIONS OF THESE ORGANS AND THEIR STANDARD VARIETIES.

THE

ELEMENTS OF BOTANY.

SECTION I.

General remarks on plants:—Division of plants into different organs:—General remarks on the root, the stem, and the leaf.

SECTION II.

The elementary divisions of a flower, or the parts of fructification:—General remarks on the calyx, corolla, stamen, pistil, nectary, seed-vessel, seed, and receptacle.

SECTION III.

On the appendages to plants; including the branch, the bulb, the bud, the leaf-stalk, the flower-stalk, the stipule, the floral-leaf, the thorn, the prickle, the tendril, the gland, and the pubescence.

SECTION I.

PLANTS.

1. By the term *plant*, we are to understand all the various organized productions of the vegetable kingdom, from the smallest to the largest, and from the plainest to the most exquisite in beauty.

We must, therefore, include every vegetable of whatever nature or utility; so that the noble oak of a hundred years, and the herb that lives but for a day, are equally to be comprehended by this general term.

2. Plants are usually defined, as being organized bodies, consisting of five principal parts, as the *root*, the *stem*, the *leaf*, the *flower*, and the *seed* or *fruit*.

Though some plants have not all these parts, they are nevertheless perfect in themselves, and as well adapted to perform the various functions necessary to support vegetable life.

3. According to the attachment or local situation of plants, they are divided into four classes, as being either *terrestrial*, *aquatic*, *parasitical* or *ærial*.

If their roots are placed in the dry earth, as with most plants, they are called *terrestrial*; if the plant grows in water, as the water-lilly, *aquatic*; if on any other plant or substance, as the misletoe and several fungi, *parasitical*; and if they are neither attached to the ground nor to any other substitute, but suspended in the air, as the Indian fig, they are denominated *ærial*.

4. Plants are also subject to a specific application of terms according to the time of their duration, and are therefrom, either styled *annuals*, *biennials*, or *perennials*.

Annuals are those which last but one year; that is, come up in the spring and die in the autumn, as wheat and barley: *biennials* are those which produce flowers and seed the second year after their being raised, and then die, as the leek and Canterbury-bell: and *perennial* plants, are those whose roots last for many years, as with most plants: and these are either *evergreen* or *deciduous*, according as they retain or lose their leaves, so that the laurel comes under the former term, and the apple-tree under the meaning of the latter. The duration of plants, is usually characterized in botanical works, by peculiar signs; thus, ⊙, signifies an annual; ♂, a biennial; ♃, a perennial, and ♄, a shrub or tree.

5. In addition to the division of plants already mentioned, they are again sub-divided into *trees, shrubs*, or *herbs*, depending either upon their magnitude or other essential differences.

Trees are the largest productions of the vegetable kingdom, consisting of a single trunk, out of which spring forth branches, as the oak: *shrubs* are a lesser production than trees, which instead of one single trunk, frequently send forth from the same root many sets or stems, as the honeysuckle; and *herbs* are those plants, whose stalks die away every year, as the sunflower and many others.

THE ROOT.

1. The root is that part of the plant, by which it attaches itself to the earth, or to the substance on which it feeds, and is the principal organ of nutrition.

2. The roots of plants, have been numerously related as species very different from each other, but the distinctions of *spindle-shaped, truncated, fibrous, ramose, bulbous* and *tuberous*, are perfectly sufficient.

3. The *spindle-shaped root* is that kind which tapers

gradually, as its name implies, from the base or collar, to the point.

This root is well exemplified in the carrot, parsnip, radish, and several other culinary vegetables; it is usually in one root, but occasionally divided. (F. 21.)

4. The *truncated root* is that kind which tapers gradually like the spindle-shaped, but it terminates abruptly, as if the lower part had been cut or bitten off.

The devil's-bit scabious, affords a very familiar specimen of this root: the primrose, the valerian, the greater plaintain, and the cowslip, may also be collected as examples; but you are not always, however, to expect, that when any of these plants are dug up, the root will be found uniformly truncated; this is only the case, when the plant is above a year old, for during the first year, it is spindle-shaped; after this, it becomes woody, dies and rots, the upper part excepted, and this causes the eroded or bitten-off appearance, while new fibres shoot out from the sides of the part left, and compensate for the want of the old main root. (F. 22 and 25.)

5. *Fibrous* or *capillary roots* are those which consist of a number of small and thread-like fibres, one of which is generally central and the rest lateral.

The fibrous root is found in most annual plants and in most grasses. They support the plant, not by their individual strength, but by their number and distribution, elongating in a divergent direction, and rivetting down the plant on all sides. Wheat, barley, oats, and many other plants, display this species of root. (F. 19.)

6. The *ramose* or *branched root* is the most frequent kind; it is generally of a woody nature, and divided into numerous ramifications like the branches of a tree.

All trees and most shrubs, have this kind of root, consequently no other illustration can be necessary to make it understood. (F. 24.)

7. *Bulbous* roots are those which consist of one

globe or head, from the under surface of which, many fibres descend.

The tulip, lily, snow-drop, crocus, and many other familiar garden plants, are very good examples of this root; but bulbous roots are divided into three sets, according to the peculiarity of their structure. When they are of one firm compact substance, as the crocus and turnip, they are called *solid bulbous* roots (F. 26); if in plates or scales, as with the lily, *scaly bulbous* roots (F. 18); and if they have coats or layers one over another, as with the onion, (F. 23) they are then termed *coated bulbous* roots.

8. The species of root called *tuberous* consists of a knot or tubercle, furnished with a number of small or scattered fibres, or of a number of knobs or tubercles united by the means of such fibres, and forming clusters.

There are many plants with this order of root, but the potatoe, earth-nut, peony, ladies-traces, white saxifrage, and sweet flag, are examples so very common, that any other references would be needless. (F. 20.)

9. In many plants, the root is systematically divided into two parts, the *caudex* or *great root* and the *radicula* or *rootlet*.

The *caudex* is the main root from whence the stem arises, and from which the *rootlets* or *fibres* are given off; or to explain it more practically—if you take a tulip root, that part of it which forms a solid bulb, is the caudex, and the threads which proceed from it, the rootlets. The caudex is also intended to be represented by the letter *a*, F. 26, and the rootlets, by the letters b b, in the same figure.

THE STEM.

1. The stem is that part of a plant arising from the root, and maintaining the leaves and other necessary appendages.

Linnæus used the word *trunk*, as a generical term for all stems; but the plan of considering stems in the present day, is far more correct and applicable.

2. For the sake of facilitating botanical description, stems have been divided into six sets; viz. *trunks, stalks, straws, scapes, fronds* and *stipes.*

Some botanists likewise include, the *leaf-stalk* and *flower-stalk* as peculiar stems; however, as they cannot be called stems, we shall notice them hereafter, as *appendages* to those parts.

3. A *trunk* is the proper stem of trees and shrubs, and is characterized by its height, size, and woody structure.

Trunks are always perennial, generally naked at the lower part, and divided and sub-divided towards the summit, into branches and twigs, bearing the leaves and the flower or fructification.

4. The *stalk* signifies the stem of herbaceous plants only. It is rarely woody, and lives but for one or two years in the natural state of the plant.

The cabbage, peony, sun-flower and many other very common and well-known plants, have this particular species of stem.

5. A *straw* is the peculiar stem of grasses, rushes and other similar plants. They are either hollow or partially filled with pith, and generally divided into compartments by a species of knot or joint.

Wheat, barley, oats, rush, bull-rush, bog-rush, and cotton-grass, are probably the best examples that can be referred to.

6. A *scape* is that kind of stem, which arises from the root and supports the flower, but not the leaf.

Scapes are always herbaceous, and are either *simple*, or bearing one flower only, as in the primrose; or *divided* and many-flowered, as in the cowslip. The snow-drop, the daisy, the lily, the hyacinth, the daffodil and the narcissus, are all furnished with scape stems.—(F. 31, a.)

7. The *frond* is that species of stem, in which the stem, leaf and fructification are united; or in other words, the flowers and fruit are produced from the leaf itself.

The frond is more especially connected with the fern tribe. It is also applied to the lichen tribe, and others in which the whole plant is either a crustaceous or leafy substance, from which the fructification immediately proceeds. (F. 33.)

8. The word *stipe*, is used to express the stem of palms, ferns, fuci and fungi. They are generally cylindrical, but sometimes swollen in the middle, and bear a frond, or a peculiar foliage at their summit.

The stipe, then, is the base or foot-stalk of the *frond*, and though it may in many ferns and fungi, be considered as a true stem, yet in the palm it is only secondary, and the lofty stem which bears the frondose top of those majestic vegetables to the clouds, is nothing more than a congeries of the bases of former fronds, and those which are constantly pushing out from the summit; so that notwithstanding the great height and appellation of palm-trees, they are very different in structure and mode of growth, from trees properly so called.

The mushroom is perhaps the most easy practical illustration we can give you of the *stipe;* for that part which is represented by the letter a, in the 35th figure, is its stem or stype, and that by the letters b b, its peculiar foliage or frond.

THE LEAF.

1. The leaf is usually the temporary part of the plant; generally of a thin and flat substance of a green colour,

and issuing either from the branches or immediately from the stem or root.

All leaves, however, are not thin and flat in their configuration, or of an uniform green colour; for the leaves of the aloe and common house-leek are thick and fleshy; the leaves of the beet are of a dark dull purple; and the leaves of the canary reed-grass are variegated with stripes of white and green.

2. Leaves are generally divided into two sets, viz. those which are called *sessile*, and those which are denominated *petiolate*.

When they spring immediately from the root by a broad expansion, as in the hyacinth, or united to the stem or branch by an *immediate* approximation with their base, they are said to be *sessile* (b b, F. 31, and 56); but if the expansion of the leaf is supported on a foot stalk, or petiole, (a, F. 40) as in the geranium, they are termed *petiolate*.

3. In addition to the division of leaves into sessile leaves and petiolate, they are also divided into *simple* leaves and *compound* leaves.

A leaf is *simple* when it rests, by itself, upon one common leaf stalk, and consists of a regular expansion, as in the primrose, geranium, &c. and *compound* when it consists of two or any greater number of leaflets, connected by one common leaf-stalk, as in the rose, elder, &c.

4. The characteristic points connected with the generality of leaves (and leaflets) of the *petiolate* kind, are nine in number; for in the elements of botany, they are usually described as having an *upper* and an *under surface*, a *mid-rib* and *lateral nerves*, a *base*, an *apex*, a *disk*, a *margin*, and a *foot-stalk* or *petiole*.

To understand these peculiar parts, you have only to select a leaf of the cherry-tree, and you will find the *upper surface* to be of a dark green colour, and somewhat smooth; that the *under surface* is of a lighter hue, and divided into two parts by a central or *mid rib*, (F.40, b b,) from which are sent out several *lateral nerves*: that the mid rib is nothing more than a continuation of the *foot-stalk* (a) or the part by which it is connected to the branch; that the *base* (c c) expands on each side of the foot-stalk and proceeds to form the *margin* (e e) or the boundary of the *disk* (by which term is meant, the intermediate substance of the leaf,) and that the leaf finally terminates with an *apex* or point (d).

5. That all these parts are present in every expanded leaf, we have many instances to convince us of the contrary; for although they are to be met with in numerous vegetables, still there are several plants whose leaves have not so many distinguishing marks.

All leaves which are *sessile* have no foot-stalk, and many neither a mid rib or lateral nerves, since the nerves sometimes run in a parallel direction one with another, as in the leaves of the hyacinth, and several others of that tribe. Again, in many other plants, the leaves being round, or roundish, they have no terminating point; it is therefore very clear, that all the parts we have mentioned are not common to every expanded leaf.

SECTION II.

PARTS OF FRUCTIFICATION.

1. By the parts of fructification are meant, those organs of a plant, which are destined by nature for the reproduction of seed; so that under this expression, botanists comprehend the *flower* and the *fruit*, both of which are well known to be temporary parts of a plant appropriated to the propagation of its species.

THE FLOWER.

2. The flower, like the leaf, is a temporary part of the plant, issuing generally from the extremity of the branches, but sometimes also from the root, stem, and even leaves. It is usually distinguished by the brilliancy of its colour or the sweetness of its smell.

Although the flower is in most plants placed at the extremity of the branches, it is by no means confined to that part. In the meadow-saffron it rises immediately from the root; in the cowslip from the stem; and in some plants from the leaves.

3. The parts which are considered necessary to form a perfect flower, are five in number; viz. the *calyx*, the *corolla*, the *stamen*, the *pistil*, and the *receptacle*. The *nectary*, *seed-vessel* and *seed*, are also described as parts of the flower.

It is not essential, that every flower should have *all* these parts, for notwithstanding many do, there are others that are wanting in one or two points, and yet are competent to perform the important office of re-production. Thus the tulip has no calyx; the poppy no nectary; but still the flowers of these plants, are true in the fulfilment of their generative economy.

THE CALYX.

4. The calyx is that part of the flower, often consisting of one or more green or yellowish green leaves, placed at a small distance or close to the corolla.

It is well shown in the primrose; for if you take the blossom of that plant, and pull away all the yellow part, you will have a perfect *cup calyx* (F. 1) of a green colour. Again, the calyx may be seen very distinctly in a rose not quite fully blown, the green leaves which so closely invest the flower being the calyx.

5. There are seven different kinds of calyces; viz. the *perianth*, the *fence*, the *catkin*, the *sheath*, the *glume*, the *veil*, and the *curtain*.

6. The *perianth*, or flower-cup, is the most common kind of calyx; it is generally green, and situated immediately below the flower, so as to form in appearance a part of it.

This kind is well exemplified in the five green leaves which encompass a rose, including the urn-shaped base. The primrose has also a calyx, which comes under the meaning of a cup, or perianth. (F. 1.)

7. The *fence*, or involucrum, is a species of calyx peculiar to umbelliferous plants. It is placed below the

common receptacle, and is scarcely to be distinguished from a bractea.

The common garden carrot will be found to have an involucrum; as also, the fool's-parsley, the narrow-leaved water parsnip, the common earth-nut and the anemones. (F. 14, a a.)

8. The *catkin* or amentum is a species of calyx, which consists of a common cylindrical receptacle, beset with numerous scales, each of which is accompanied by one or more stamens or pistils, so that the whole forms an aggregate flower.

The willow, fir, walnut, hazel, and hop, are all furnished with a calyx of this kind. (F. 4.)

9. The *sheath* is that kind of calyx, which is situated more or less remote from the flower, and after constituting a covering to the infant bud, opens longitudinally.

The snow-drop, common dragon, and several species of the narcissus tribe, have a sheath calyx. (F. 31, c.)

10. The *glume* or husk is a species of calyx, constituted by the valves of corn and grasses, enclosing one or more florets.

Wheat, barley, oats, and all other gramineous plants, have this peculiar calyx. (F. 57.)

11. The *veil* or calyptra is a kind of membraneous hood, which is said to be the calyx of the mosses covering their capsule or fructification, like an extinguisher on a candle.

This is well seen in the genus *hypnum* Linnæus considered the calyptra a calyx, but other botanists, especially Schreber and Smith, reckon it to be a sort of corolla. (F. 58, a.)

12. The *curtain* or *volva*, is the membranous covering of the fungus tribe, concealing their parts of fructification, and in due time bursting all round, forming a ring upon the stalk.

Such is the original meaning of this term, as explained by Linnæus; but it is now used to signify the fleshy external covering of some other fungi, which are scarcely raised out of the ground, and enfolds the whole plant when young. It is well exemplified in the common mushroom, &c. (F. 35.)

THE COROLLA.

13. The corolla is the interior envelope of the flower, investing the central parts, but invested by the calyx. (F. 10, c c.) It is generally of a finer and much more delicate texture than the calyx, and is, of all parts of the fructification, the most showy and ornamental, being always, or with but few exceptions, that which is the most highly coloured, and hence commonly regarded as alone constituting the flower.

The yellow part, which you were directed to remove in the fourth note, constituted the *corolla* of the primrose: or if you take the tulip you will readily know the corolla, because there is never any calyx to that flower.

14. All that it is necessary to observe here of the corolla is, that the leaves (F. 3,) of which it is composed are called *petals*, to distinguish them from the other leaves of the plant, and from the divisions of the calyx.

In some instances, it is a very difficult point of investigation, to distinguish the corolla from the calyx, for nature has not always distinguished the organs in question by any very obvious or decisive character. The calyx is, indeed, generally green, and the corolla coloured, but there are many exceptions to this rule. The calyx of the spurge-laurel is yellow, and the corolla green: the calyx of the scarlet fushia is of a bright scarlet, the corolla indigo. The calyx and corolla of the mezereon are not only coloured, but are even united at the margin, so as to form but one piece. Again, the corolla of the white lily is at first perfectly green, and similar, by analogy, to a calyx; but it changes afterwards to a beautiful white, and assumes the appearance of a corolla.

THE STAMEN.

15. The stamens are a very important part of a flower, They are generally of a very slender fabric and of a thread-shaped figure, surmounted with a peculiar ball or head, and situated, for the most part, immediately within the corolla. (F. 8.*)

Stamens are found to be differently situated in different flowers, so that in some they are attached to the germen, and in others to the calyx, corolla, and so on. These variations in the situation of the stamens are not, however, the result of chance, but are permanent in all the species of plants to which they are peculiar.

16. Stamens are divided into two parts; viz. the *filament* and the *anther*.

17. The *filament* is the thread-shaped part supporting the head or anther. (F. 8, e.)

The filament does does not appear to be a very important part, for the stamen is capable of performing its functions without it, but never without an anther. Many plants are destitute of the filament altogether, as in the genus *aristolochia*.

18. The *anther* is the only essential part of the stamen, and is the small head or knob (F. 8, d) which contains

the *pollen.* When the anther is ripe the integuments burst, and the fine dust, or pollen, (F. 2,) is discharged upon the pistil.

In the stamens of most flowers there is an individual anther attached to each filament, as in the snow-drop; but in the stamens of some flowers there are two anthers to one filament, as in perennial mercury. In the common fumitory, there are three anthers to one filament; and in the common bryony there are five anthers to three filaments.

THE PISTIL.

19. The pistils are likewise small and column-shaped organs, of the utmost importance to the economy of a flower. They occupy, almost invariably, the centre of the flower, and are surrounded immediately by the stamens. (F. 8.‡)

If you gather the lily and take away the corolla, or white petals, you will have seven long and slender organs issuing from the base: the *one* which is in the centre is the *pistil,* and the six situated around it are the *stamens.* The narcissus, tulip, lily of the valley, snow drop, and hyacinth, will also be found to have six stamens and *one* pistil: the primrose, cowslip, and convolvulus, five stamens and *one* pistil: the gelder-rose, French tamarisk, and common elder, five stamens and *three* pistils: the common wood-sorrel, corn cockle, and ragged robin, ten stamens and *five* pistils; and so on with other plants.

20. The pistil is divided into three parts; the *germen,* the *style,* and the *stigma.*

21. The *germen,* or *ovary,* is the lowest part of the pistil, supporting the style and the stigma, and containing the rudiments of the future seed.

The part which is called the germen in the young flower, gradually undergoes a change, till it finally becomes the seed-vessel or fruit.

22. The *style* is the middle portion of the pistil, and is a prolongation of the substance of the germen. It generally issues from the upper extremity of the germen, but sometimes from the side or base.

It appears, from observation, that the style is not altogether essential to the formation of a perfect flower: as in the poppy, it is entirely wanting, but the germen and stigma are always present.

23. The *stigma* is a small and glandular-looking substance crowning the style, and hence denominated the *summit*.

The primrose, heart's-ease, and many other common garden flowers may be consulted, for a practical knowledge of these parts of a pistil. If you take the primrose and remove the calyx, corolla, and stamens, you will readily distinguish the pistil, with its round ball, or *stigma*, (F. 8, a) at the top; then the *style*, (b) upon which it is supported, and lastly, the *germen*, or part (c) to which the style is attached.

THE NECTARY.

24. The *nectary* is an appendage peculiar to some flowers, attached, for the most part, to the corolla, and secreting or containing a honied juice, though it is not necessary to a nectary, that honey should be present.

The nectary may be exemplified, in the horn-like process issuing from the base of the corolla of the violet, or orchis. It assumes, however, a great variety of shapes and situations in different genera of plants.

THE SEED-VESSEL.

25. The seed-vessel is a term applied to the membrane or substance in which the seed is produced. It is formed from the germen or base of the pistil, which, after the flower has performed its proper office, gradually expands and becomes the seed-vessel.

Seed-vessels are very different in their nature, form, and substance, as the gooseberry, currant, strawberry, orange, pear, cherry, filbert, poppy, and so on, very plainly assure us.

26. From the use, structure, or form of seed-vessels, they have been systematically divided into seven sets; viz. the *capsule*, the *pod*, the *legume*, the *drupe*, the *pome*, the *berry*, and the *cone*.

Though most plants have seed-vessels, nevertheless there are some exceptions; but in these cases, the seed is generally retained enclosed within the calyx until they ripen: this is the case with the nettle. In the tribe of grasses, this office is very frequently performed by the corolla.

27. The *capsule* is a dry, hollow, membranous seed-vessel, usually divided into valves, and opening naturally in some peculiar manner, according to the plant to which it belongs. (F. 62 and 63.)

In the orchis, they open at the side by a small hole; in the pimpernel horizontally, in the convolvulus, longways; at the bottom in arrow-grass, and at the top in the poppy.

28. The *pod* is a species of seed-vessel, which consists of two valves or partitions, within which, the seeds

are fixed alternately to each seam. Some botanists divide pods into two sets, one called *silique* and the other *silicle*.

The *silique* is that species of pod (F. 65) which is usually longer than it is broad, having two valves, or covers, and separated by a linear receptacle, the seeds alternately fixed to both sutures or seam, as in the common stock and wall-flower. The *silicle* is that kind of pod (F. 61) which is generally broader than it is long, having two valves, and the seeds alternately fixed to both seams, as in honesty, and shepherd's-purse.

29. The *legume* is likewise a seed-vessel of two valves, but in which the seeds are attached to one seam only.

Familiar specimens of the legume may be selected, from most of the plants arranged under the diadelphia class, as the pea, &c. (F.66.)

30. The *drupe* is that sort of seed-vessel, which is either of a pulpy nature, containing, within, a single hard or bony nut; or those having only a dry and hard shell.

The cherry, peach, plum, apricot, and all stone fruits, are examples of one kind of drupe (F.59); and the almond, walnut, cocoa-nut, filbert (F.69), and hazel (F.68), of the other.

31. The *pome* is a seed-vessel of a peculiar fleshy nature, and instead of containing a nut, like the drupe, it encloses a capsule with several seeds.

The husky part in the centre of a pear or apple, which is called the heart or core, is a membranous capsule of five cells, in which are contained the seeds or pips. The pulp surrounding this capsule constitutes the species of seed-vessel denominated a pome. (F. 60.)

32. The *berry* is that kind of seed-vessel, which is of a soft and pulpy nature, containing one or more seeds,

but not separated by regular valves nor enclosed within a capsule. Berries are either *simple* or *compound*.

The currant, the gooseberry, the orange, the melon and the cucumber, are all *simple* berries (F. 64); while the raspberry and dew-berry are *compound*, (F. 67) because they consist of several single ones united, each containing a seed.

33. The *cone* or *strobile* is a species of seed-vessel, formed by a catkin with hardened scales, each scale containing a seed at its base.

In the most perfect examples of this kind of seed-vessel, the seeds are closely sheltered by the scales as by a capsule, of which the fir-apple and cypress are common instances. (F. 70.) In the birch and alder they have a kind of capsule besides; and in the willow and poplar, a stalked-bivalved capsule, still more separate from the scales.

THE SEED.

34. The seed is that part which it has been the grand object of the flower to produce during its blooming. It is, for the most part, contained in some kind of seed-vessel, and constitutes the rudiment of the future plant.

35. A seed consists of several parts, some of which are more essential than others, and of these we shall mention, the *eye*, the *seed-coat*, the *seed-lobes*, and the *heart*.

These respective parts are not to be observed in every kind of seed, but in the generality you may very readily detect them.

36. The *eye*, or *helium* is the external scar of a seed, by means of which it was fastened to the seed-vessel. The *seed-coat* is the external covering; the *seed-lobes*, or

cotyledons, are the internal substances which constitute the bulk of the seed; and the *heart*, or *embryo*, is that small part, which is the first principle of a new plant and is commonly situated between the cotyledons.

To obtain a practical knowledge of these parts, you should take a common bean, as the most easy for illustration. On examining this seed whole, you will perceive the part by which it was attached to the seed-vessel, by the scar, therefore that part is called the *eye;* in the second place, you must take off the husk, above denominated as the *seed-coat;* which done, the remaining part, you will observe, easily divides into two equal parts of considerable size, called the *seed-lobes;* and, situated between these lobes, you will find a small speck or seed called the *embryo*.

THE RECEPTACLE.

37. The receptacle is the seat or base upon which the different parts of the flower are situated.

The receptacle is not always distinguishable by any particular figure, except in compound flowers, in which it is very remarkable and important. (F. 9.) If you select, for example, the sun-flower, and detach the calyx, corolla, and florets, you will have a complete base or *receptacle*. In the daisy you will find the receptacle conical; in the chrysanthemum, convex; and in others, flat, and so on.

SECTION III.

THE APPENDAGES TO PLANTS.

1. By the appendages to plants, are to be understood, the peculiar organs essential to the vegetable economy of some plants and not to others.

Thus, for example, the sloe would not be perfect without its thorn, or the vine without its tendril; and yet these parts are not necessary to the lily or the myrtle.

2. Under the head of appendages to plants, we shall include the *branch*, the *bulb*, the *bud*, the *leaf-stalk*, the *flower-stalk*, the *stipule*, the *floral-leaf*, the *thorn*, the *prickle*, the *tendril*, the *gland*, and the *pubescence* or *hair*.

Although it has not been usual in botanical works to include the branch, bulb, bud, leaf-stalk, and flower-stalk, as appendages, we have preferred mentioning them here, because they are by no means common to all plants.

3. The *branches* are a natural division of the stem, peculiar to most trees and herbs, originating generally in the upper part, and often along the sides.

In the mode of growth and developement of branches, they exhibit nearly the same appearances as the particular stem from which they issue.

4. The *bulb* is a species of gem of a tender and succulent substance, and of an oval or globular figure, situated either upon the root, stem, or branch, from which

it ultimately and spontaneously detaches itself, and forms a new individual. Bulbs are of two kinds, *radical* and *caulinary*.

If it is situated on the root (F. 26, a a) as in the crocus, it is said to be *radical;* and if upon the stem (F. 27, a a) or branch (or axil of the leaf, as in the tiger-lily,) it is said to be *caulinary*.

5. The *bud* is likewise a species of gem, of an ovate or conical figure, issuing from the axil of the leaves, or from the sides and extremities of the branch, and containing the rudiment of future branches, leaves, or fruit; but not detaching itself spontaneously from the plant, and forming a new individual. Buds are of three kinds; the *leaf-bud*, the *flower-bud*, and the *compound-bud*.

The *leaf-bud* is slender and acute, producing leaves only, as in the peach-tree (F. 34, a); the *flower-bud*, thick and short, containing the flower only, as also seen in the peach-tree (b); and the *compound-bud* larger than either of the two, producing both the leaf and the flower (c), as in the fruit-buds of the horse-chesnut.

6. The *leaf-stalk*, or *petiole*, is the slender stem-like appendage to a leaf, by which it is connected to the branch.

In describing the distinctive parts of an expanded leaf, we have pointed out the *foot-stalk* as an essential part, terminating in the midrib; for although the leaves of some plants are without, yet the generality are furnished with one.

The part marked *a* in the 40th figure, is the foot-stalk of that leaf, and the angle formed by the union of the foot-stalk with the branch, (f) is botanically called the *axilla of the leaf*.

7. The *flower-stalk*, or *peduncle*, is that part which supports the flower and fruit upon the branch or stem, but not the leaves.

All flowers are not furnished with a peduncle, but by far the greater number will be found to possess them. The part marked *f* in the 10th figure, is the peduncle of the flower there represented.

8. *Stipules* are small foliaceous appendages accompanying the real leaves, assuming the appearance of leaves in minature.

The two small leaves, *a a*, in the 30th figure, are intended to represent stipules. Again, if you examine a stalk of heart's-ease, you will find at the base of each leaf-stalk, a pair of leaves very different from the real leaf at the other end of the leaf-stalk, and these are the stipules.

9. The *floral-leaf*, or *bractea*, is a leaf which in general differs from the true leaves both in shape and in colour; and is commonly situated on the flower-stalk, and often so close to the corolla as to be mistaken for the calyx.

As the stipule is an appendage to the leaf or leaf-stalk, so the floral-leaf is an accompaniment to the flower or flower-stalk. The floral-leaf or leaves are represented by the letters *a a*, in the 28th figure, but at a distance from the flower. They may also be seen in the lime, milk-wort, rest-harrow, lady's-finger, and many other plants.

10. The *thorn*, or *spine*, is a sharp-pointed projection growing from the woody substance of some plants.

Although thorns are peculiar to some plants, they are not scattered over the whole surface: thus, they protrude from the stem and branches in the buckthorn and orange-tree (F. 27); from the leaf-stalk in the robinia pseudacacia, or locust of the United States; from the leaves, in the aloe, Adam's-needle, holly, and butcher's-broom; from the calyx in the thistle; and from the seed-vessel in the thorn-apple, &c.

11. The *prickle* is a sharp process from the plant, arising from the bark only, and not from the wood. In this respect it differs very materially from the thorn.

The rose, bramble, berberry, and gooseberry, may be consulted for practical illustrations of the prickle. (See F. 29.)

The distinction between the thorn and the prickle is very easily understood. The thorn is composed both of wood and bark, the prickle of bark or cuticle alone ; and hence, if you strip the bark from a rose-bush or bramble, you will find that the prickles come entirely away with it ; but if you make the same experiment on the hawthorn or sloe, you will not succeed ; you may strip the bark off, but the thorn will remain projecting from the wood.

12. The *tendril* is a fine spiral string or fibre, proceeding from different parts of the plant, by means of which, it fastens itself to some other plant or body for support.

The tendril is not in general at first convoluted; it shoots out in a straight direction, but soon twists, and often, if it does not find a body to lay hold of, puts on a very beautiful appearance, its folds lying in contact with each other, and gradually contracting their diameter so as to form a hollow cone, as in the vine and passion-flower ; and sometimes a tube resembling such as is made by twisting wire. (F. 32.)

13. *Glands* are small and minute appendages of various forms, found chiefly on the surface of the leaf and leaf-stalk, but often also on the other parts of a plant. They are supposed to be organs of secretion.

Though the leaf-stalk is that part of the plant on which they are most frequently situated, yet they are by no means confined to it. They are seated on the indented edges of the leaves in the sweet-leaved willow ; on the base of the leaf in the almond-tree, the gourd, the gelder-rose, and the bird-cherry ; on the back of the leaf in the bastard ricinus, tamarisk, and others ; whilst in the butter-wort and sun-dew, they spring out from the upper surface of the leaves.

14. By the term *pubescence*, is to be understood, all sorts of vegetable down or hairiness, with which the surface of a plant may be covered.

The pubescent appendages, or covering to plants, differ in form and texture, but consist principally of small slender bodies, which are either soft and yielding to the slightest impression, or rigid and comparatively unyielding. The former are, properly speaking, *hairs*, and the latter *bristles*.

THE

LANGUAGE OF BOTANY.

PART III.

EXPLAINING THE MOST USEFUL AND PRACTICAL TERMS APPLIED BY BOTANISTS TO THE VARIOUS CIRCUMSTANCES CONNECTED WITH PLANTS IN GENERAL, AND WITH THE DIFFERENT ORGANS OF PLANTS.

THE

LANGUAGE OF BOTANY.

SECTION I.

Botanical terms relative to plants in general:—Nomenclature of the root:—Nomenclature of the stem:—and the Nomenclature of the leaf.

SECTION II.

Botanical terms relative to the different organs of a flower; to the nature of flowers, and to their manner of blooming, or inflorescence.

SECTION III.

Botanical terms relative to the appendages of plants; including the branch, the bulb, the bud, the leaf-stalk, the flower-stalk, the stipule, the floral-leaf, the thorn, the prickle, the tendril, the gland, and the pubescence.

SECTION I.

NOMENCLATURE OF PLANTS IN GENERAL.

1. Plants are generally characterized in botanical language, according to their situation, duration, magnitude, and structure.

From their *situation*, they are either terrestrial, aquatic, parasitical, or ærial: from their *duration*, annual, biennial, or perennial; and from their *magnitude*, or *structure*, trees, shrubs, or herbs.

2. In the second part of the work, we also observed that plants are said to consist of five elementary organs; and that some plants have likewise peculiar appendages.

These elementary organs and appendages, as well as their varieties and the parts of which they are composed, are, in some instances, subject to a great diversity of botanical distinction. We will now take an opportunity of considering them in the same order as they were mentioned in the preceding part of the volume.

NOMENCLATURE OF THE ROOT.

1. In the Elements of Botany we have described roots as being of six different kinds; viz. spindle-shaped, truncated, fibrous, ramose, bulbous, and tuberous.

As these standard variations have been previously explained, we shall not venture any additional remarks.

2. There are six circumstances from whence botanists have found it necessary to assign expressive terms to

roots. These are, their situation, direction, duration, substance, form, and composition.

3. *Situation:*—By the situation is meant the soil or place to which they are affixed ; and hence, they are said to be subterraneous, ærial, floating, or parasitical.

a. Subterraneous—when they are in the ground, as with the snow-drop and most plants.

b. Ærial—when they are neither attached to the ground nor any other substitute, but suspended in the air, as with the Indian fig and ærial flower.

c. Floating—when the root has germinated in the soil, separates and floats upon the surface of the water, as with the common duck-weed.

d. Parasitical—when they are attached to the bark of other living plants, as with the misletoe.

4. *Direction:*—The direction is the particular position in which roots grow; so that they are called either perpendicular, horizontal, or oblique.

a. Perpendicular—when the caudex or main body of the root descends perpendicularly into the ground, as in most trees.

b. Horizontal—when the extension is nearly parallel to the plane of the horizon, so that the roots form nearly a triangle with the stem or herbaceous part of the plant, as in winter-green and sweet-flag.

c. Oblique—when the root takes an intermediate direction of the perpendicular and horizontal.

5. *Duration:*—From the duration or length of time which roots live, they are either annual, biennial, or perennial.

a. Annual—those which are produced from seed, grow to their full extent, and die in one year or season, as with barley, wheat, common pea, and garden bean.

b. Biennial—those that live through the winter in which they are produced, and after the plant has flowered and yielded seed, die in the following year; as with the carrot, teasels, and Canterbury-bell.

c. Perennial—those which live for many years, as with most trees and shrubs.

6. *Substance:*—When their substance is a mark of distinction, roots are said to be of a woody or of a fleshy nature.

a. Woody—when composed of an epidermis, a bark, a vascular system, woody matter, and pith; as with the roots of trees and shrubs.

b. Fleshy—when they belong to herbaceous plants, and consist chiefly of cellular and vascular textures, interspersed with slender bundles of woody fibre; as with the snow-drop, lily, hyacinth, and narcissus.

7. *Form* and *Composition:*—By the form and composition of roots, we are to understand the figure which they assume, and the parts which constitute the figure. In these respects, roots are either simple, branched, or articulated.

a. Simple—when they consist of a single caudex furnished with fibres only, or of one or more rootlets with fibrils or small fibres, as with the carrot, parsnip, horse-radish, dandelion, radish, and primrose.

b. Branched—when they consist of a caudex divided into lateral branches, which are again subdivided and ultimately terminated in absorbing fibres, so that the root, in its division, resembles the stem and branches inverted. This form of root is the most general, being that of all trees and shrubs; and also of many herbaceous plants, as the elecampane and senega.

c. Articulated—when the root is apparently formed of distinct pieces united, as if one piece grew out of another, so as to form a connected whole, with rootlets proceeding from each joint, as with wild ginger, hedge hyssop, Solomon's seal, and bistort.

NOMENCLATURE OF THE STEM.

1. Stems have already been mentioned as being of six standard kinds; viz. trunks, stalks, straws, scapes, fronds, and stipes.

2. In the language of botany, stems are regarded according to many particulars, but principally as concerns their composition, direction, duration, substance, form, mode of branching, and surface.

3. *Composition*:—If their composition is the subject of remark, they are either called simple or divided.

a. Simple—when they consist of one piece only, without any branches bearing leaves, as with the knotty-rooted fig-wort, bistort, and date-plum.

b. Divided—when they are divided into branches, as with most plants.

4. *Direction*:—By the direction of stems is meant, the manner or position in which they grow; so that they are sometimes said to be erect, at others, oblique, supported, climbing, decumbent, and procumbent.

a. Erect—when their position forms nearly a right angle with the surface of a level soil. Erect stems, however, are of four kinds; viz. straight—when they rise in an even perpendicular line, as in the silver-fir and spearmint; flexuous—when they rise perpendicularly and are regularly curved, as in the box-leaved staff-tree and common birthwort; tortuous—when they are curved in different directions, but not regularly, like the flexuous stems; nodding—when they have a bend at their summit, as in the cedar and Solomon's seal.

b. Oblique—when between a perpendicular and an horizontal plane. Oblique stems are either ascending, as in the common toad-flax and common clover; declined, as in the fig-tree; or incurvated, as in the common bramble.

c. Supported—when they are supported or propped up, as it were, by a number of other stems that surround it, which incline towards each other at their summits, until they seem ingrafted into the base of the stem which they support, as in the mangrove.

d. Climbing—when they are too delicate to support themselves. and consequently requiring some perpendicular body to enable them to elevate their foliage and fructification into the air. Climbing stems are either twining, or growing from left to right, as in woodbine and the hop, or from right to left, as in the scarlet bean and great bind-weed; radicating, or sending out roots, as in the ivy and ash-leaved trumpet-flower; or climbing, as in the grape-vine, purple virgin's-bower, bitter-sweet, and all the species of passion-flower.

e. Decumbent—when they rise a little upright at their base, but have their upper portion bent down towards the ground, so that the greater part is procumbent.

f. Procumbent—when they are too weak to support themselves, and lie on the ground. Procumbent stems are either creeping, as in the lesser periwinkle and ground ivy; or floating, as in the floating club-rush.

5. *Duration:*—According to the duration, or time which stems live, they are scientifically denominated annuals, biennials, or perennials.

The meaning attached to these terms have already received an attentive consideration; the student is therefore referred to what has been said concerning the duration of plants.

6. *Substance:*—From the substance of stems they solve themselves into two kinds: those which are woody, and those which are herbaceous.

a. Woody—those in which wood forms, comparatively, the greater part of their bulk. Woody stems are either solid, as in the oak; or fibrous, as in the cocoa-nut tree.

b. Herbaceous—those which contain a small portion of wood, but are composed chiefly of cellular substance. Herbaceous stems are either fleshy, as in the common house-leek and most sea-weeds; spongy, as in the Indian corn, great cat's-tail, and the mushroom tribe; or hollow, as in the common dropwort, castor-oil plant, and almost all the grasses.

7. *Form:*—In difference of form, stems are either round, semicircular, compressed, angled, angulosed, knotted, jointed, or kneed.

a. Round—when they have no angles, as in the thorn-apple and changeable hydrangea.

b. Semicircular—half round; that is, round on one side and flat on the other.

c. Compressed—when they are flat, as in the spleen-wort and flat-stalked meadow-grass.

d. Angled—when they have several acute angles in their circumference. Angular stems may be obtuse; three, four, five, six, or many-cornered; acute and triangular; four, five, six, or many-angled; or three-sided, when there are three flat sides forming acute angles.

e. Angulosed—when the angles are either very obscure, and the stem consequently, can scarcely be placed in either of the foregoing arrangements; or that the angles are variable in number, and which may be furrowed, as in common Alexanders, or striated, as in the common sorrel.

f. Knotted—when stems are divided at intervals by swellings or knots, as in the knotty crane's-bill.

g. Jointed—when they are composed of joints, or apparently distinct pieces, united at their ends.

h. Kneed—when a jointed stem is more or less bent at each joint, as in the floating fox-tail-grass and three-flowered fescue-grass.

8. *Mode of branching:*—From the mode of branching, stems are dichotomous, trichotomous, slightly-branched, much-branched, or abruptly-branched.

a. Dichotomous or forked—when the divisions and subdivisions, are, throughout, in bifurcations; as in the corn-salad, petty spurge, and forked marvel of Peru.

b. Trichotomous—when, instead of being bifurcated, the divisions are trifid, as in the common marvel of Peru.

c. Slightly-branched—when the number of divisions are comparatively few.

d. Much-branched—when not only the greater divisions are numerous, but these again are divided and subdivided without order, as in the elm and gooseberry-bush.

e. Abruptly-branched—when each branch, after terminating in flowers, produces a number of fresh shoots, in a circular order, from just below the origin of these flowers, as in the naked-flowered azalea, and many of the Cape heaths.

9. *Surface*:—From the peculiar character of the surface of stems, there are numerous terms in use, either as regards their being bare, covered, or rough.

Bare—when the epidermis is perfectly free from appendages of every description, leaves, scales, spines, prickles, or any kind of pubescence The varieties are:

a. Shining—when they glisten, as if varnished, as in shining crane's-bill.

b. Smooth—when they are free from all kinds of roughness or hairiness, as in the periwinkle.

c. Even—when throughout, they are perfectly free from inequalities, as in the common white poppy.

d. Punctured—when they are covered with small, yet visible perforations, either simple or surrounded at the orifice with a raised border, as in rue and perforated St. John's wort.

e. Maculated, or spotted—when they are marked with spots or blotches, as in hemlock.

f. Leafless—when they are altogether devoid of leaves, as in the dodder.

g. Unarmed—when they are devoid of prickles and spines.

h. Exstipulate—when without stipules.

Covered—when the epidermis is clothed with some kind of appendage. The varieties are:

i. Leafy—when they are furnished with leaves from the base to the apex. When the stem passes through each leaf, it is denominated perfoliate, as in yellow-wort. (F. 73.)

j. Winged—when the edges or angles are longitudinally expanded into leaf-like borders.

k. Sheathed—when they are embraced by the base of each leaf, as if by a sheath, as in grasses and snake-weed. (F. 56.)

l. Stipulated—when they are furnished with stipules at the axilla of each leaf, as in common vetch and broad-leaved everlasting pea.

m. Tendril-bending—when they bear tendrils, as in the passion-flower and grape-vine. (F. 32.)

n. Bulb-bearing—when they are studded with bulbs in the axilla of the leaves, as in bulbiferous coral-wort, and in several of the lily tribe.

o. Spiny—when they are furnished with sharp spines, which are not productions of the bark, and consequently do not come off with it, as in common hawthorn and sloe-tree. (F. 27.)

p. Prickly—when they are covered with sharp-pointed bodies, which separate with the epidermis, as in the rose. (F. 29.)

q. Scaly—when they are covered, more or less, with leafy scales, which are closely applied to their surface, as in broom rape. When, however, the scales, instead of being succulent and leafy, are dry and membranaceous, this variety of the scaly stem, is termed ramentaceous, as in slender-branched heath.

r. Pubescent—when they are covered with hair-like appendages. The pubescence varies very considerably, according to differences of soil, climate, and exposure; nevertheless, there are determinate characteristics, which always more or less distinguish it, even in its variations. The varieties of this subdivision are, the

Hairy—when the pubescence consists of rather long separate hairs, as in mouse-ear and meadow-sage.

Hispid—when the hairs are stiff and bristly, as in borage and common viper bugloss.

Downy—when the hairs are soft to the touch, like down, and so matted together that the particular hairs cannot be distinguished; as in shepherd's club and round-leaved crane's bill.

Shaggy—when the pubescence consists of long soft hairs, as in villose speedwell and downy hedge-nettle.

Woolly—when the fine hairs are long and matted, but easily distinguished from each other, as in woolly hedge-nettle and woolly horehound.

Silky—when the hairs are shining, and so arranged as to give the stem the appearance of being covered with silk.

Instead of pubescence, the covering is, in some instances, either a dry powder, or a moist excretion. Those of the former character are three in number, and those of the latter two in number.

s. Hoary—when the entire surface is strewed over with a fine white dust, which is easily rubbed off, like the bloom of grapes, as exemplified in dwarf shrubbery orach.

t. Mealy—when the white powder is less minute, or is mealy, as in bird's-eye primrose.

u. Glaucous—when the dust or bloom is of a blueish-green or sea-green colour, as in palma christi, or castor-oil plant.

v. Viscid—when it is covered with a clammy resinous exudation, as in clammy catch-fly.

w. Glutinous—when the exudation is adhesive, but instead of being resinous, it is gummy, or soluble in water, as in clammy primrose.

Rough—when they assume an uneven character. The varieties are,

x. Scabrous—when they are thickly covered with small eminences, which are not visible, but can be felt on running the finger along, as in black knapweed.

y. Warty—when they are studded over with small hard warts, which can be both seen and felt, as in warty spindle-tree.

z. Vesicular—when the roughness depends on a small elevation of the epidermis, containing a watery fluid, which gives the plant the appearance as if it was covered with ice, as in the ice-plant.

NOMENCLATURE OF THE LEAF.

1. All leaves in the infant bud, are very peculiarly folded up, so as to occupy the smallest possible space.

This regulates the expansion of the leaves, when the bud opens in the spring; the manner of which, is always the same in individual plants of the same species.

2. The expanding of leaves from the bud, is technically denominated *foliation;* and the figures which they assume at the time, may be conveniently included under the terms, folded, overlapping, and rolled.

The best method of ascertaining the character of a bud, as respects its foliation, is to cut it across while it is opening, and then examine the sections of the leaves.

3. *Folded:*—This kind of foliation displays the leaf,

or its parts, variously doubled together. There are two varieties of it; the doubled and plaited.

a. Doubled, or conduplicate—when the two sides of the leaf lie parallel to each other; as in the oak, the cherry, the rose, the walnut, the beech, and the lime. (F. 37.)

b. Plaited, or plicate—when the leaf is folded up like a fan, as in many of the palm tribe, in the birch, and lady's-mantle. (F. 44.)

4. *Overlapping*:—In this species of foliation, the margins of the leaves overlap those within them, or opposite to them, without being rolled. There are three varieties; the imbricate, the equitant, and the obvolute.

a. Imbricate—when the edges of two opposite leaves touch each other, embracing those within them, which they cover, like tiles. In some instances, the edges of the one leaf extend a little over those of that to which it is opposed; while in others, the opposed edges scarcely touch. The privet and lilac will afford specimens of the imbricated foliation. (F. 41.)

b. Equitant—when the leaf is so folded that the two sides deeply embrace the opposite leaf, which in its turn encloses the one opposed to it; and so on to the centre of the bud. It is beautifully exemplified in the day lily, in the iris tribe, and in Solomon's-seal. (F.37, b.)

c. Obvolute—when one leaf, doubled lengthways, embraces within its doubling one half of the opposite leaf, folded in the same manner, as in the genus valerian, scabious, teasel, and sage. (F. 42.)

5. *Rolled*:—This division contains all those buds in which the leaves are rolled, either on their lateral margins, or from the apex to the base. There are five varieties; viz. the convolute, the involnte, the revolute, the circinal, and the reclinate.

a. Convolute—in which the leaf is rolled lengthways in a spiral manner, one margin forming the axis round which the other turns; as in the plum genus, the lettuce tribe, the cabbage, Indian corn, and many grasses. (F. 38.)

b. Involute—in which each lateral margin of the leaf is rolled inwards; as in the yellow water-lily, in honey-suckles, and violets. (F. 43, a.)

c. Revolute—in which the lateral margins are rolled outwards, as in rosemary, and the primrose tribe. (F. 43, b.)

d. Circinal—in which the leaf is rolled from the apex to the base, as in the ferns. (F. 45.)

e. Reclinate—in which the leaf hangs down and is wrapt round the foot-stalk, as in the buds of the officinal wolf's-bane and the genus anemone. (F. 47.)

6. In all the varieties of foliation, as the buds open, the leaves gradually unfold themselves, and assume their natural forms.

The opening of the bud does not, in every instance, immediately set free the leaves; for, in some gems, each leaf is separately enclosed in a membranous cover, which opens either laterally or at the apex, and permits the leaf to expand.

7. After leaves have undergone the process of foliation, and attained their peculiar character, they are said to be either sessile or petiolate, simple or compound.

8. In describing different species of plants, a knowledge of the peculiarities attending leaves, is of considerable importance; botanists have therefore been called upon to distinguish them according to their situation, direction, distribution, duration, and other attending circumstances.

9. *Situation*:—From their place of situation, theyare called radical, caulinar, rameal, seminal, or floral.

a. Radical, or root-leaf—springing directly from the root, as in the snow-drop and violet. (F. 31, b b.)

b. Caulinar, or stem-leaf—arising from the stem, as in garden valerian. (F. 40.)

c. Rameal or branch-leaf—situated on the branch, and which are only described when they differ from those of the stem, as in purple cow-wheat.

d. Seminal, or seed-leaf—the first leaves of the majority of plants, proceeding from seeds that have more than one lobe, as in the garden-pea

e. Floral, or flower-leaf—when next the flower and generally unlike the other leaves, as in early-red honeysuckle. (F. 28, a a.)

10. *Direction*:—From the direction in which leaves grow, they are said to be erect, compressed, spreading, horizontal, nodding, reflex, inflex, pendulous, twisted, reverse, unilateral, procumbent, emerging, or sunk.

a. Erect—when nearly perpendicular, as in jointed rush. (F. 52, a.)

b. Compressed—when their upper surface is close to the stem, as in the thlaspi campestris.

c. Spreading—forming a moderately acute angle with the stem, as in brooklime (F. 52, b.)

d. Horizontal—when parallel with the horizon, as in field gentian. (F. 52, c.)

e. Nodding—spreading with a drooping apex. (F. 52, d.)

f. Reflex or recurved—curved backwards, as in recurved-leaved heath. (F. 52, e.)

g Inflex, or incurved—curved upwards. (F. 52, f.)

h. Pendulous or depending—when the whole leaf droops. (F. 52, g.)

i. Twisted or oblique—when one part of the leaf is vertical, the other horizontal, as in oblique allium and violet-flowered fritillary.

j. Resupinate or reversed—when the surface, which is commonly undermost, is found uppermost, as in the spotted-flowered alstrœmia and white water-lily.

k. Unilateral—when all the leaves lean on points to the same side, as in many-flowered Solomon's seal.

l. Procumbent—lying on the surface of the ground, as in the common daisy.

m. Emerging—when the leaf is raised upon its foot-stalk above the surface of the water, as in the greater water plantain.

n. Floating—resting on the surface of the water, as in broad-leaved pond-weed and white-flowered water-lily.

o. Sunk—submersed or immersed, entirely under water, as with marsh water-violet and perfoliate pond-weed.

11. *Distribution:*—The words, opposite, decussated, ternate, cruciate, whorled, alternate, spiral, scattered, two-ranked, tufted, crowded, imbricated, rose-like, crowning, and remote, are employed to denote the distribution of leaves on the stem and branches.

a. Opposite—when they appear directly on opposite sides of the stem in pairs, as in white archangel and common nettle. (F. 48.)

b. Decussated—crossing each other in pairs cross-like, as in caper spurge and four-sided crassula. (F. 54.)

c. Ternate—when the leaves stand by threes round the stem, as in verbena tryphylla.

d. Quaternal—when in fours, as in various species of heath.

e. Cruciate or cruciform—when in four leaves lying on the surface of the horizon, each leaf pointing to an opposite direction. (F. 48.)

f. Whorled or verticillated—when the number of leaves surrounding the stem or branch exceeds four, and point to different directions, forming a star-like figure. (F. 55.)

g. Alternate—when not in pairs, and are given off in various directions one after another, as in round-leaved mallow. (F. 71.)

h. Spiral—alternate, forming a spiral line around the common axis, as in the Norway spruce fir.

i. Scattered—alternate and irregularly placed.

j. Two-ranked—alternate, spreading in two directions, and yet are not regularly opposite at their insertion, as in the yew-tree, deciduous cypress and silver pine.

k. Tufted or fasciculated—when several leaves spring from the same point, as in common larch and common berberry. The terms "bina, terna," &c. are used to express two, three, or the number of leaves which enter into each tuft.

l. Crowded—clustered together, as in chick-weed winter green.

m. Imbricated—placed like tiles upon a house, as in common cypress and spiral aloe. (F. 46.)

n. Rose-like—when the leaves are imbricated in a manner resembling a rose. (F. 50.)

o. Crowning—when they terminate the stem or branches like a plume of feathers, as in the palm tribe.

p. Remote—when at an unusual distance from each other.

12. *Duration:*—From the time which leaves live, they are either called caduous, deciduous, withering or persistent.

a. Caduous—falling off in the middle of the summer.

b. Deciduous—falling off at the approach of winter.

c. Withering—green the whole year, and falling off as the new ones appear.

d. Persistent—lasting many years and always green.

13. *Insertion:*—According to the peculiar attachment which leaves have, they are either described as being sessile, decurrent, perfoliate or petiolate.

a. Sessile—without foot-stalks, lying immediately on the stem or branch, as in officinal soap-wort and common butter-wort. Each leaf represented in F. 54, is sessile. The varieties are

Embracing—clasping the stem with their bases, as in the milk thistle and white poppy. (F. 72.)

Connate—when the embracing leaves are opposite and united at their bases, as in the jagged teasel. (F. 51.)

Sheathing—when leaves embrace the stem with their bases, so as to enclose it with a sheath. (F. 56.)

Equitant—when being opposite, they clasp each other, as in the Iris tribe.

b. Decurrent—when the lamellar part of the leaf runs down the stem or branch, as in great mullein. (F. 49.)

c. Perfoliate—when the stem runs through the leaf, as in thorough-wax and perfoliated uvularia. (F. 73.)—If the union be in the whole, or nearly the whole breadth of the leaves, so as to give the two leaves the appearance of being united into but one leaf, they are said to be *connato-perfoliate*, (F. 79.) Connate leaves are, in some instances, united by a membrane, which, stretching from the margin of the opposed leaves near the base, forms a kind of pitcher round the stem, (F. 53) in which rain-water is retained, as in fuller's teasel.

d. Petiolate—when situated on petioles or foot-stalks, as in the cultivated cherry-tree and black mullein. (F. 40.) Petiolate leaves are either *loose*, when they merely rest upon the stem, or *peltate*, when the foot-stalk is inserted, not into the basis, but into the disk, as in the great Indian cress.

14. *Expansion:*—With respect to the terms derived from the expansion of leaves, they are derived from two separate sources, either as concerns their superficial figure, or their solid configuration.—With regard to their *superficial figure*, they are either capillary, linear, gramineous, needle-shaped, lanceolate, sword-shaped, spatulate, wedge-shaped, fan-shaped, oblong, oval, ovate, obovate, roundish, circular, crescent-shaped, angled, repand, trowel-shaped, diamond-shaped, fiddle-shaped, lyre-shaped, lobed, arrow-shaped, halberd-shaped, heart shaped, kidney-shaped, palmated, incised, much-parted, runcinate, pinnatifid, pectinate, or pedate.

a. Capillary—when they are long, fine and flexible, as in fennel and garden dill. (F. 74.)

b. Linear—narrow, with parallel sides, about a geometrical line in breadth, as in senecio linifolius. (F. 75.)

c. Gramineous, or riband-like—differing from the linear in being broader, and not quite parallel towards the apex, as in grasses. (F. 76.)

d. Needle-shaped, or acerose—linear and evergreen, generally acute and rigid, as in Scotch fir and common juniper. (F. 77.)

e. Awl-shaped or subulate—when it is thick at the base and gradually attenuated to a sharp point, as in jonquil and shallot. (F. 78.)

f. Lanceolate—of a narrow oblong form, tapering towards the end, as in rib-wort. (F. 80.)

g. Sword-shaped or ensiform—when it is long, tapering to a point, very thin on both edges, and slightly curved, as in German flower-de-luce and common corn-flag or sword-lily. (F. 81.)

h. Spatulate—when round at the apex and gradually tapers towards the base, as in narrow-leaved navel-wort. (F. 82.)

i. Wedge-shaped or cuneiform—broad and abrupt at the summit, and tapering down to the base, as in wedge-leaved saxifrage and shrubby candy-tuft. (F. 85.)

j. Fan-shaped—resembling the wedge-shaped in the base, but more dilated and rounded at the apex. (F. 86.)

k. Oblong—three or four times longer than broad, as in the banana tree and eastern oleaster. (F. 83.)

l. Oval or elliptical—when it is twice as long as it is broad, and nearly equally rounded at the extremities, as in Venetian sumach and American mammea. (F. 87.)

m. Ovate or egg-shaped—when the length is greater than the breadth, with both extremities rounded, but the base much broader than the apex, as in common marjoram and elecampane. (F. 111.)

n. Obovate—egg-shaped, with the broad end uppermost, as in cowslip and common water pimpernel. (F. 112.)

o. Roundish or subrotund—approaching to the circular figure, as in round-leaved mallow. (F. 88.)

p. Circular, orbicular, or round—length and breadth equal, and the circumference a circle, as in round-leaved navel-wort and common penny-wort. (F. 116.)

q. Crescent-shaped or semilunate—curved like a crescent, as in crescent-leaved passion-flower. (F. 113.)

r. Angled—where the circumference has considerable projections which are not lobular. The varieties are

Triangular—having three angles, as in English mercury and garden orach, (F. 84.)

Quadrangular—having four angles, as in the common tulip tree.

Pentangular—having five angles, as in the geranium peltatum. (F. 89.)

s. Repand—bordered with numerous angles and segments of circles alternately, as in sauce-alone. (F. 90.)

t. Trowel-shaped or deltoid—when it has three angles, or represents the Greek letter Delta, one of the angles forming the apex of the leaf, as in the great delta-leaved fig marygold and black poplar. (F. 91.)

u. Diamond-shaped or rhomboid—approaching to a square, as in floating water-caltrops. (F. 145.)

v. Fiddle-shaped or panduræform—oblong, broad at the two extremities and contracted in the middle, as in the fiddle dock and Virginian bindweed. (F. 92.)

w. Lyre-shaped or lyrate—cut into several transverse segments, gradually larger towards the extremity of the leaf which is rounded, as in common avens. (F. 93)

x. Lobed or lobate—when it is deeply divided into rounded segments, and is therefore said to be

Two-lobed—as in smooth-leaved mountain ebony. (F. 94.)

Three-lobed—as in hepatica anemone. (F. 95.)

Five-lobed, &c.—as in common hop and sycamore.

y. Arrow-shaped or saggitate—triangular, hollowed out very much at the base, as in common sorrel and common arrow-head. (F. 102.)

z. Halberd-shaped or hastate—when the sides are protruded into two lateral spreading points or lobes near the base, as in common arum and common wood sorrel. (F. 96.) Sometimes the lateral lobes are distinct, as represented by F. 97.

a a. Heart-shaped or cordate—when it is hollowed at the base into two lobes, and pointed at the apex, so that the leaf has somewhat the appearance of the heart on a card, as in common burdock and common black bryony. (F. 98.) When the apex, instead of being directly opposite to the base, is thrown off at one side, the leaf is said to be oblique heart-shaped, as beautifully illustrated in begonia. (F. 99.)

b b. Kidney-shaped or reniform—when the apex is broad and rounded and the base deeply hollowed out, as in asarabacca and common ground ivy. (F. 101.)

c c. Palmated—when it is divided into oblong or finger-like lobes, not, however, extending to the base, but leaving an entire flat space which has been likened to the palm of the hand, as in blue-flowered passion-flower. (F. 100.)

d d. Incised or laciniated—when it is cut into numerous irregular divisions which are termed segments, as in the long-stalked geranium and cut-leaved navel-wort. (F. 108.) When the divisions reach nearly to the base, it is said to be parted, (F. 107) and according to the number of these, the leaf is said to be bipartite, tripartite, quadripartite, quinquepartite, and multipartite, or divided into two, three, four, five, or many parts.

e e. Cloven—when the margin of the segments are nearly straight lines, and according to the number of clefts. The leaf is termed

Trifid—having three clefts or divisions, as in trifid bidens.

Quinquifid—having five clefts, as in spotted geranium.

Multifid—the margin of round leaves, cut from the apex almost to the base, without having any great intermediate sinuses, as in monk's-hood and bitter-apple.

f f. Runcinate—signifies, that the expansion is deeply cut into many transverse acute-angled segments, the points of which, tend towards the base of the leaf, as in common dandelion. (F. 105.)

g g. Pinnatifid—when the segments are deeper, and at a more regular distance from each other, as in the star-thistle and corn scabious. (F. 106.)

h h. Pectinate—when the segments are very narrow, linear, and parallel, like the tooth of a comb, as in the lower leaves of marsh water-violet. (F. 108.)

15. From the differences which exist in the *solid configuration* of leaves, there are nineteen appropriate terms employed, viz. cylindrical, hair-like, semi-cylindrical, tubular, four-cornered, three-cornered, tongue-shaped, gibbous, scimitar-shaped, hatchet-shaped, compressed, flat, two-edged, spherical, ovoid, coccoon-shaped, club-shaped, hooked and lenticular.

a. Cylindrical—when a transverse section, made any where throughout the greater part of the length of the leaf, is circular, as in common chives and cultivated salt-wort. (F. 104.)

b. Hair-like or capillaceous—when the diameter of the leaf is so small, that the leaf is as fine as a hair.

c. Semi-cylindrical—when one side of the leaf is flat, and the other convex, as in the colchicum gibbosum. (F. 109.)

d. Tubular—when the greater portion of the leaf is cylindrical or nearly so, tapering to a point and hollow within, as in the onion. (F. 110.) Sometimes the hollow appears as if it were formed by the two sides of the leaf being compressed together, but separated near the mid-rib, so that one part of the leaf is flat and another tubular, as beautifully exemplified in the genus sarracenea.

e. Four-edged or tetragonal—when there are four longitudinal sides, and consequently, four corners, as in square-stalked corn-flag. (F. 117.)

f. Three-edged—thick and triangular, as in common-flowering rush and golden-flowered fig-marygold. (F. 121.)

g. Tongue-shaped or lingulate—a thick oblong blunt figure, and a little convex on its inferior surface, as in the common-tongue fig-marygold.

h. Gibbous—swelling on one side or both, from excessive abundance of pulp, as in cushion aloe.

i. Scimitar-shaped or acinaciform—compressed with one thick and straight edge, the other thin and curved, as in scimitar-leaved fig-marygold. (F. 118.)

j. Hatchet-shaped or dolabriform—compressed, with a very prominent dilated keel and a cylindrical base, as in hatchet-leaved fig-marygold. (F. 124.)

k. Compressed—flattened laterally, as in flat-leaved cacalia.

l. Flat—as most leaves are, cherry, apple, &c.

m. Two-edged or ancipital—both the edges in a transverse section, produced to a very acute angle, as in broad-leaved cat's-tail. (F. 114)

n. Spherical—when it approaches near the globular form.

o. Ovoid—when it somewhat resembles an egg.

p. Coccoon-shaped—when it is cylindrical in the middle, and tapers to a point at each end. (F. 115.)

q. Club-shaped—when it is round and stem-like, with a thick blunt apex.

r. Hooked or uncinate—when it is curved, so as to resemble the figure of a hook.

s. Lenticular—when it is flat, roundish, and convex on both surfaces, and a transverse section of the leaf has the appearance represented by F. 146.

16. *Apex:*—The apex of a leaf may either be acute, sharpish, spine-pointed, awned, cirrose, obtuse, pointed-obtuse, thickened, retuse, emarginate, truncated, jagged or tridentate.

a. Acute—when the conjunction of the two lines of the edges forms an acute angle, as in many plants, amongst which, narrow-leaved flax and throat-wort, may be collected as examples. (F. 119.)

b. Sharpish—when there is a slighter degree of termination than in the acute. (F. 126.)

c. Acuminate—when it is long and very tapering, as in common reed-grass and common lilac. (F. 120.)

d. Spine-pointed or cuspidate—when it runs out gradually into a small awl-shaped rigid spine, as in thistles and poplar-leaved fig-tree. (F. 125.)

e. Awned—when it is terminated by a long rigid spine, which does not appear as a continuation of the leaf. (F. 122.)

f. Cirrose or circinate—tipped with a tendril. (F.123.) This tendril is, in a few instances, furnished with an additional organ for some particular purpose, not essential to the leaf; thus, in one species of the genus nepenthes, the apex of each leaf terminates in a long rigid thread, a continuation of the midrib, bearing a small covered pitcher, (F. 127) which is generally found nearly full of water. In another species, this pitcher is sessile, (F. 129); and in the dionæa muscipula, or Venus's fly-trap, the appendage is composed of a pair of toothed lobes. (F. 130.)

g. Obtuse—when it forms the segments of a circle, and is rounded, as in broad-leaved dock and square-stalked St. John's wort. (F. 128.)

h. Pointed-obtuse—when a small point projects from the middle of the obtuse apex. (F. 132.)

i. Thickened—when the rounded apex of a leaf is a little thickened, but not sufficiently so as to render it clubbed.

j. Retuse—when it is obtuse, with a broad shallow notch in the middle, as in common mountain sorrel. (F. 133.)

k. Emarginate—when the notch is sharper or nearly triangular, as in bladder senna and common penny-wort. (F. 135.)

l. Truncated—when it appears as if cut across in a straight line, as in the common tulip tree. (F. 134.)

m. Jagged or præmorse—jagged, pointed, as if bitten off; very blunt, with various irregular notches, as in hibiscus præmorsus. (F. 136.)

n. Tridentate—when the apex forms three teeth, as in genista tridentata. (F. 131.)

17. *Base:*—By some botanical writers, leaves are described, from the nature of their bases, as being heart-shaped, hastate, reniform, &c. but as these terms have been explained under the superficial configuration of leaves, there only remains to be observed, that leaves may have an equal or an unequal base.

a. Equal—when the two halves of the expansion, are of the same length, as in the cherry-tree and apple-tree. (F. 40.)

b. Unequal—when the two halves are of different lengths, or one larger than the other, as in the begonia and common lime-tree. (F 139.)

18. *Margin:*—The principal characteristic names, used to express the different kinds of margin which leaves have, are derived from the margin being either entire, indented, bordered or rolled.

a. Entire margins—entire, the margin of the leaf uninterrupted, or free from every kind of indentation, as in the wild goat's-beard and purple goat's-beard. (F. 137.)

b. Indented margins—Those in which the margins are not regular and even. The following are the varieties of indented margins:

Sinuated—when it is cut, as it were, into roundish scollops, as in the common oak. (F. 138.)

Gnawed—when the scollops are very irregular, as if formed by the gnawing of some insect. (F. 148.)

Toothed—beset with projecting, horizontal, and rather distant teeth of its own substance, as with the lower leaves of the throat-wort and blue-bottle. (F. 140.) The varieties are—

Equally-toothed—(F. 143.) Unequally-toothed—(F. 144.)

Deeply-toothed—(F. 149), Obscurely-toothed—(F. 141), and Doubly-toothed—(F. 142.)

Serrated or sawed—when the teeth are sharp, and lie, as it were, upon each other, as in a saw, all pointing towards the apex of the leaf, as in the common orpine. The varieties are—

Equally, unequally, sharply, deeply, doubly and slightly serrated.

Crenated—when the teeth are rounded, and not directed to either end of the leaf, as in the common betony and common scull-cap. The varieties are—

Doubly-crenate—the crenatures themselves crenated, as in clary and golden locks.

Tooth-crenate—when the crenatures are of a doubtful form, being neither completely rounded nor yet pointed. (F. 150.)

Crenulated—when they are very shallow, and at the same time, perfect. (F. 151.)

Spinous—when beset with sharp rigid spines, as in the spear-leaved cnicus and common holly. (F. 152.)

c. Bordered margins —When the substance of the margin of a leaf, differs from that of the expansion, the leaf is considered bordered; and according to the character of the border, the margin receives different names: as

Cartilaginous—when the margin is firmer than the disk and somewhat elastic, as in the broad-leaved Adam's-needle. This cartillage is generally whitish, yellowish, pinkish, or some other colour, but is seldom green.

Horny—when it resembles the cartilaginous, but is harder and less elastic.

Ciliate—when beset with soft parallel hairs, not closely set together. (F. 153.) If the hairs are stiff and like bristles, it is then said to be acutely-ciliated.

Glandular—when the margin is studded with small glandular bodies, either opaque or semi-transparent. If the glands are supported on hairs, it is said to be ciliated-glandular. (F. 154.)

d. Rolled margins—where the margins assume a turning direction. Hence they are said to be

Revolute—when rolled backwards, or upon the under surface of the leaf.

Involute—when rolled forwards.

Undulated—when the disk near the margin, is waved obtusely up and down, as in the base rocket.

Curled—when the margin of the leaf becomes more expanded than the disk, so as to grow elegantly curled and twisted, as in the curl-leaved mallow.

19. *Surface:*—The numerous terms made use of, to denote the characteristic marks connected with the surface of the leaf, are flat, smooth, shining, lucid, convex, concave, channelled, keeled, furrowed, streaked, navel-like, folded, waved, wrinkled, blistered, scabrous, rough, warty, pustular, muricated, prickly, aculeated, hispid, hirsute, bristly, strigose and bearded.

a. Flat—when no irregularities are exhibited.

b. Smooth—without any kind of roughness.

c. Shining—smooth and shining, as in the common Indian shot and sweet bay.

d. Lucid—as if covered with varnish, as in the shining angelica and shining-leaved rayena.

e. Convex—when the upper surface of the leaf is convex, and the under concave.

f. Concave—the reverse of convex.

g. Channelled—when an oblong or a linear leaf, is longitudinally shallowed, and a transverse section of it is a semicircle, as in the sea plantain. (F. 155.)

h. Keeled or carinate—when the transverse section is angular and the midrib on the under surface, resembles the keel of a boat, as in the carinate allium. (F. 156.)

i. Furrowed—having several linear depressions, as in the iron-coloured fox-glove.

j. Streaked—marked with coloured lines, as in reed-like canary-grass.

k. Navel-like—when the surface is depressed in the centre, and the leaf is peltate. (F. 157.)

l. Folded—when the disk, especially towards the margin, is acutely folded up and down, as in the curl-leaved mallow.

m. Waved—when the undulations commence from the midrib, as in the base rocket.

n. Wrinkled—when the veins of the leaf are tighter than the surface between them, causing the latter to swell into little inequalities, as in various species of sage. (F. 158.)

o. Blistered—when the veins are so tight, that the intermediate space appears blistered. This appearance is frequent in the garden cabbage.

p. Pitted—when the fullness between the veins, produces depressions.

q. Scabrous—covered with small hard tubercles, more easily distinguished by the finger than the eye, as in the common mulberry and the hop plant.

r. Rough—when the tubercles are more visible.

s. Warty—when they are still larger and more solid.

t. Pustular or vesicular—when they are evident elevations of the cuticle filled with aqueous fluid, as in the ice-plant.

u. Muricated—when the surface of a leaf, is studded with short herbaceous spines.

v. Prickly—when these have stiff points.

w. Aculeated—when instead of being herbaceous, the spines are hard and pungent.

x. Hispid—when the surface of a leaf is beset with short stiff hairs.

y. Hirsute—when these are larger, and consequently, less rigid.

z. Bristly—if they stand singly, and resemble bristles.

a a. Strigose—if they are firm, and stand upon small prominences or papillæ.

b b. Bearded—when they are rather long and crowded together.

20. *Pubescence:*—Soft hairs are generally termed pubescence, and the surface of the leaf receives the following appellations from the character of this description of covering: hairy, shaggy, silky, downy, woolly, tufted, and starred.

a. Hairy—when the hairs are soft, distinct, somewhat long, and bent.

b. Shaggy—when they are soft, nearly erect, and parallel.

c. Silky—when they are soft, and lie thick and flat on the surface, giving it a satin-like lustre.

d. Downy—when they are very soft, and matted together, so that the individual hairs are not distinguishable.

e. Woolly—when they are also matted, but individually distinguishable, as in the woolly hedge-nettle.

f. Tufted—when they are soft and matted, and can be easily detached in small tufts.

g. Starred—when they are radiated like stars.

21. *Glands:*—The leaves of many plants have a peculiar glandular character common to them, and from the nature of this particular distinction, they are either said to be glandular, dotted, viscid, hoary, or mealy.

a. Glandular—when they are not elevated or on pedicles, as in the white willow and bird cherry-tree.

b. Dotted—when they are not raised, but appear like punctures, which either penetrate the substance of the leaf, or are merely superficial, and visible on one disk only.

c. Viscid—when there is a glandular secretion, rendering the surface of the leaf, moist and tenacious.

d. Hoary—when the secretion is a dry, very fine, waxy powder, of a blueish colour, devoid of gloss, and easily wiped off.

e. Mealy—when it resembles a mealy powder.

22. *Colour*:—The colour of leaves is not unfrequently a subject of botanical distinction, and hence they are sometimes described as being coloured, variegated, spotted, or striated.

a. Coloured—being of any other than a green colour, as in the amaranthus tricholor.

b. Variegated—when there is an intermixture of colour, as in the round-leaved mint.

c. Spotted—when the colour is in spots or blotches, as in the spotted and officinal lung-wort.

d. Striated—when marked with coloured lines, as in the reed-like canary-grass.

23. *Substance*:—When the substance of the leaf is to be considered in describing plants, the terms rigid, membranous, chaff-like, chartaceous, fleshy, leathery, and succulent are employed.

a. Rigid—easily broken on being bent, as in the butcher's broom and Scotch fir.

b. Membranous—when there is scarcely any pulp between the external membranes of the leaf, as in the orange-tree and the leaves of many plants.

c. Chaff-like—when the leaf is dry, or apparently sapless, and somewhat translucent.

d. Chartaceous—when it resembles paper, as in the draco terminalis.

e. Fleshy—when it is thick, and consists chiefly of a juicy but firm cellular parenchyma, as in the house-leek,

f. Leathery—when it is thick, tough and elastic, as in the misletoe and changeable hydrangea.

g. Succulent—when it is thick, and consists chiefly of a juicy and soft cellular substance, as in the hedge-hog fig-marygold.

Mirbel observes, that the consistence of the fleshy leaf, is that of the apple; of the succulent leaf, that of the plum.—*Elimens de Phys. veg.* iii. *p.* 642.

24. *Productions:*—The leaves of some plants have the singular property of producing spines, leaves, and flowers, and, indeed, of producing plants themselves; from which circumstances, they receive names of specific signification.

a. Spine-bearing—producing spines in the same manner as the stem.

b. Leaf-bearing—when they are productive of other leaves, as in the duck-weed.

c. Flower-bearing—if they bear flowers, as on the leaf-stalk in the turnera cuneiformis, on the upper disk of the leaf in the butcher's broom, and from the serratures of its margin in xylophylla.

d. Plant-bearing—when they throw out roots and produce plants, in every respect resembling the plant to which they belong, as in the cotyledon calycinum.

NOMENCLATURE OF THE COMPOUND LEAF.

25. A compound leaf consists of distinct expansions or leaflets, connected either directly or indirectly, and a common foot-stalk, whereas a simple leaf is constituted by one leaflet only. Compound leaves may be simply-compound, doubly-compound, or much-compound.

When botanists describe plants with compound leaves, they speak of them as having such, and also specify the characteristic marks common to the leaflets of which they are composed. The leaflets of compound leaves may, indeed, be regarded as distinct simple leaves; and most of the terms applied to single leaves, will also be found applicable to leaflets.

26. *Simply Compound:*—The simple compound leaf consists of a common foot-stalk only, supporting two or

more leaflets. (F. 162.) Its varieties are denominated, trifoliate, quadrinate, quinate, digitate, many-leaved, umbellate, yoked, pinnate and vertebrated.

a. Trifoliate or ternate—when the leaves are sessile, attached to the apex of the leaf-stalk, and three in number, as in the genus clover. (F. 159.)

b. Quadrinate—when there are four leaflets, as in the marsilea quadrifolia. (F. 160.)

c. Quinate—when there are five leaflets, as in the red-flowered horse-chesnut. (F. 162.)

d. Digitate—when there are seven, as in several of the potentillas.

e. Many-leaved—when the number of leaflets exceed seven.

f. Umbellate—when being numerous, they are so arranged, as to form a parasol, as in many of the lupins.

g. Yoked—when the leaflets, instead of being supported on the very apex of the leaf-stalk, are attached to its sides. It is said to be simply yoked, when one pair only of opposite leaflets, is supported on the common foot-stalk, as in the genus zygophyllum. (F. 163.)—Doubly-yoked—when there are two pairs, and so on.

h. Pinnate—when several leaves proceed laterally from one foot-stalk, instead of being supported at the top. The individual leaflets are termed *pinna*, and according to the arrangement of these on the leaf-stalk, pinnate leaves receive different appellations, as

Abruptly-pinnate—without either a terminal leaflet or a tendril, as in the genus mimosa. (F. 164.)

Impari-pinnate—when it is pinnated with a terminal or solitary leaflet at the apex of the leaf-stalk, as in roses. (F. 165.)

Cirroso-pinnate—when furnished with a tendril, in place of an odd leaflet, as in the pea and vetch tribe. (F. 160.)

Lyrato-pinnate—in a lyrate manner, having the terminal leaflet largest, and the rest gradually smaller as they approach the base, as in the erysimum pracox.

Oppositely-pinnate—when the leaflets are in opposite pairs, and it is not essential to enumerate them, as in saintfoil and roses. (F. 164.)

Alternately-pinnate—when they are alternate, as in the great wood-vetch. (F. 160.)

Interruptedly-pinnate—when the principal leaflets are ranged alternately, with an intermediate series of smaller ones, as in the drop-wort and meadow-sweet. (F. 166.)

Jointedly-pinnated—when the common leaf-stalk is joined between each pair of leaflets, as in the weimannia-pinnata.

Decreasingly-pinnate—when the leaflets gradually diminish in size from the base and the apex of the leaf, as in the bush-vetch.

Verticillato-pinnate—when the leaflets, instead of being arranged in the same plane on each side of the common leaf-stalk, are placed around it.

i. Vertebrated—consisting of several leaflets, which appear to grow out of each other, or are attached one upon the summit of another, with an evident joint at the point of attachment, as in the prickly-leaved fagara. (F. 147.)

27. *Doubly Compound:*—The double compound leaves are those, in which the common leaf-stalk is divided into, or supports secondary foot-stalks. (F. 39.) The varieties are, the bigeminate, tergeminate, biternate, bipinnate, conjugato-pinnate, ternato-pinnate, and digitato-pinnate.

a. Bigeminate or twice-paired—when near the apex of the common leaf-stalk, there is a single pair of secondary leaf-stalks, each of which, supports a pair of opposite leaflets, as in the four-leaved juga-tree. (F. 167.)

b. Tergeminate—when the leaf resembles the bigeminate in its foot-stalk divisions, and has besides, a third pair of leaflets at the point where the secondary leaf-stalks originate, as in the mimosa tergemina. (F. 168.)

c. Biternate—when the common foot-stalk supports three secondary leaf-stalks on its apex, and each of these support three leaflets, as in the Alpine barren-wort. (F. 171 and 36.)

d. Bipinnate—when the secondary leaf-stalks are arranged in pairs on the common leaf-stalk, and each secondary leaf-stalk is pinnate, or displays the characters of the simple pinnate leaf. (F. 169.)

e. Conjugato-pinnate—when a common leaf-stalk supports a single pair of secondary leaf-stalks, each of which is pinnate, as in soldier's-bush juga-tree. (F. 170.)

f. Ternato-pinnate—when the common leaf-stalk supports, on its apex, three pinnate leaflets, as in the hoffmanseggia.

g. Digitato-pinnate—when there are more than three, as in the humble-plant.

28. *Much Compound:*—The much compound leaves are those, in which the common leaf-stalk supports secondary petioles, and these, in their turn, supporting ternary leaf-stalks. There are two varieties, the triternate and the tripinnate.

a. Triternate—when the common foot-stalk supports on its apex, three secondary petioles, which each support three ternary petioles, and on every one of these, three leaflets, as in the common columbine and nine-leaved fumatory. (F. 172.)

b. Tripinnate—when along the sides of the common foot-stalk, there are secondary foot-stalks supporting the ternary, which are pinnate, as in the carrot. (F. 173.)

SECTION II.

NOMENCLATURE OF THE FLOWER.

1. The flower has been described, as a temporary part of the plant, consisting of the calyx, the corolla, the stamen, the pistil, the receptacle, the nectary, the seed-vessel, and the seed.

We shall first explain the botanical terms, applied to these respective parts, then speak of the characteristic names of flowers, and finally, of their manner of blooming, or inflorescence.

OF THE CALYX.

2. There are seven different kinds of calyces, viz.—the perianth, the fence, the catkin, the sheath, the glume, the veil, and the curtain.

THE PERIANTH OR FLOWER-CUP.

3. The perianth is characterized, from the number of its leaves, the division of its margin, its disposition to the germen, the number on each flower, its situation with respect to the fructification, and its duration.

4. *Number*:—From the number of leaves, by which a perianth is formed, it is called monophyllous, diphyllous, and so on, according to the number.

a. Monophyllous — when formed only of one leaf, as in the primrose.

b. Diphyllous—when formed of two leaves, as in the common poppy.

c. Triphyllous—when formed of three leaves, as in the dock.

d. Polyphyllous—when more than three leaves, as in the ranunculus.

5. *Margin:*—From the divisions of its margin, a perianth is entire, serrated or ciliated.

a. Entire—being without any irregularity, as with most plants.

b. Serrated—sawed at the edges, as in some species of St. John's wort.

c. Ciliated—fringed with hairs, as in some species of centaury.

6. *Figure:*—From the figure of a perianth, it is tubular, spreading, reflexed, or inflated.

a. Tubular—running in the form of a tube, as in the thorn-apple.

b. Spreading—with spreading leaflets, as in the officinal borage.

c. Reflexed—bent back, as in the dandelion and swallow-wort.

d. Inflated—hollow or puffed up like a bladder, as in the ground cherry.

7. *Disposition:*—From the disposition of the germen, a perianth is said to be superior or inferior.

a. Superior—when the germen is under the lower part of the perianth; hence the remains are visible on the fruit, as in roses, pears, &c.

b. Inferior—when the germen is above the base of the perianth, as in the poppy and water-lily.

8. *Number:*—From the number of perianths on each flower, the perianth is said to be simple or double

a. Simple—when only one, as in the primrose and most flowers.

b. Double—when there are two or more, as in the mallow.

9. *Situation:*—From the situation of the perianth with respect to the fructification, it is either termed the perianth of the flower, the perianth of the fruit, or the perianth of the fructification.

a. Perianth of the flower—when it includes the stamens and not the germen, as in the barren flowers of the perennial mercury.

b. Perianth of the fruit—if it includes the germen but not the stamens, as in the fertile flowers of the perennial mercury.

c. Perianth of the fructification—when it includes both the germen and stamens, as in the common bramble and others.

10. *Duration:*—From the time which a perianth lasts, it is either caducous, deciduous, or permanent.

a. Caducous—when it falls off at the first opening of the flower, as in the poppy.

b. Deciduous—when it falls off with the corolla, as in the berberry.

c. Permanent—when it continues until the fruit is ripe, as in the dead-nettle, betony, and others.

FENCE OR INVOLUCRUM.

11. The fence or involucrum, is only characterized according to the part of the umbel from which it is placed, or from the number of leaves by which it is constituted. In these respects, it is said to be universal, partial, and dimidiate; and one-leaved, two-leaved, three-leaved &c.

a. Universal—when situated at the base of the whole umbel, as in the coriander. (F. 14, a a.)

b. Partial—when placed under each smaller or partial stalk, as in the carrot. (F. 14, b b.)

c. Dimidiate—when it is deficient on one side, as in the fool's parsley.

CATKIN OR AMENTUM.

12. The catkin or amentum, differs only in two particulars; in form and nature.

13. *Form:*—In form, they are either cylindrical, globular, ovate, filiform, attenuated, or thick.

a. Cylindrical—as in the common beet.
b. Globular—as in the common birch-tree.
c. Ovate—as in the Scotch fir.
d. Filiform—as in the dwarf chesnut-tree.
e. Attenuated—as in the common chesnut.
f. Thick—as in the common walnut.

14. *Nature:*—In nature, the catkin is either scaly, chaffy, or naked.

a. Scaly—when it consists of simple scales, as in the common juniper.
b. Chaffy—when it has the character of the amentum of the Scotch fir.
c. Naked—when the scales are so small or wanting, that the parts of fructification appear naked, as in the excoccaria.

SHEATH OR SPATHE.

15. Sheaths or spathes, are distinguished from two circumstances; the number of pieces of which they consist, and the number of flowers produced in each. In the first respect, they are said to be one-valved, two-valved, imbricated, or dimidiate; and in the second, one-flowered, two-flowered, and three-flowered, according to the number.

a. One-valved—when it consists of one piece, as in the snowdrop.
b. Two-valved—when it consists of two pieces, as in the water-soldier.
c. Imbricated—when it consists of a number of scales, which are laid over each other like tiles, as in the plantain-tree.
d. Dimidiate—when there is only one valve, and that covering the flower but partially, as in the ixia africana.

GLUME OR HUSK.

16. The glume or husk is said to differ in two points; the number of its valves, and the number of flowers contained in each husk. In the first respect, they are said to be one-valved, two-valved, or many-valved; and in the second, one-flowered, two-flowered, or many-flowered, according to the number of flowers in each.

a. One-valved—when it consists of only one scale, as in the rye-grass.

b. Two-valved—when it consists of two scales, as in the hair-grass.

c. Many-valved—having more than two scales, as in the millet, panic-grass, and panicled uniola.

VEIL OR CALYPTRA.

17. The veil or calyptra is the subject of a few systematical appellations, depending on attending peculiarities. The most common are,

a. Acuminate—where it is pointed, as in the bryum.

b. Caducous—falling off yearly, as in the bauxbaumia.

c. Conical—appertaining to a conical figure, as in most mosses.

d. Complete—surrounding the whole of the top of the capsule.

e. Dimidiate—covering only half the top of the capsule.

f. Dentated—toothed in the margin, as in the eucalypta ciliata.

CURTAIN OR VOLVA.

18. The curtain has only two characteristic terms applied to it, and these depend on its situation as being approximating or remote.

a. Approximating—when it is situated on the stem of the fungus near the cap.

b. Remote—when it is situated at a distance from the cap.

OF THE COROLLA.

19. Corollas differ from several circumstances, but principally in the number and division of their petals, their equality, figure, margin, proportion, duration and colour.

20. *Petals:*—According to the number of its petals, the corolla is either monopetalous, dipetalous, tripetalous, or polypetalous.

a. Monopetalous—consisting of only one petal, as in the convolvulus, tobacco, thorn-apple, and many others. The lower part (F. 10, g.) of a monopetalous corolla, is called the tube; and the border, *c c*, or upper part, the limb.

b. Dipetalous—consisting of two petals, as in the enchanter's night-shade.

c. Tripetalous—consisting of three petals, as in sagittaria.

d. Polypetalous—when there are more than three petals, as in the marsh-marygold, lily, tulip and others. The lower part of a polypetalous corolla, (F. 3, a), is called the unguis, or claw; and the upper spreading part, *(b,)* the border.

21. *Divisions:*—With regard to the divisions of the petals of a corolla, they may be bifid or two-cleft, trifid or three-cleft, and many-cleft; or they may be bipartite, tripartite, or laciniated.

a. Bifid or two-cleft—when each petal is divided into two, as in chickweed and enchanter's night-shade.

b. Trifid or three-cleft—when each petal is divided into three parts.

c. Many-cleft—when each petal is divided into more than three parts: thus, the petals of the common ragged-robin have four clefts, those of the primrose five clefts, and those of the winter-green more.

d. Bipartite or twice parted—simple, but divided almost down to the base, as in the stich-wort.

e. Tripartite or thrice-parted—simple, but divided into three parts, almost down to the base.

f. Laciniated—when divided into segments, as in the mignonette.

22. *Equality*:—In respect to equality, the corolla is either regular or irregular.

a. Regular—when equal in the figure, size, and proportion of the parts, as in the jasmine and privet.

b. Irregular—when the parts differ in figure, magnitude, or proportion, as in the lupin, aconite, and dead-nettle.

23. *Figure*:—The most common varieties of figure are, the globose, campanulate, funnel-shaped, salver-shaped, wheel-shaped, ringent, personate, cross-shaped, papilionaceous, and a few others.

a. Globose or globular—when spherical, or round like a ball, as in the globe-ranunculus.

b. Campanulate or bell-shaped—swelling or bulging out without any tube, as in the convolvulus and campanula.

c. Infundibuliform or funnel shaped—having a conical border rising from a tube, as in the thorn-apple, henbane, and tobacco.

d. Salver-shaped—rising from a tube with a flat border.

e. Rotate or wheel-shaped—spreading flat without any tube, as in the borage and speedwell.

f. Ringent or gaping—irregular, gaping with two distinct lips, as in the dead-nettle.

g. Personate or masked—when the lip is closed, as in the snap-dragon.

h. Cruciform or cross-shaped—consisting of four equal petals, which spread out in the form of a cross, as in the wall-flower and stock.

i. Papilionaceous or butterfly-shaped—irregular, usually consisting of four petals, and bearing some resemblance to the figure of a butterfly, as in the pea, &c. The lower petal, which is shaped somewhat like a boat, is called the keel; the vexillum or standard, is the upper petal which rises upwards; and the alæ or wings, are the two lateral wings which stand singly, but separated by the keel.

j. Rosaceous or rose-like—consisting of four or more regular petals, which are inserted into the receptacle by a short and broad claw, as in the wild-rose.

k. Undulate or waved—the surface rising and falling in waves, or obtusely, not in angles, as in the superb and blue gloriosa.

l. Plicate—folded like a fan, as in the convolvulus.

m. Revolute—the petals turned back, as in the asparagus.

24. *Margin:*—In respect to margin, the corolla is said to be crenate, serrate, or ciliate.

a. Crenate—when attended with crenatures, as in the flax.

b. Serrate—having serratures, as in the lime.

c. Ciliate—beset with hairs, as in the rue and others.

25. *Proportion :*—In respect to proportion, the corolla may be termed, long or short.

a. Long—when it is longer than the calyx, as in the long-flowered lobelia.

b. Short—when it is shorter than the calyx, as in the procumbent pearl-wort.

26. *Situation :*—With regard to situation, the corolla is said to be superior or inferior.

a. Superior—having its receptacle above the germen.

b. Inferior—having its receptacle below the germen.

27. *Duration :*—In point of duration, the corolla is caducous, deciduous, permanent, or marcescent.

a. Caducous—continuing only until the expansion of the flower, and then falling off, as in the herb christopher and meadow-rue.

b. Deciduous—when the petals fall off with the rest of the flower.

c. Permanent—continuing until the fruit is ripe, as in the water-lily.

d. Marcescent—withering on the stalk, without dropping, as in the campanula, cucumber, gourd, and others.

28. *Colour*:—In regard to colour, the corolla of different plants, assume almost every known colour.

OF THE STAMEN.

29. Stamens are divided into two parts, the filament and the anther.

30. *Filament*:—The principal differences attending the filament, which give rise to botanical terms are, their number, figure, insertion, proportion, and direction.

a. Number—may be one, two, three, or more, to each anther.

b. Figure—may be flat, capillary, wedge-shaped, and so on.

c. Insertion—into different parts, as the corolla, calyx, nectary, &c

d. Proportion—as being equal, unequal, long, short, and so on.

e. Direction—may be erect, spreading, reflected, inflected, or otherwise.

31. *Anther*:—The principal differences attending the anther, are also derived from their number, figure, insertion, proportion, and direction.

a. Number—may be one, two, three, or more, to each filament.

b. Figure—may be globular, oblong, arrow-shaped, &c.

c. Insertion—may be sessile, distinct, coherent, lateral, and so on.

d. Proportion—may vary in comparison to the other parts.

e. Direction—may be erect, spreading, pendulous, and so on.

32. *Farina*:—The pollen or farina, was described by

Linnæus, as a third part of the anther; but botanists of the present day, regard it only as matter secreted by, or contained in the anther.

The pollen, by means of the microscope, is found to assume a variety of forms in different plants. In the sun-flower, they have the appearance of prickly balls; in the bloody crane's-bill, they are like perforated globules of fire; in the mallows, they resemble wheels furnished with teeth; in the palma-christi, they are shaped like grains of wheat; in the pansey they are angular; in the Indian corn, they are flat and smooth; in the borage, like a thin leaf rolled up; in the narcissus, kidney-shaped, and from other plants, a great variety might be related.

OF THE PISTIL.

33. The pistil consists of three parts; viz. the germen, the style, and the stigma.

34. *Germen:*—The germen varies in different plants, in number, figure, situation, insertion and proportion.

a. Number—may be one, two, three, or more to each plant.

b. Figure—may be roundish, oblong, ovate, and so on.

c. Situation—may be superior, that is, included in the corolla or calyx; or inferior, placed beneath the corolla or calyx.

d. Insertion—may be sessile, or pedicellate i. e. placed on a pedicle.

e. Proportion—may be longer or shorter than the corolla, &c.

35. *Style:*—The style varies in different plants, in number, figure, situation, proportion, division, and in duration.

a. Number—may be one, two, three or more to each germen.

b. Figure—may be cylindrical, columnar, capillary, &c.

c. Situation—may be on the top of the germen or from the side.

d. Proportion—may be long or short in comparison to the stamens.

e. Division—being either simple or undivided; or divided into two, three, or more parts.

f. Duration—being either permanent, remaining until the fruit is ripe, as in plants of the class tetradynamia; or deciduous, falling off with the other parts of the flower, as in the greater number of vegetables.

36. *Stigma:*—The stigma is generally said to vary in number, figure, and duration.

a. Number—may be one, two, three, or more.

b. Figure—may be globular, cruciform, feathery, and so on.

c. Duration—being either permanent, or marcescent.

OF THE NECTARY.

37. The nectary may be said to differ in two respects, in figure, and in situation.

38. *Figure:*—The most common varieties of the figure, are the calcarate, cucullate, campanulate, cyathiform, and a few others.

a. Calcarate or spur-like—as in the larkspur, columbine, and snap-dragon.

b. Cucullate or hooded—as in the aconite and common balsam.

c. Campanulate or bell-shaped—as in the narcissus and jonquil.

d. Cyathiform or cup-shaped—as in the small nettle.

e. Glandular—consisting of little nectiferous glands between the stamen and pistil, as in the white mustard. The following are a few anomalous figures;—

f. The nectary in plants which have but one petal, is contained in the tube, as in the primrose.

g. It is sometimes a hollow cavity in the substance of the petals, as in the crown-imperial and ranunculus.

h. In the petals of the lily it is a naked channel.

i. In the bee orchis it has the appearance of a bee,

j. In the green man orchis, it is somewhat like a man hanging by the head.

39. *Situation* :—The situation of the nectary in different plants is very numerous, among which, perhaps, the following are the most common.

a. In some plants, the nectary is really a part of the corolla, since it lies within the substance of the petals, as in the lily, iris, &c.

b. In many plants, it is placed in a series or row, within the petals or corolla; yet it is entirely unconnected with their substance; and is said to crown the corolla, as in the passion-flower, swallow-wort, and several others.

c. In the Indian cress and a few more plants, the nectary is situated upon, and makes a part of the calyx, instead of the corolla. It is called the calycine nectary.

d. In the bastard flower-fence, the nectary is situated upon the anthers.

e. In the campanula, laurel, and others, the nectary is placed upon the filaments.

f. In the stock July-flower, rocket, flowering-rush, and hyacinth, the nectary is placed upon the germen.

g. In the honey-flower, orpine, buck-wheat, navel-wort, and several other plants, the nectary is placed upon or attached to the common receptacle.

OF THE SEED VESSEL.

40. There are seven different kinds of seed vessels. These are, the capsule, the pod, the legume, the drupe, the pome, the berry, and the cone.

CAPSULE.

41. Capsules are said to consist of five parts; viz. valves, sutures, partitions, cells, and a central column.

a. Valves—are the external shell into which the capsule splits.

b. Sutures—are the external surface in which the valves are joined.

c. Partitions—are the parts by which the capsule is divided into cells.

d. Cells—are the spaces between the partitions and valves.

e. Central column—is the filament which unites the partitions, and to which the seeds are generally attached.

42. Capsules are said to differ with respect to their number of valves, the number of cells, the number of seeds contained, and also with regard to their figure and substance.

a. Number of valves—may be two, as in the celandine; three, as in the violet; four, as in the ludwigia, and so on.

b. Number of cells—may be one, as in the primrose; two as in the thorn-apple; or many, as in different kinds of water-lily.

c. Number of seeds—may be one, two, three, or many as in the poppy.

d. Figure—may be oblong, round, cylindrical, ovate, cornered, and so on.

e. Substance—may be membranous, woody, elastic, fleshy, &c.

SILIQUE AND SILICLE.

43. The most common varieties of these species of seed-vessels, are the round, compressed, articulated, tortulose, rostrate, and drupaceous.

a. Round—as with the silique of the yellow fumitory, and silicle of the penny cress.

b. Compressed—with level valves, as with the silique of the cheiranthus annuus

c. Articulated—intercepted with joints, as with the silique of the wild radish.

d. Tortulose—having swellings or knobs here and there, as with the silique of the garden radish.

e. Rostrate—having the partition very prominent at the apex, as with the silique of the white mustard.

f. Drupaceous—if the membrane is double, soft externally, and hard within.

LEGUME.

44. The legume is characterized chiefly from its figure, substance, and proportion.

a. Figure—may be roundish, oblong, ovate, linear, and so on.
b. Substance—may be woody, fleshy, pulpy, membraneous, &c.
c. Proportion—may be long, short, very small, or very great.

DRUPE.

45. Drupes are distinguished into the succulent and dry, and from the number of seeds contained in each, into one-seeded, two-seeded, and so on.

a. Succulent—when of a fleshy consistence, as the cherry, plum, &c.
b. Dry—as with the horse-chesnut, almond, and many others.

POME.

46. This species of seed-vessel, has received no other botanical appellations than those expressive of its form, as oblong, round, and so on; and those which denote the number of its cells, as three-celled, four-celled, and the like.

BERRY.

47. In addition to the division of berries into simple and compound, they are further distinguished in the language of botany, into one-seeded, two-seeded, and so on; and into proper and improper berries.

a. Proper—when it is formed, as is usual, of the germen or seed bud.
b. Improper—when it is formed of any of the other parts of the fructification. Thus, in the mulberry, the rose, and the blite, the

large, fleshy, and succulent calyx, becomes a berry. In the strawberry and cashew-nut, it is formed from the receptacle; in the raspberry and adonis, of the seed; in the marvel of Peru, of the nectary; and in the garden burnet, of the tube of the corolla, which hardens and shuts for the purpose.

CONE OR STROBILE.

48. The cone has not received any botanical language requiring our notice. It is only said to assume a variety of forms in different vegetables.

OF THE SEED.

49. The parts of a seed already described in the Elements of Botany, are the hilum or eye, the testa or seed-coat, the cotyledons or seed-lobes, and the embryo or heart.

These parts are beautifully seen in the bean, more particularly after macerating it in water. *(See Elements of Botany*, p. 36.*)*

50. The less essential parts of a seed are, the pellicle, the tunic, the seed-down, the tail, the beak and the wing.

Seeds are also occasionally furnished with spines, hooks, scales, and crested appendages, particularly a little gland-like part near the eye, sometimes denominated *strophiolum*, as in the asarum.

51. *Pellicle*:—The pellicula closely adheres to the outside of some seeds, so as to conceal the proper colour and surface of their skin.

The pellicle may be membranous, and often downy, as in the convolvulus, or mucilaginous, not perceptible till the seed is moistened, as in the vervain.

52. *Tunic:*—The tunic or arillus, is either a complete or partial covering of a seed, fixed to its base only, and more or less loosely or closely enveloping its other parts.

The mace which envelopes the nutmeg is a partial arillus. In the oxalis or wood-sorrel, there is an elastic pouch-like arillus, serving to project the seeds with considerable force.

53. *Seed-down:*—The pappus or seed-down, is a sort of feathery or hairy crown, with which many seeds, especially those of the compound flowers, are furnished, evidently intended for the dispersion of the seed to a considerable distance.

Instances of the pappus are the feathery appendages to the seeds of dandelion and goat's-beard, in which it is elevated on a foot-stalk The seeds of the groundsel, hawkweed, and the thistle, are also furnished with this kind of down.

54. *Tail:*—The cauda or tail, is an elongated (generally feathery) appendage to some seeds, formed from the permanent style.

The seeds of virgins bower, and pasque flower, may be selected for illustrations of the cauda.

55. *Beak:*—The rostrum or beak is usually applied to some elongation of a seed-vessel, originating likewise from the permanent style.

The seeds of geranium, hellebore, stone crop, and others, are furnished with this species of appendage.

56. *Wing:*—The ala or wing, is a dilated membraneous appendage to some seeds, serving to waft them along in the air.

The seeds of geranium, crown-imperial, begonia, maple, shepherd's-purse, rhubarb, buck-wheat and others, have this additional part.

57. Seeds differ with respect to number, figure, surface, colour, consistence, and other circumstances, not necessary to mention.

a. Number—may be one, two, three, four, or more.

b. Figure—may be round, ovate, oblong, and a variety of other forms.

c. Surface—may be smooth, polished, furrowed, tubercled, &c.

d. Colour—may be reddish, black, white, blue, green, and so on.

e. Consistence—may be juicy, hard, cork-like, fungous, &c.

OF THE RECEPTACLE.

58. Botanists have distinguished receptacles into two kinds, the proper or peculiar receptacle, and the common or general receptacle.

59. *Proper Receptacle* :—This kind of receptacle belongs only to one flower, and is usually formed from the apex of the peduncle or scape.

The garden tulip, white-lily, wood-strawberry, sweet hovenia, and common cashew-nut, are furnished with this species of receptacle. The proper receptacle or apex of the peduncle swells in some flowers, and becomes the fruit; thus the fruit of the wood-strawberry is not a berry, but a fleshy receptacle with its naked seeds nestling on its surface; so in the sweet hovenia, the peduncles swell into a thick fleshy receptacle on which there are small capsules; and in the common cashew, the peduncle swells into a receptacle on which the nut rests.

60. *Common Receptacle* :—This species of receptacle connects several florets or distinct flowers, so that if

any one of them is removed, an irregularity is occasioned.

The most frequent varieties of the common receptacle, are those of the dandelion, and chrysanthemum, in which it is dotted; of the thistle, in which it is hairy; of the teasel, and scabious, in which it is scaly; and of the cotton-thistle and others, in which it is divided into open cells, like a honey-comb, with a seed lodged in each cell. Flat, conical, convex, and other forms of this receptacle are also to be met with.

VARIETY OF FLOWERS.

61. All flowers according to their composition, are said to be either simple or aggregate.

62. *Simple:*—Simple flowers differ from aggregate flowers, in not having any part of the fructifications common to many florets; but consisting of a single blossom only.

The primrose, snowdrop, tulip, violet, convolvulus, and narcissus, have all simple flowers supported on foot-stalks. The garden crocus, the meadow-saffron, and many other plants, have sessile flowers of the same order.

63. A simple flower furnished with both calyx and corolla, is called a *complete flower;* when the corolla is wanting, *incomplete;* and when the corolla is present without the calyx, it is termed a *naked flower*.

The cowslip, primrose, violet, hearts-ease, and convolvulus, have all *complete* flowers; the African galenia, and drooping lizard's tail, *incomplete* flowers; and the common tulip, a *naked* flower.

64. *Aggregate:*—Aggregate flowers are those in which many florets are so connected by some part of the

fructification, that not one of them can be taken out, without destroying the form of the whole.

The connecting part, in aggregate flowers, is either the receptacle or the calyx; and the partial flowers of which they are composed, are called *florets*.

65. Aggregate flowers are of two kinds; viz. the aggregate, properly so called, and the compound.

66. *Aggregate proper*:—Aggregate flowers, properly so called, have a common undivided receptacle, the anthers all separate, and the florets usually on foot-stalks.

The sweet-william, cowslip, gelder rose, hazel, willow, arum, hyacinth, narcissus, hemlock, and grasses, have all flowers of the aggregate order.

The other five species of aggregate flowers called by Linnæus, the umbellate, from their constituting an umbel; the cymose, from their blooming in a cyme; amentaceous, from their calyx being an amentum or catkin; glumose, from their calyx being a glume or husk; and spadiceous, from their having a receptacle issuing from a spathe or sheath, are nothing more than varieties of the kind of flower, now called aggregate proper.

67. *Compound*:—Compound flowers consist of numerous florets, all sessile or seated on a common undivided receptacle, and inclosed in one continuous calyx. It is also essential to this kind of flower that the anthers be united into the form of a cylinder.

In compound flowers the florets are always one-petalled and superior, each standing on a solitary naked seed, or at least the rudiments of one, though not always perfected. The sun-flower, is, I believe, as good an illustration of the compound flower as can be brought forward. The daisy, thistle, and dandelion might also be mentioned.

68. The florets which constitute a compound flower, may be of two kinds; *ligulate*, shaped like a strap or riband, with three or five teeth; or *tubular*, in the form of a tube.

The marginal florets of the 6th figure, (or of the daisy), are of the ligulated description (F. 7.), and compose its *radii* or rays; and the yellow central ones (F. 6.) come under the tubular denomination, constituting its *discus* or disk.

69. All flowers, as well as florets, have received systematic names, according to the presence or absence of the stamens and pistils.

It is requisite to understand the varieties depending on these grounds, because the terms derived therefrom, are necessarily much used in the artificial system of Linnæus, and the knowledge of that system will be made more easy of comprehension.

70. When the stamens and pistils are both, as usual, in one flower, it is called *perfect* or *united*; when they are situated in different flowers of the same species, such have been called separated flowers; those which have the stamens being named the *barren* flowers, as producing no fruit in themselves, and those with the pistils, the *fertile* flowers, as bearing the seed.

The tulip, hearts-ease, primrose, violet, cowslip, and most plants, have *perfect* flowers; the Indian corn, common alder, common nettle, common mulberry, and the tribe of sedges, have both *barren* and *fertile* flowers on *the same* species of plant; whereas the tribe of willows, the common hop, and the black bryony, have *barren* flowers on *one* plant, 'and *fertile* flowers on *another* of the same species.

71. There are numerous other terms applied to

flowers, as respects many peculiar traits connected with their form, structure, and so on.

If the flower has but one petal, it is said to be monopetalous; if two, dipetalous, and so on; if no petals, apetalous; if the corolla is of the butterfly-shaped, then the flower is termed papilionaceous; if in the shape of a bell, companulate, and so on. The terms umbellate or umbelliferous, amentaceous, glumose, spadicious, and cymose, have been lately mentioned.

72. *Double Flowers*:—The only kind of flowers which remain to be mentioned, are the double. These flowers are not natural productions, but the consequence of cultivation, the internal organs becoming converted into petals.

Double flowers will not serve the purposes of a systematic botanist, since the principal organs upon which any system might be founded, are no longer present. They are only regarded as deviations from the general laws of nature, and are totally uninteresting to any but the florist.

INFLORESCENCE.

73. Inflorescence, is a term employed to express the particular manner in which flowers are situated upon a plant, otherwise denominated, the manner of flowering.

It is not necessary to mention in particular, the different varieties of inflorescence peculiar to simple flowers. If the flower is situated on a stalk or peduncle, it is said to be *pedunculated*; if it adheres to the plant without a stalk, *sessile*; if it is placed on the stem, *caulinar*; if on the root, *radical*, and so on.

74. There are ten modes of flowering peculiar to aggregate flowers. These are, the whorl, the cluster,

the spike, the corymb, the fascicle, the tuft, the umbel, the cyme, the panicle, and the bunch.

75. *Whorl:*—In the verticillus or whorl, the flowers surround the stem in a sort of ring; though they may not be always inserted on all sides, but merely on two opposite ones.

The flowers of the mares-tail, dead-nettle, sea-dock, corn-mint, Indian sage, black stinking-horehound, and common balm, are in the form of a whorl. (F. 12.)

76. The most common varieties of the whorl, are, the pedunculated, the sessile, the dimidiate, the naked, and a few others.

a. Pedunculated—each flower placed on a peduncle, as in the common balm.

b. Sessile—without a peduncle, as in the corn mint.

c. Dimidiate—going half round, as in the ballota disticha.

d. Naked—without any floral or other leaf, as in the whorled sage.

77. *Cluster:*—The cluster or racemus, consists of numerous rather distant flowers, each on its own proper peduncle, and all connected by one common stalk.

The bunch of currants in bloom is the best example to be referred to. The flowers of the poke, the common wild-cherry and bird-cherry might also be examined. (F. 15.)

78. The most common varieties of the cluster, are the simple, the compound, the conjugate, the aggregate, and a few more.

a. Simple—not having any branches, as in the red currant.

b. Compound—being branched, as in the common grape vine.

c. Conjugate—two clusters going from the end of the common peduncle.

d. Aggregate—several being collected together.

79. *Spike:*—The spica or spike, is a species of inflorescence consisting of one common stalk bearing numerous flowers, all ranged along it without any, or having very small partial stalks.

We have examples of the spike in an ear of wheat, rye, or barley, and many other grasses ; also in the mullein, agrimony, and lavender. (F. 11.)

80. The most common varieties of the spike, are, the cylindrical, the articulated, the conjugate, the ramose, the interrupted, and a few others.

a. Cylindrical—having a cylindrical form, as in the hoary and whitish plantain.

b. Articulated—having distinct joints, as in the marsh glass-wort.

c. Conjugate—Two spikes going from the summit of the peduncle, as in the European and small-flowered heliotrope.

d. Ramose—divided into branches, as in the English mercury.

e. Intercepted—in separate groups, as in the wood betony.

81. *Corymb:*—The corymbus or corymb, is a spike whose partial flower stalks are gradually longer as they stand lower on the common stalk, so that all the flowers are nearly on a level.

The Virginian gelder-rose, a common garden shrub, affords a very perfect specimen of this kind of inflorescence. The cuckoo-flower, scurvy-grass, gold-of-pleasure, and other plants of the class tetradynamia, also have corymbose flowers. (F. 9, a.)

The corymb differs from the umbel in this circumstance, that in the former, the partial foot-stalks take their origin from different parts of the common stalk; whilst in the latter, all the peduncles proceed from a common centre.

82. The only varieties of the corymb necessary to be mentioned, are the simple and the compound.

a. Simple—when not divided into branches, as in penny-cress.

b. Compound—when it has branches, as in the narrow-leaved everlasting.

83. *Fascicle:*—The fasciculus or fascicle, is a species of inflorescence, in which the partial flowers on little foot-stalks, are variously inserted and subdivided, and collected into a close bundle, level at the top.

The sweet-william affords the most familiar illustration of a fascicle.

The fascicle differs from the corymb, in the little stalks coming only from about the apex of the general peduncle, and not from its whole length—from an umbel, on account of the stalks not proceeding from a common point—and from a cyme, in not having its principal divisions umbellate.

84. *Tuft:*—The head or tuft is a term used to express the kind of blooming, in which several flowers form a kind of ball or head, at the extremity of the foot-stalks.

The globe amaranth, bachelor's buttons, wild thyme, and some species of trefoil, will afford very good illustrations of the tuft.

85. The most common varieties of the tuft are, the globular, ovate, hispid, pedunculated, sessile, roundish, and a few others.

a. Globular—of a round form, as in the common globe amaranth.

b. Ovate—in the form of an egg, as in the headed Liparia.

c. Hispid—having bristles, as in the field basil.

d. Pedunculated—furnished with little foot-stalks, as in the headed germander.

e. Sessile—having no foot-stalks, as in the dwarf germander.

f. Roundish—not perfectly round, as in the selago fruticosa.

86. *Umbel*:—The umbella or umbel has several stalks or rays, nearly equal in length, spreading from one common centre, their summits forming a level, convex or even globular surface, or more rarely a concave surface.

The common fennel, knotted stone parsley, white-rot, ginseng, hare's-ear, and the tribe of plants arranged in the natural order *umbellatæ*, may be examined for a practical knowledge of this species of inflorescence. (F. 14.)

87. The varieties of this inflorescence, are from the insertion of the umbel, either pedunculate or sessile; and from the division of the umbel, either simple or compound.

a. Pedunculate—when the rays or flower-stalks proceed from a peduncle.

b. Sessile—when the rays or flower-stalks proceed not from a common peduncle, but from the stem or branch of the plant, as in the knotted water-parsnip and small-fruited cherry tree.

c. Simple—when single-flowered, as in the knotted stone-parsley.

d. Compound—when each ray or stalk, bears an umbellula or little umbel, as in the common fennel. In this case, the first or larger set of rays, constitute the *universal umbel*; while the second or lesser set of peduncles constitute the *partial umbel*.

88. *Cyme*:—The cyma or cyme consists of several flower-stalks having the general appearance of an umbel, and agrees with it so far, that its common stalks all

spring from one centre, but differs in having those stalks variously and alternately subdivided.

We have instances of the cyme in the alder, wild gelder rose, wall-pepper, radish, crassula, common laurustinus, and in various species of cornel or dogwood. (F. 13.)

This mode of inflorescence also agrees with a corymb, in general respect, but in the latter, the primary stalks have no common centre, though the partial ones may sometimes be umbellate, which last case is precisely the reverse of a cyme.

89. *Panicle:*—The panicula or panicle, is a species of compound inflorescence, which bears the flowers in a sort of loose, subdivided, bunch or cluster, without any order.

The flowers of the common horse-chesnut, the London-pride, Venetian sumach, and panicled gypsophila, are good examples of a panicle; but this species of inflorescence occurs most frequently in grasses, as in oats, panic grass, and many others. (F. 16.)

90. The most common varieties of the panicle, are the spreading, the crowded, and the forked.

a. Spreading—when the stalks are distant, loose, or spreading, as in the spreading campanula.

b. Crowded—when the stalks are dense or crowded together, as in the rampion.

c. Forked—as exemplified in the flowering of the yellow flax.

91. *Bunch:*—The thyrsus or bunch, is a mode of inflorescence very nearly allied to the panicle, being, in fact, a panicle contracted into an ovate or egg-shaped form.

We have instances of this kind of inflorescence in a bunch of grapes, in the common lilac, in butter-bur, bastard colts-foot, and other plants. (F. 17.)

SECTION III.

NOMENCLATURE OF THE APPENDAGES.

1. In this department, we have to speak of the terms applied to the different varieties or peculiarities of the organs we have previously arranged, as appendages to plants.

BRANCH OR RAMUS.

2. The most appropriate terms applied to the branch, are opposite, alternate, whorled, dispersed, descending, brachiate, deflexed, reflexed, retroflexed, and fastigiate.

a. Opposite—when they go off or pair opposite to each other, as in corn mint.

b. Alternate—when they are given off one after another, as in the officinal marsh mallow.

c. Whorled—when more than two go from the stem in a whorled manner, as in the Norway spruce fir.

d. Dispersed—when they are given off without any order.

e. Descending—descending from the stalk at an obtuse or at a right angle, as in the hedge-ladies'-bedstraw and branching ammannia.

f. Brachiated—the opposite spreading branches crossing each other, as in the prickly pisonia.

g. Deflexed—arched, with the apex downwards, as in the larch.

h. Reflexed—hanging perpendicularly from the trunk.

i. Retroflexed—turned backwards, as in the bitter-sweet.

j. Fastigiate—forming a kind of pyramid, as in the chrysanthemum corymbosum.

BULB OR BULBUS.

3. Of the bulb, there are no particular circumstances observed, to call for any distinction in botanical language.

BUD OR GEMMA.

4. We have already mentioned buds as being of three kinds, viz. the leaf-bud, the flower-bud, and the compound-bud. We have now to mention, that buds may be opposite, alternate and spiral, and sessile or stalked, solitary and aggregate.

a. Opposite—placed exactly on the same line, on opposite sides of the stem or branch.

b. Alternate—placed alternately, although on opposite sides.

c. Spiral—placed round the stem or branch in such a manner, that a cord wound round it in an oblique direction, would touch each gem.

d. Solitary—when only one gem is to be seen in the axilla of each leaf, as in the greater number of instances.

e. Aggregate—when, as in some plants, two, three, or even more are protruded at the same time, thus we find two in the common elder, three in the broad-leaved birth-wort, and many in the tooth-ache-tree.

f. Sessile—when they rise with a broad base from the surface where they are protruded, and consequently are in close contact with it, as with the gems of most trees and shrubs.

g. Stalked or pedicillated—when they are distant and supported on a short foot-stalk, as in the common alder.

LEAF-STALK, PETIOLE, OR PETIOLUS.

5. The foot-stalk or petiole, is generally distinguished into the *apex*, or part which it is inserted into the leaf, and the *base* which comes from the stem or branch.

The petiole or leaf-stalk, is very frequently called the *foot-stalk* of the leaf; and again, the peduncle or flower-stalk of the flower, is also called the *foot-stalk* of the flower.

6. There are three circumstances attending leaf-stalks, which have given rise to botanical language; these are, their figure, insertion, and composition.

6. *Figure:*—In figure they may be linear, winged, appendiculated, round, channelled, compressed, spinescent, and so on

a. Linear—when they are equal in breadth throughout, as in the lemon-tree.

b. Winged—having their expansions on each side, as in the orange-tree.

c. Appendiculated—when furnished with leaflets at its base, as in the small teasel.

d. Round—round throughout, as in the garden pea.

e. Channelled—when it is dilated to its base, as in the wild angelica.

f. Compressed—compressed towards its base, as in the trembling poplar.

g. Spinescent—becoming a spine after the fall of the leaf, as in the purging buckthorn.

8. *Insertion:*—In insertion, the leaf-stalk is termed inserted, articulated, adhering, decurrent, amplexicaul, and vaginate.

a. Inserted—when it is attached, as in the common pear and most trees.

b. Articulated—when it is in joints, as in the common wood-sorrel.

c. Adhering—adhering so to the stem, that it cannot be displaced without injuring the bark.

d. Decurrent—adhering at its base, and going some little way down the stem, as in the black-seeded pea.

e. Amplexicaul—surrounding the stem at its base, as in the spleen-wort-leaved groundsel.

f. Vaginate—surrounding or sheathing the stem with a perfect tube, as in the common Indian shot.

9. *Composition:*—In composition, the petiole is either simple or compound.

a. Simple—when not divided, as in most leaves. (F. 40, f.)

b. Compound—when divided into other leaf-stalks, as in all compound leaves. (F. 36.)

FLOWER-STALK, PEDUNCLE OR PEDUNCULUS.

10. Various species of the peduncle are enumerated by some botanical writers, but the subsequent notes will be found sufficiently comprehensive for general reference. The terms are principally derived from the situation of the appendage in question and the number placed together.

In some flowers, for example the cowslip, the common peduncle is subdivided into partial flower-stalks, and these are technically called *partial peduncles* or *pedicelli*.

11. *Situation:*—In situation, they may be radical, cauline, rameal, opposite, axillary, lateral, terminal, intermediate, gemmaceous and dispersed.

a. Radical—proceeding immediately from the root.

b. Cauline—proceeding immediately from the stem, as in the ash-leaved averrhoa.

e. Rameal—growing out of the main branch, as in the Malay apple-tree.

d. Opposite—growing opposite to a leaf, as in the mountain geranium.

e. Axillary—growing either from the bosom of a leaf, that is, between it and the stem, as in the alkanet—or between a branch and a stem, as in the sea tassel-pond-weed.

f. Lateral—growing on the side of a stem or branch, as in the Cornish heath.

g. Terminal—when it terminates a stem or branch, as in the greater centaury.

h. Intermediate—proceeding from the intermediate part of a branch between two leaves.

i. Gemmaceous—growing out of a leaf-bud, as in the common berberry.

j. Dispersed—scattered irregularly over the stem or branch.

12. *Number:*—In number, the peduncle may be solitary or aggregate.

a. Simple or solitary—either single on a plant, as in the cloud-berry; or only one in the same place, as in the antirrhinum spurium.

b. Double or aggregate—when several grow together, as in the black mullein.

STIPULE OR STIPULA.

13. The principal sources of botanical description, as regards the stipule, are derived from its situation, duration, structure, &c.

Stipules are very conspicuous in the tamarind, the rose, the cassia, the honey-flower, the apricot, the peach, the bird-cherry, and in many species of pea-bloom flower. In the tulip-tree, they are particularly conspicuous.

14. *Situation:*—In respect to situation, the stipule may be solitary, paired, lateral, extrafoliaceous, intrafoliaceous, and oppositifolious.

a. Solitary—when there is only one stipule, as in the butcher's-broom.

b. Paired—when there are two stipules attached to the stem, one an each side of the leaf-stalk, as in the yellow annual lathyrus, and most of the plants furnished with stipules.

c. Lateral—when they grow upon, or are inserted into the sides of the foot-stalk, as in the lotus tetraphyllus.

d. Extrafoliaceous—when they grow on the outside of the leaves or below them, as in the beach, lime, &c.

e. Intrafoliaceous—when they grow above or within the leaves, as in the bird-cherry, in the white mulberry and common mulberry.

f. Oppositifolious—when they grow opposite to a leaf, as in the clover.

15. *Duration:*—In respect to duration, the stipule may be caducous, deciduous or persistent.

a. Caducous—falling off before the leaves are expanded, as in the common cherry-tree, oak, poplar, and many others.

b. Deciduous—falling off with the flower, as in many plants.

c Persistent—remaining until the fall of the leaf, as in the rose, raspberry, tormentil, and so on.

16. *Structure:* — The terms decurrent, sheathing, subulate, and many others applied to stipules, have been previously explained under the nomenclature or terminalogy of the leaf.

FLORAL LEAF OR BRACTEA.

17. The technical terms applied to the floral-leaf, are very few: these have their origin from the colour of the bractea, as being coloured or green; or from its duration, as being caducous, deciduous, or persistent.

The terms just mentioned, have been repeatedly explained: we shall here only observe, that the following, among other plants, furnish us with the most remarkable instances of the floral-leaf, viz. the lime-tree, cow-wheat, some species of fumitory, milk-wort, rest-harrow, passion-flower, and hellebore.

THORN, SPINE OR SPINA.

18. Thorns, according to attending peculiarities, are either called cauline, terminal, foliar, marginal, axillary, calycine, pericarpial, stipular, simple, double, &c.

a Cauline—protruded from the stem and branches, as in the buckthorn.

b. Terminal—placed at the end of a branch or leaf, as in the buckthorn.

c. Foliar—protruded from the surface of the leaf, as in the milk-thistle.

d. Marginal—protruded from the margin of the leaf, as in the holly.

e. Axillary—proceeding from the angle which is formed by a branch or leaf with the stem, as in the three-thorned honey-locust-tree.

f. Calycine—protruded from the calyx, as in the thistle.

g. Pericarpial—protruded from the pericarp or seed-vessel, as in the thorn-apple.

h. Stipular—situated on the stipule, as in the mimosa nilotica.

i. Simple—when there is only one thorn, as in most thorny plants.

j. Double, treble, &c.—according to the number given off at the same place.

19. The terms muricate, straight, recurve, and others expressive of form or nature, have been already explained, in speaking of the different organs or appendages to plants.

PRICKLE OR ACULEUS.

20. The same terms employed under the technicalities of the thorn or spine, are also used to express the same characteristic marks of the prickle.

The rose, sweet briar, raspberry, berberry, angelica-tree, gooseberry, Indian night-shade, and tomentose night-shade, will afford very excellent illustrations of the prickle.

TENDRIL OR CIRRUS.

21. Tendrils are distinguished from their origin, the division of their apices, and from their convolutions.

22. *Origin:*—With respect to origin, tendrils are either foliar, petiolar, peduncular, axillary, sub-axillary or lateral.

a. Foliar—when they are a continuation of the midrib of a simple leaf, as in the superb gloriosa.

b. Petiolar—when terminating the common petiole of the leaf, as in the common garden-pea. This is sometimes distinguished by the number of leaflets which grow under it, and hence called di-phyllous, triphyllous, and so on.

c. Peduncular—when they proceed from the peduncle, as in the grape vine.

d. Axillary—when they arise from the stem or branch in the axilla of the leaves, as in the flesh-coloured passion-flower.

e. Sub-axillary—when they originate below the leaf.

f. Lateral—when they proceed from the side of the leaf, as in the bryony.

23. *Apex:*—From the division of the apex of a tendril, it is either simple, compound, bifid, trifid or multifid.

a. Simple—consisting of one undivided piece, as in the square-stalked passion-flower.

b. Compound—consisting of a stalk variously branched or divided.

c. Bifid—when it has two divisions, as in the grape vine.

d. Trifid—when it has three divisions, as in the clawed trumpet-flower.

e. Multifid or branched—when the divisions are more numerous, as in the everlasting pea.

24. *Convolution:*—From the manner of convolution, the tendril is either convolute or revolute.

a. Convolute—when all the turnings are regular and in the same direction, as in the hedera quinquefolia.

b. Revolute—when the tendril winds itself irregularly, sometimes on one side, and sometimes on the other, as in the flesh-coloured passion-flower.

GLAND OR GLANDULA.

25. Glands differ with respect to situation, attachment, and figure.

26. *Situation:*—In situation, they are either foliar, petiolar, corollar, or filamentous.

a. Foliar—when they are situated on the surface of the leaf, as in the spotted bark-cotton which has one gland on the leaf, and in the Barbadoes cotton, the leaves of which have three.

b. Petiolar—when they are situated on the petiole or foot-stalk, as in the passion-flower and palma christi or castor-oil plant.

c. Corollar—when they are situated on the corolla, as in the common berberry.

d. Filamentous—when they are situated on the filaments, as in the common fraxinella.

27. *Attachment:*—In attachment, glands are either sessile or pedunculated.

a. Sessile—without any foot-stalk or peduncle, as in the cultivated cherry-tree.

b. Pedunculated—situated on a peduncle, as the glands are in F. 154.

28. *Figure:*—Glands assume a great variety of appearances.

Sometimes they resemble a blister or bladder, as in the St. John's wort; sometimes a number of scales, as in many ferns; sometimes small grains, not unlike those of millet, as in the fir-tree, and in some instances a small cup, as in the apricot tree.

PUBESCENCE.

29. Under this head, we have to consider the pilus or hair, and the setæ or bristle.

HAIR OR PILUS.

30. Hairs are fine, slender, cylindrical, flexible bodies found on the surfaces of the herbaceous parts of plants. They are either simple or compound.

31. *Simple:*—When they are of a single piece, the

most common form is that of a jointed thread, generally too flexible to support itself.

According to the degree of firmness peculiar to hairs, their quantity, and the mode of their application to the surface of stems and leaves, are derived the characteristic names of hairy, woolly, shaggy, silky, glandulo-ciliated, &c. already mentioned in speaking of the surface of stems and leaves.

32. *Compound*:—When they consist of more than one piece. The most common varieties of this kind, are the feathery, the branched, and the star-like.

a. Feathery—a simple hair with other hairs attached to it laterally, as in the wave-leaved hawk-weed.

b. Branched—that is, lateral hairs are given off from common stalks, as on the petiole of the gooseberry leaf, or it consists of an erect firm stem, from the summits of which, smaller hairs diverge in every direction, as in the saw-leaved horehound.

c. Star-like or stellated—being composed of simple diverging awl-shaped hairs, springing from a common centre, which is a small knob sunk in the cutis, as on the leaves of marsh mallow.

BRISTLE OR SETE.

33. A bristle is a hollow, rigid, sharp-pointed pubescence, which either wounds the finger when it is pressed upon it, or gives a very harsh, scabrous, or prickly character to the surface of the stem, or of the leaves when the finger is rubbed over them. They are of two kinds, the simple and the compound.

34. *Simple*:—When they consist but of one piece. Simple bristles are either awl-shaped or spindle-shaped.

a. Awl-shaped or subulate—is the most common of the simple bristles; it is slightly curved, and gradually tapering from the base to the apex, which is rigid and very sharp. The sting of the nettle, is the best example of this form of bristle.

b. Spindle-shaped or fusiform—when it is thickest in the centre, and accumulated at each end. It lies parallel to the surface of the leaf, to which it is affixed by a very small foot-stalk, is hollow, and contains a coloured fluid. This form of bristle is peculiar to the genus malpighia or Barbadoes cherry.

35. *Compound:*—When they consist of more than one piece, and are almost always solid. There are two varieties of the compound bristle; viz. the forked, and the fasciculated.

a. Forked—the forked are, in some instances, merely rigid hair-like bodies, terminating in two or three diverging points, as in the hispid thrincia; but in other instances, as with the stems and leaves of the hop-plant, the stalk of the bristle, which is supported on a firm cellular tubercle, is very short, and its forked extremities resemble two flattish awl-shaped bristles, pointing in opposite directions.

b. Fasciculated—consisting of a number of simple, straight bristles, diverging from a papillary knob, as in the creeping cactus.

36. The bristles of plants have also received other denominations, of which the terms striga, hook, barb, and awn, must be mentioned.

a. Striga, or stiff-bristles—that variety of the awl-shaped, which are seen in the common borage.

b. Hamus or hook—that kind of bristle which is hooked at its extremity, as in the goose-grass or cleavers.

c. Glochis or barb—when several sharp tooth-like processes are turned back from the apex of the bristle.

d. Arista or awn—a long bristle proceeding from the husk of grasses, as in the common barley.

37. The terms erect, stellate, plumose or feathery, as applied to hairs, are also used with the same intent of meaning, to bristles.

THE

LINNÆAN

ARTIFICIAL SYSTEM.

PART IV.

CONSTITUTING A SIMPLE AND BEAUTIFUL DIVISION OF PLANTS, ACCORDING TO THEIR PARTS OF FRUCTIFICATION, INTO TWENTY-FOUR CLASSES, WITH THEIR COMPONENT ORDERS.

THE

LINNÆAN ARTIFICIAL SYSTEM.

SECTION I.

General view of the system:—the division, origin and derivation of the classes. The origin and derivation of the orders.

SECTION II.

An explanation of every class and order constituting the system, illustrated with references to plants of each division.

SECTION III.

General rules for ascertaining the class, order and genus to which any plant may belong, or a convenient and simple guide to a practical knowledge of the Linnæan Arrangement.

SECTION I.

GENERAL VIEW OF THE SYSTEM.

1. In the History of Botany, we alluded to the necessity of a simple and comprehensive arrangement of plants, in which every vegetable production might be classed, with tolerable accuracy and precision.

Many systems were published by some of the most learned botanists, but none have been so well received or so truly valued, as the excellent arrangement we are now about to consider.

2. The artificial system of Linnæus, is founded entirely on the *stamens* and *pistils* of the flower, and according to his arrangement, all known plants are distributed into different classes, orders, genera, species, and varieties.

The stamen is generally considered as the male part of the flower, and the pistil as the female ; the former, because the flowers having stamens only, bear no seed ; and the latter, because they bear seed when the pollen of the stamen has been discharged upon them. With this idea of the sexes of plants, the Linnæan system, is very commonly called the *sexual system*.

3. The *classes* are the first general division of all vegetables into twenty-four kinds. There are numerous plants which have a character common to them all, and the aggregation of these plants as bearing this evident *primary* distinction, constitutes a class.

Thus, if two hundied new plants were to be discovered, and all of them were found to have flowers with one stamen, they would be arranged in the first class of the Linnæan system; if they had two, in the second, and so on, provided they were deficient in any other peculiarities which give rise to a distinct class. If on the contrary, these two hundred plants were found to possess characters unknown to botanists before, they would naturally constitute a separate class of vegetables.

4. Each of the twenty-four classes, admit of being subdivided into *orders* or tribes. These orders are derived from a *secondary* characteristic.

For example, the first class of plants are those which produce perfect flowers with one stamen only. If the plants which belong to this class are examined, some will be found to have but *one* pistil, the others *two;* it is consequently very plausible, since the pistil is a sufficient *secondary* characteristic, to say the class is composed of two sets of plants. These two sets are therefore the two *orders*.

5. The orders into which the classes are divided, are again subdivided into *genera* or families. The genera, in their turn, are derived from peculiar characters, which many plants of the same order possess in common to themselves.

In most of the orders, you will find some plants which have one or more peculiarities, that agree with each other; thus the different geraniums have their particular character, the tulips theirs, the poppies theirs, and other plants in the same way, their marks of distinction. It is then, on these points of distinction, that the genera of plants are constructed.

6. The genera, like the preceding divisions, are also subject to a further arrangement into *species*, and these species into *varieties*.

For instance, you often see in green houses, a great many different sorts of geranium; the geraniums form a *genus* or family of plants, and each different sort is a *species* of that genus; so that when you hear a person say, round-leaved geranium, a Pensylvanian geranium, or a dark-flowered geranium, you know that they all belong to the genus geranium: and that the round-leaved, Pensylvanian, and dark-flowered geraniums are different species.

7. The *varieties* are nothing more than plants of the same species, with some trivial distinction in which they differ from others of the same species.

With some plants, owing to soil, situation, or other causes, both the leaves and flowers are subject to variation. When this is the case, they are denominated varieties.

8. Such are the primary and ultimate divisions according to the artificial system of Linnæus. We shall next speak of the division, origin and derivation of the classes, and afterwards of the origin and derivation of the orders.

In performing these tasks, we shall endeavour to impress upon the memory, the usual circumstances on which the respective divisions are established.

DIVISION, FOUNDATION, AND DERIVATION OF THE CLASSES.

9. The character of the classes are established from *six* circumstances connected with the stamen.

10. *First Division*:—These are established on the *number* of the stamens *alone*, as is the case with the first ten classes. Their names are derived from two Greek

words, the first expressing number, and the second a stamen.

1. Monandria;	from *monos*	one,	and *andros* of *aner*, a stamen.
2. Diandria;	from *dis*	two,	and *andros* of *aner*, a stamen.
3. Triandria;	from *treis*	three,	and *andros* of *aner*, a stamen.
4. Tetrandria;	from *tettares*	four,	and *andros* of *aner*, a stamen.
5. Pentandria;	from *pente*	five,	and *andros* of *aner*, a stamen.
6. Hexandria;	from *hex*	six,	and *andros* of *aner*, a stamen.
7. Heptandria;	from *hepta*	seven,	and *andros* of *aner*, a stamen.
8. Octandria;	from *okto*	eight,	and *andros* of *aner*, a stamen.
9. Enneandria;	from *ennea*	nine,	and *andros* of *aner*, a stamen.
10. Decandria;	from *deka*	ten,	and *andros* of *aner*, a stamen.

11. *Second Division:*—The classes of this part, are founded upon the *number* and *insertion* of the stamens, as with the eleventh, twelfth, and thirteenth classes. Their names are also derived from two Greek words, one expressing number, and the other a stamen.

11. Dodecandria;	from *dodeka*	twelve,	and *andros* of *aner*, a stamen.
12. Icosandria;	from *ikosi*	twenty,	and *andros* of *aner*, a stamen.
13. Polyandria;	from *polus*	many,	and *andros* of *aner*, a stamen.

12. *Third Division:*—Consists of two classes in which the *number* and *proportion* of the stamens differ. These are the fourteenth and fifteenth classes, the names of which are derived from two words, one expressing number, and the other power.

14. Didynamia;	from *dis*	two,	and *dunamis*, power.
15. Tetradynamia;	from *tettaris*	four,	and *dunamis*, power.

13. *Fourth Division:*—Here we find five classes in which the stamens are *united*. They are the sixteenth, seventeenth, eighteenth, nineteenth aud twentieth classes.

The three first are derived from two words, one denoting number, and the other a brother, because stamens are, figuratively speaking, brothers to each other; the two last, from words expressing their distinguishing characters.

16. Monadelphia; from *monos* one, and *adelphos*, a brother.

17. Diadelphia; from *dis* two, and *adelphos*, a brother.

18. Polyadelphia; from *polus* many, and *adelphos*, a brother.

19. Syngenesia; from *sun* together, and *genos*, generation, because the stamens are found united by their anthers.

20. Gynandria; from *gune* a pistil, and *andros* of *aner*, a stamen, because the pistils are most conspicuous, and have the stamens placed upon them.

14. *Fifth Division*:—The classes of this part, are established on the principle of the stamens being *separate*, that is, not in the same flower, or on the same plant as the pistils, or otherwise. They are the twenty-first, twenty-second, and twenty-third classes.

21. Monœcia; from *monos* one, and *oikos* a house, because the stamens and pistils are distinct, in separate flowers on *the same* plant.

22. Diœcia; from *dis* two, and *oikos* a house, because the stamens and pistils are distinct upon *different* plants of the same species.

23. Polygamia; from *polus* many, and *gamos* unions, because the stamens and pistils are separate in some flowers, and united in others, either on the same plant, or on two or three distinct plants.

15. *Sixth Division*:—Is constituted by the class cryptogamia, in which the stamens and pistils are *concealed*, or not perceptible to the naked eye.

This class is derived from the words *kruptos* concealed, and *gamos* unions, from the circumstance just related.

16. We shall here close our general observations on the divisions of the Linnæan artificial classes, and next

make a few remarks on the foundation and derivation of the *orders.*

ORIGIN AND DERIVATION OF THE ORDERS.

17. The orders are the secondary divisions of the Linnæan system, and are established upon different principles.

18. In the first thirteen classes, they are founded on the *number of the pistils* in each flower, and derived from two Greek words, one expressing number, and the other, a pistil.

1. Monogynia ;	from *monos*	one,	and *gune*, a pistil.
2. Digynia ;	from *dis*	two,	and *gune*, a pistil.
3. Trigynia ;	from *treis*	three,	and *gune*, a pistil.
4. Tetragynia ;	from *tettares*	four,	and *gune*, a pistil.
5. Pentagynia ;	from *pente*	five,	and *gune*, a pistil.
6. Hexagynia ;	from *hex*	six,	and *gune*, a pistil.
7. Heptagynia,	from *hepta*	seven,	and *gune*, a pistil.
8. Octagynia ;	from *okto*	eight,	and *gune*, a pistil.
9. Enneagynia ;	from *ennea*	nine,	and *gune*, a pistil.
10. Decagynia ;	from *deka*	ten,	and *gune*, a pistil.
11. Dodecagynia ;	from *dodeka*	twelve,	and *gune*, a pistil.
12. Polygynia ;	from *polus*	many,	and *gune*, a pistil.

19. The orders of the fourteenth class didynamia, are taken from the *situation of the seeds.*

1. Gymnospermia ; from *gumnos* naked, and *sperma* seed.
2. Angiospermia ; from *aggos* a vessel, and *sperma* seed.

20. The orders of the fifteenth class, tetradynamia, are formed from *a difference in the shape of the seed vessels.*

1. Siliculosa ; from the Latin *silicula*, a little pod.
2. Siliquosa ; from the Latin *silicula*, a long pod.

21. In the classes monadelphia, diadelphia, polyadelphia, and gynandria, the orders are taken from *the number of the stamens.*

Monandria, diandria, triandria and so on, according to the number of stamens.

22. In the nineteenth class, syngenesia, the orders are taken from *the structure of the flower.*

1. Polygamia æqualis ; the first from *polus* many, and *gamos* unions ; the second *æqualis* equal ; meaning that each flower is equally possessed of stamens and pistils.
2. Polygamia superflua ; the first from *polus* many, and *gamos*, unions ; the second *superflua*, superfluous ; meaning that the florets in the disk being perfect, produce seed, and those in the ray or circumference (which are furnished with pistils only), are superfluous, as the former were sufficient to continue the species.
3. Polygamia frustranea; the first from *polus* many, and *gamos* unions ; the second *frustranea* needless ; because the florets in the ray being neuter, their existence seems useless.
4. Polygamia necessaria; the first from *polus* many, and *gamos* unions ; the second *necessaria* necessary ; because the florets in the disk have stamens only, and in the ray pistils only, so that, if those in the disk were absent, there would be no seed, hence the necessity of the pistils in the ray.
5. Polygamia segregata; the first from *polus* many, and *gamos* unions ; the second *segregata* separate ; because the florets are all equal, that is perfect, as with the order polygamia æqualis, but *separate* by having *a calyx to each flower*, which separates the florets individually.

23. The classes monœcia and diœcia, take their orders from *the number* and *other peculiarities of the stamen*, and are named after the classes.

Monandria, diandria, triandria, tetrandria, pentandria, hexandria, polyandria, monadelphia, and polyadelphia, are the list of orders, as belonging to the two classes above mentioned.

24. In the twenty-third class, polygamia, the orders are established on *the separation of the stamens and pistils.*

These orders are monœcia and diœcia, in accordance with the classes so called; and triœcia from *treis* three, and *oikos* a house, because the stamens and pistils may be said to have three dwellings.

25. The orders of the last class, or cryptogamia, are founded on circumstances which we shall mention, when speaking of that peculiar class of vegetables.

With this we close the first section of the Linnæan system; in the next we shall display the separate characters of each class, and give a full account of the whole arrangement in respective order.

SECTION II.

EXPLANATION OF THE CLASSES AND ORDERS.

1. The Artificial System of Linnæus, or "Linnæan System," as it is usually called, we have already said, is a simple arrangement of all vegetable productions into *twenty-four classes*, according to some peculiar character as regards *the stamen*.

Linnæus did not offer this arrangement as a *natural system*, nevertheless, its classes very frequently bring together many genera of plants, very similar in their natural resemblance, many of which we shall mention in the notes to the primary character of each class.

2. The *classes*, it must be attentively remembered, are founded on six circumstances; viz. the number, the insertion, the proportion, the union, the separation, and the concealment of the stamens.

We shall avail ourselves of the advantage of treating of the classes according to these separate divisions.

CLASSES DERIVED FROM THE NUMBER OF STAMENS.

.3 The first ten classes are established on this principle. The plants which belong to them must produce simple perfect flowers, the stamens of which are generally separate.

CLASS I.—MONANDRIA.

4. *Character*:—The class monandria consists of such plants, as bear flowers furnished with but *one* stamen. (F. 174.)

The class monandria has no high claim to the character of a natural class. Indeed it brings together vegetables of very unlike habits, or appearance, and of very opposite qualities. The hare's-tail and glass-wort on the one hand, are very far removed from the Indian-shot and amomum on the other. Nevertheless, the first class contains several plants nearly allied to each other, as the amomum, turmeric, thalia, arrow-root, galangale, Indian-shot, alpinia, ginger, and others.

5. *Division*:—There are only two orders in this class; viz. *monogynia* and *digynia;* both derived from the number of pistils in each flower.

6. *Monogynia*:—This order comprehends those flowers of the first class, which have but *one* pistil.

The ginger, turmeric, glass-wort, grains-of-Paradise, galangale, opera-girls, arrow-root, and common mare's-tail, are plants of the class monandria, order monogynia.

7. *Digynia*:—Embracing those flowers of the class, which have *two* pistils.

The common water star-wort, a native annual of Britain, and a few other genera of plants, compose the order in question.

CLASS II.—DIANDRIA.

8. *Character*:—In this class are comprehended, such plants as bear flowers with *two* stamens. (F. 175.)

The class diandria, though not a natural class, embraces some assemblages of vegetables which are considerably allied to one another. Such are the olive, the snow-tree, the privet, the lilac, on the one hand; and on the other hand, a number of plants with ringent flowers and naked seeds, such as the monarda, rosemary, sage, &c.

9. *Division*:—There are three orders in this class;

viz. *monogynia*, *digynia* and *trigynia;* all derived from the number of pistils in each flower.

10. *Monogynia:*—Comprehending such plants of the class, as have flowers with but *one* pistil.

Among the plants in this order, are the jasmine, privet, olive, lilac, enchanter's night-shade, speedwell, hedge-hyssop, butter-wort, water-horehound, sage, and many others.

11. *Digynia:*—Including such plants of the class, as have flowers with *two* pistils.

This order consists only of the two genera, vernal grass and crypsis. The sweet-scented vernal grass is the only indigenous plant.

12. *Trigynia:*—Embracing such plants of the second class, as have flowers with *three* pistils.

The genus piper or pepper, is the only family of plants at present known of this class and order. In this genus, there is neither calyx or corolla.

CLASS III.—TRIANDRIA.

13. *Character:*—The third class includes those plants which bear flowers with *three* stamens. (F. 176.)

This is, in various respects, a natural class. Iris, crocus, moræa, antholyza, corn-flag or sword-lily, ixia, and some others, have considerable affinities to each other: they, together with commelina, spider-wort, pontederia, &c. constitute Linnæus's sixth natural order called *ensatæ*.

14. *Division:*—There are three orders of plants in this class: viz. *monogynia*, *digynia*, and *trigynia;* all established from the number of pistils in each flower.

15 *Monogynia:*—Consisting of those plants of the class, which produce flowers with but *one* pistil.

This order contains many plants, among which are the beautiful crocus, the iris, the corn-flag, the valerian, &c. Here also, we find the sword-leaved plants and numerous grass-like plants, as the cyprus-grass, the cotton-grass, the bull-rush, the bog-rush, &c.

16. *Digynia:*—Including such plants of the class, as produce flowers with *two* pistils.

The verdant carpet which covers the earth, is principally composed of plants belonging to this order, and though the least striking, are by far the most valuable of all vegetable productions. Here are the sugar-canes, and with a few exceptions, the true grasses, so many of which, as wheat, barley, rye, oats, &c. are of infinite service to man. (F. 176.)

17. *Trigynia:*—Comprehending such plants of the class, as produce flowers with *three* pistils.

This order is chiefly composed of little pink-like plants, most of which are arranged in the natural order *caryophylleæ*. The four-leaved polycarpon, blinks, jointed pipe-wort, and umbelled holosteum, are the only indigenous productions belonging to this order.

CLASS IV.—TETRANDRIA.

18. *Character:*—In this class, the flowers are furnished with *four* stamens, *all* of an equal length; in which respect, they differ from plants of the class didynamia. (F. 177.)

The class tetrandria has some claims to the character of a natural class. Several of the genera, such as protea, banksia, globularia, button-wood, teasel, scabious, &c. form a part of the Linnæan natural order *aggregatæ*. The ixora, hedyotis, houstonia, madder, ladies-bed-straw, woodroof, &c. form a part of the Linnæan natural order *stellatæ*. All these genera, together with many others which

Linnæus has introduced, as well into the fourth as into the other classes of his artificial system, constitute an extensive order of vegetables to which Jussieu has given the name of *rubiaceæ*.

19. *Division*:—The class tetrandria, is divided into three orders; these are called *monogynia*, *digynia*, and *tetragynia*, from the number of pistils in each flower.

20. *Monogynia*:—Constituted by such plants of the class, as bear flowers with but *one* pistil.

In this order, there are above a hundred genera, many of which as the protea, banksia, &c. are very magnificent vegetables. The teasel, scabious, plantain, madder, ladies-bed-straw, woodroof, and other genera possessing indigenous species, also belong to this order.

21. *Digynia*:—Comprehending such plants of the class, as bear flowers with *two* pistils.

This is but a very small order, containing only two native plants of Britain, which are, the common and lesser dodder. The Virginian witch-hazel, buffonia, and hypecoum, are also of this arrangement.

22. *Tetragynia*:—Embracing such plants of the class, as bear flowers with *four* pistils.

The families of the holly, pond-weed, tassel pond-weed, &c. are of this order. Of the first genus, there is only one species, the common holly, a native of this country, but all the species of pond-weed and pearl-wort are indigenous.

CLASS V.—PENTANDRIA.

23. *Character*:—The plants arranged in this class, have *five* stamens in each flower, the anthers of which, are either united or separate. (F. 178.)

This class is the most extensive in the system, and brings together numerous genera of plants possessing natural affinities. The turnsoles or heliotropes, grom-well, bugloss, hound's-tongue, lung-wort, comfrey, onosma, borage, wild bugloss, scorpion-grass, and some other genera of this class, are arranged in the Linnæan natural order *asperifoliæ*. The stramonium, henbane, tobacco, mullein, cestrum, strychnos, capsicum, night-shade, winter-cherry, atropa, ellisia, box-thorn, and some others are also met with, in the natural order *luridæ*. The great natural order *umbellatæ*, is entirely made up of pentandrous vegetables. Again, the buckthorn, ceanothus, staff-tree, spindle-tree, buttneria, viburnum, elder, sumach, cassine, and other genera of this class, belong to the natural order *dumosæ*.

24. *Division*:—There are six orders which compose this extensive arrangement of plants, viz. *monogynia*, *digynia*, *trigynia*, *tetragynia*, *pentagynia*, and *polygynia*; all founded on the number of pistils in each flower.

25. *Monogynia*:—Including such plants of the class, as produce flowers with only *one* pistil.

This is the most extensive order of the whole Linnæan arrangement, containing numerous well-known garden flowers and useful productions. The different families of bugloss, lung-wort, comfrey, borage, primrose, pimpernel, convolvulus, campanula, honey-suckle, thorn-apple, henbane, tobacco, night-shade, buckthorn, vine, currant, violet, balsam, and a great number of other genera, will be found to correspond in character to this order.

26. *Digynia*:—Claiming such plants of the class, as produce flowers with *two* pistils.

This order is illustrated by the natural order of umbelliferous plants as the bur-parsley, carrot, earth-nut, hemlock, spignel, laser-wort, cow-parsley, angelica, fool's-parsley, coriander, parsnip, parsley, dill, caraway, and others. The families of gentian, goose-foot, beet, &c. are also of the class pentandria, order digynia.

27. *Trigynia:*—Embracing such plants of the class, as produce flowers with *three* pistils.

In this order, stands the poisonous genus sumach or poison-oak. The beautiful laurestinus, which renders itself so valuable by blooming through most of the winter, is likewise of this order, as also the common elder, gelder-rose, French tamarisk and common chick-weed.

28. *Tetragynia:*—Formed by such plants of the class, as produce flowers with *four* pistils.

This order contains only two families of plants; the elegant and curious genus called parnassia or grass of Parnassus, and the genus evolvulus, nearly allied to convolvulus.

29. *Pentagynia:*—Including such plants of the fifth class, as produce flowers with *five* pistils.

Of the plants of this order, the common thrift, sea-lavender, common flax, and the genus drosera or sun-dew, will afford very excellent illustrations.

30. *Polygynia:*—Consisting of such plants of the class, as produce flowers with *many* pistils.

The lesser mouse-tail or myosurus minimus of this country, and the parsley-leaved yellow-root of North America, are the only specimens to be collected of this order.

CLASS VI.—HEXANDRIA.

31. *Character:*—The plants of this class, have flowers with *six* stamens, all of one uniform length, or at least, nearly so, in which respect they differ from plants of the class tetradynamia. None of the flowers of the class hexandria have four petals, as is the case with all those of the fifteenth class. (F. 179.)

The class hexandria, may be considered as one of the most beautiful in the Linnæan artificial arrangement. It also has a very fair claim to the character of a natural class; for it embraces some pretty extensive natural assemblages, such as those which Linnæus has thrown into his ninth and tenth orders *spathaceæ* and *coronariæ*. There are likewise several genera of plants in this class, which belong to the natural order *sarmentaceæ;* such are alstroemeria, Solomon's-seal, dracœna, asparagus, gloriosa, erythronium, uvularia, and others.

32. *Division:*—The class hexandria is subdivided into five orders: viz. *monogynia, digynia, trigynia, hexagynia, polygynia,* all founded on the number of pistils in each flower.

33. *Monogynia:*—Comprehending those plants of the class, which have flowers with *one* pistil only.

In this order, is the extensive and beautiful genus narcissus. The lily and the tulip tribe are likewise of this order; as also many other familiar genera of plants, such as the pine-apple, snow-drop, allium, frittillary, star-of-Bethlehem, squill, asphodel, asparagus, Solomon's seal, hyacinth, berberry, &c.

34. *Digynia:*—Embracing those plants of the class which bear flowers with *two* pistils.

This is a very small order, consisting only of a few genera, among which, the rice-plant forms a genus. There are not any natives of this country.

35. *Trygynia:*—Comprehending those plants of the class, which bear flowers with *three* pistils.

Among the genera of plants peculiar to this order, are dock, mountain-sorrel, arrow-grass, and meadow-saffron, all possessed of indigenous species; but the most familiar specimens are the common sorrel, a species of dock, and the common meadow-saffron; to these might be added, garden-patience, monk's-rhubarb, sheep's-sorrel, and all the species of dock.

36. *Hexagynia*:—Including such plants of the class, as bear flowers with *six* pistils.

There is only the heart-leaved damasonium or damasonium indicum, a native perennial of the East Indies, to constitute this order.

37. *Polygynia*:—Comprehending those plants of the class, which bear flowers with *many* pistils.

This order, like the last, consists of only one genus; this is the alisma or water-plantain, five species of which, are peculiar to Great Britain, one of New Holland, and another of North America.

CLASS VII.—HEPTANDRIA.

38. *Character*:—This class embraces such plants as have flowers with *seven* stamens. (F. 180.)

It is a very inconsiderable branch of the twenty-four classes, and possesses no sort of claim to a natural arrangement: no two of the genera which it contains, are placed by Linnæus in any of his natural orders.

39. *Division*:—Although the class heptandria, is one of the smallest in the system, it is still subdivided into four orders; viz. *monogynia*, *digynia*, *tetragynia*, and *heptagynia*, all established from the number of pistils in each flower.

40. *Monogynia*:—Consisting of such plants of the class, as produce flowers with *one* pistil only.

The genus æsculus, of which the common horse-chesnut of this country is a species, together with a few other genera of foreign plants, compose the order in question.

41. *Digynia:*—Constituted by such plants of the class, as produce flowers with *two* pistils.

The limeum africanum or African limeum, a native perennial of the Cape of Good Hope, appears to be the only known plant of this order.

42. *Tetragynia:*—Consisting of such plants of the class, as bear flowers with *four* pistils.

Two species of sausurus, the drooping and shining lizard's-tail, both native perennials of North America, are the only plants of this order.

43. *Heptagynia*:—Embracing those plants of the class, which bear flowers with *seven* pistils.

There is only one genus of plants to constitute this order, which is the septas, a Cape genus, very nearly allied to crassula, consisting of three species. The septas capensis or Cape septas, is a very singular specimen of this order as respects number; for in addition to its *seven* stamens and *seven* pistils, it is said to have the calyx in *seven* deep segments, *seven* petals, *seven* germens, and consequently *seven* capsules.

CLASS VIII.—OCTANDRIA.

44. *Character:*—Plants which produce flowers with *eight* stamens, belong to this class or arrangement. (F. 181.)

The class octandria embraces several natural assemblages of vegetables. The genera willow-herb, guaria, œnothera or tree-primrose, osbeckia, and rhexia, form a part of Linnæus's natural order *calycanthemæ*. These plants, among other characters, have the corolla and the stamens inserted into the calyx. The vaccinium or whortle-berry, and the immense family of erica or heath, are placed in the natural order *bicornes*. Again, gnidia, leather-wood, daphne, sparrow-wort, and some others, form the natural order *veprecula*.

45. *Division:*—This is rather an extensive arrange-

ment of plants, and subdivided into four orders; viz. *monogynia*, *digynia*, *trigynia*, and *tetragynia*; all derived from the number of pistils in each flower.

46. *Monogynia*:—Including every plant of the octandrous character, with *one* pistil in each flower.

Many plants present themselves as of this order, among which the well known tropæolum or nasturtium of our gardens, the different willow-herbs, blackberry, bilberry, mezereon, are familiar specimens. The heaths of this country, together with upwards of three hundred native species of the Cape of Good Hope, and a few more of other countries, form the major part of the order, as the largest genus of plants at present known.

47. *Digynia*:—Including every plant of the eighth class, with *two* pistils in each flower.

This is a small order of few plants but little known; among which is the African galenia, a native of the Cape of Good Hope, and the mossy mœhringia, a perennial plant of the south of Europe.

48. *Trigynia*:—Comprising all plants of the octandrous character, with *three* pistils in each flower.

The principal genus of this order is the polygonum or persicaria, of which the well known bistort or snake-weed, and the water-pepper, are species. The soap-berry, heart-seed, sea-side-grape, seriana, and paullinia, are other genera of the same order.

49. *Tetragynia*:—Embracing every plant of the octandrous character, with *four* pistils in each flower.

In this subdivision we find the true-love or herb-parish, and the tuberous moschatel, both native perennials of this country.

CLASS IX.—ENNEANDRIA.

50. *Character* :—All plants of this class, bear flowers with *nine* stamens. (F. 182.)

With respect to the genera which belong to the class enneandria, they constitute different assemblages of vegetables, more or less natural. The laurel, cashew-nut, and rhubarb, are of the Linnæan natural order *holeraceæ*. The other two genera, butomus and eriogonum, bear no particular affinity to each other, or to the genera we have just mentioned.

51. *Division* :—There are three sets of plants belonging to this class, and consequently three orders; viz. *monogynia*, *trigynia*, and *hexagynia*, all established on the number of pistils in each flower.

52. *Monogynia* :—Comprising those plants of the class, which produce flowers with *one* pistil only.

This order is chiefly constituted by a single family of valuable plants, generically called laurus or laurel. The cinnamon tree, bastard-cinnamon, camphor-tree, and cogwood, sweet-bay, royal-bay, alligator-pear, benjamin-tree and sassafras-tree, are all species of the genus laurus. The genera of anacardium or cashew-nut, and eriogonum are very small.

53. *Trigynia* :—Including such plants of the class, which produce flowers with *three* pistils.

The family of rhubarb or rheum is the only genus of this order, the true medical species of which, is the rheum palmatum or officinal rhubarb.

54. *Hexagynia* :—Consisting of a particular plant of the class, which produces flowers with *six* pistils.

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This single plant, is the butomus umbellatus or common flowering-rush, a great ornament to our rivers and pools.

CLASS X.—DECANDRIA.

55. *Character* :—Here we have arranged, all plants which bear flowers with *ten* stamens. (F. 183.)

The class decandria is very extensive, and possesses many genera similar in their natural characters. For example, sophora, and bean-trefoil with some other genera, belong to the natural order *papilionaceæ*. Judas-tree, mountain-ebony, locust-tree, flower-fence, adenanthera, guilandina, cæsalpinia, cassia, logwood and some others belong to the natural order *lomentaceæ*. Beard-tree, mahogany-tree Barbadoes-cherry, and banisteria, are of the natural order *trihilatæ*. Guaiacum, tribulus, fagonia, bean-caper, quassia, dionæa, oxalis, averrhoa, and others, of the order *gruinales*. Clethra, pyrola, ledum, andromeda, rose-bay, kalmia, epigæa, gaultheria, arbutus, and storax, of the natural order *bicornes*. Hydrangea, chrysosplenium, saxifrage, tiarella, mitella, cotyledon, sedum, penthorum, and bergia, are arranged in the natural order *succulentæ*. Lastly, gysophila, saponaria, dianthus, arenaria, stellaria, cucubalus, silene, spergula, cerastium, agrostemma, lychnis, and others, will be found in the order *caryophylleæ*.

56. *Division*:—The class decandria is subdivided into five orders ; viz. *monogynia*, *digynia*, *trigynia*, *pentagynia*, and *decagynia*, all founded on the number of pistils in each flower.

57. *Monogynia*:—In this order are arranged such plants of the class, as produce flowers with *one* pistil only.

Among the plants of this order, we have families of the bean-trefoil, Judas-tree, mountain-ebony, cassia, fraxinella, rue, logwood, mahogany-tree, quassia, rose-bay, winter-green, and others. The singular plant called dionæa muscipula or Venus's fly-trap, is also of this class and order.

58. *Digynia:*—Embracing such plants of the class as produce flowers with *two* pistils.

In this division of plants, we have the families of hydrangea, saxifrage, golden-saxifrage, soap-wort, and pinks.

59. *Trigynia:*—In this order, are included such plants of the class, as produce flowers with *three* pistils.

Here will be found the different families of catch-fly or silene, stich-wort, sand-wort, Barbadoes-cherry, banisteria, garidella, &c.

60. *Pentagynia:*—A selection of those plants of the class, which produce flowers with *five* pistils.

Among the plants of this order, the most familiar are the hog-plum, navel-wort, stone-crop, corn-cockle, wood-sorrel, wall-pennywort, common orpine, wall-pepper, ragged-robin, and spurrey.

61. *Decagynia:*—Including such plants of the class, as produce flowers with *ten* pistils.

This order consists only of two genera, neurada and phytolacca; the latter, an irregular genus as to stamens and styles.

CLASSES ESTABLISHED ON THE NUMBER AND INSERTION OF THE STAMENS.

62. In this division, we shall enter the eleventh, the twelfth, and the thirteenth classes, each of which, will be found very simple and very distinct.

CLASS XI.—DODECANDRIA.

63. *Character:*—The exact number of stamens, does

not give rise to this class, for here are included all plants which produce flowers with *twelve* to *nineteen* stamens.

It cannot be asserted, that the class dodecandria is a natural class. The different genera which it contains, have very little natural affinity to each other. Asarum is referred to the order *sarmentaceæ ;* garcinia and halesia to the order *bicornes ;* portulaca and house-leek to *succulentæ ;* the vast genus euphorbia, with a number of other genera, belong to the order *tricoccæ*.

64. It seems to be the essential character of this class, that the stamens, or in place of them, the anthers, are *inserted* into the *receptacle*. (F. 184.)

By the place of insertion, we very readily distinguish the plants of the class dodecandria from those of icosandria, for in this last, the stamens are either inserted into the calyx or into the petals, and from those of the class polyandria, by the number not exceeding nineteen.

65. *Division:*—The orders of this class are six in number, viz. *monogynia*, *digynia*, *trigynia*, *tetragynia*, *pentagynia*, and *dodecagynia*, all founded on the number of the pistils.

66. *Monogynia :*—Including, such plants of the class, as bear flowers with *one* pistil only.

The European asarabacca, tree-celandine, snow-drop tree, purslane, common lythrum, and other plants may be consulted as illustrations of this order.

67. *Digynia :*—Embracing such plants of the class, as bear flowers with *two* pistils.

To this order belongs the heliocarpus, a very rare American tree, with a singularly fringed or radiated fruit, and the family of agrimony, among which the agrimonia eupatoria or common agrimony is a native perennial of this country.

68. *Tryginia:*—Embracing those plants of the class, which produce flowers with *three* pistils.

This order is principally constituted by two genera of plants; viz. the family reseda, among which the dyer's weed, base rocket, and mignonette are very familiar species; and the genus euphorbia or spurge, an extensive family of above one hundred species.

69. *Tetragynia:*—Constituted by such plants of the class, as produce flowers with *four* pistils.

The two genera calligonum and aponogeton, are the only kind of vegetables of this department.

70. *Pentagynia:*—Claiming such plants of the dodecandrous class as bear flowers with *five* pistils.

The hairy glius, an annual plant of the south of Europe, appears to be the only certain plant of this order. The genus blackwellia is considered a doubtful one.

71. *Dodecagynia:*—Embracing such plants of the class, as bear flowers with *about twelve* pistils.

The genus sempervivum or house-leek, is the only family of plants arranged in this order. The common species is a perennial native of this country, but all the others, are of foreign extraction.

CLASS XII.—ICOSANDRIA.

72. *Character:*—This class embraces those plants, which have flowers with *twenty* or *more* stamens *inserted* into the *calyx* or *corolla*. (F. 185.)

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Although the class Icosandria cannot be said to be a natural class in the strict sense of the term, it nevertheless includes several great assemblages of vegetables, which are related to each other by striking family affinities. The great genus cactus, does not seem to have much relation with the other genera. The genera pomegranate, almond, cherry-tree, cocoa, plum-tree, pyrus and spiræa are referred to the natural order *pomaceæ*. The principal genera of the order polygynia are of the natural order *senticosæ*. The class altogether is a very useful and innoxious selection of plants, scarcely comprising one of a poisonous nature.

73. The distinguishing feature we have said of the flowers of this class is, that the stamens are attached to the calyx or corolla, and *never* to the receptacle.

This is a more certain guide than the number of stamens, which is by no means constant, many flowers belonging to it possessing a much greater number, and others, as tormentilla, not so many as twenty.

74. *Division* :—This useful and valuable class of plants is divided into five orders; viz. *monogynia, digynia, trigynia, pentagynia and polygynia;* all established on the number of pistils in each flower.

75. *Monogynia*:—In this order are arranged those plants of the icosandrous character, which produce flowers with *one* pistil only.

The most familiar examples of this order are the peach, plum, cherry, common allspice, cactus, myrtle, pomegranate, almond, and cocoa-plum-tree.

76. *Digynia*:—In this order we find such plants of the class, as bear flowers with *two* pistils.

The foreign genus waldsteinia, is said to be the only family of plants, correctly of this order.

77. *Trigynia:*—This order contains those plants of the icosandrous character, which have flowers with *three* pistils.

The genus sesuvium, a small foreign family of vegetables, is the only constituent of this part of the class.

78. *Pentagynia:*—This order lays claim to such plants of the class icosandria, as produce flowers with *five* pistils.

Among the productions of this subdivision we have the medlar-tree, quince, common pear, common apple, crab-apple, mountain ash, Virginian gelder-rose, meadow-sweet, and a large genus of upwards of two hundred species of mesembryanthemum or fig-marygold.

79. *Polygynia:*—The last order includes all plants of the necessary primary character, which set forth flowers with *many* pistils.

Here we are at liberty to search for examples among the beautiful family of roses. Illustrative specimens also present themselves in the raspberry, dewberry, bramble, strawberry, cinquefoils, tormentil, avens or herb-bennet, and many others.

CLASS XIII.—POLYANDRIA.

80. *Character:*—The flowers of this class have, as its name implies, *many* stamens, (that is from *twenty* to one hundred or more) all *inserted* into the *receptacle.* (F. 186.)

The principal natural relations which take place between the different genera of this class, are by no means inconsiderable. The genera caper tree, and marcgravia, belong to the Linnæan natural order *putamineæ.* Bixa, tilia or lime-tree, and thea, form a part of the order *columniferæ.* Papaver or poppy, chelidomium or celandine, glaucium, argemone, sanguinaria, and podophyllum, to the order *rhœadeœ*. Herb-christopher, pæony, larkspur, wolf's-bane, bug-wort, fennel-flower, columbine, meadow-rue, virgin's-bower, atragene, hellebore, marsh-marygold, adonis or pheasant's-eye, ranunculus and others, are of the order *multisiliquœ*. Magnolia, tulip-tree, michelia, uvaria, and annona or custard apple, are the principal genera in the natural order *coadunatœ*. The class polyandria, is particularly noted for its poisonous productions, a character very different to the last class.

81. This class of plants may be distinguished from those of the eleventh dodecandria, by *the superior number* of stamens; and from those of the twelfth, icosandria, by the difference *in their insertion*.

If there are form twelve to nineteen stamens, and these inserted into the receptacle, the plant must belong to the class dodecandria. But if there are more than nineteen, and still attached to the receptacle, it is then to be found in the present class polyandria. If, instead of the stamens being inserted into the receptacle, they should be attached to the calyx or corolla, you must be certain the plant is of the class icosandria.

82. *Division*:—The orders of the polyandrous class are seven; viz. *monogynia*, *digynia*, *trigynia*, *tetragynia*, *pentagynia*, *hexagynia*, and *polygynia*, all established from the number of pistils in each flower.

83. *Monogynia*:—Including such plants of this arrangement, as produce flowers with *one* pistil only.

Among the plants of this order, the most known are the poppy, the celandine, horned poppy, common lime-tree, cistus or rock-rose, tea, and the tribe of nymphæa or water-lily.

84. *Digynia*:—Including such plants of the class, as produce flowers with *two* pistils.

The genus pæonia or pæony, is the chief selection of plants in the order digynia. The genera fothergilla, curatella, and bauera are likewise of this same order.

85. *Trigynia:*—Embracing such plants of the polyandrous character, as possess flowers with *three* pistils.

Here we shall find upwards of twenty species of delphinium or larkspur, and near that number of aconite or wolf's-bane.

86. *Tetragynia:*—Consisting of such flowers of the class, as have *four* pistils.

The small family of cimicifuga or bug-wort, and the caryocar are the only plants we can mention as of this order.

87. *Pentagynia:*—Embracing such plants of the class, as have flowers with *five* pistils.

The genus aquilegia or columbine, of which the common and two-coloured are native perennials of this country, are of this order; as also the genus fennel flower, one species of which, commonly called devil in the bush, or love in a mist, is very frequent in our gardens.

88. *Hexagynia:*—Including a few plants of the class which produce flowers with *six* pistils.

The genus stratiotes or water-soldier is the only illustration to be collected from English botany.

89. *Polygynia:*—This order brings together such plants of the class, as bear flowers with *many* pistils.

The tulip-tree, aniseed-tree, magnolia, custard-apple, bitterwood, anemones, virgin's-bower, meadow-rue, pheasant's-eye, fair-maid-of-February, golden-locks, garden-crow-foot, globe-flower, hellebore, marsh-marygold, and several others, are here collected.

CLASSES FOUNDED ON THE NUMBER AND PROPORTION OF THE STAMENS.

90. There are only two classes of this division, consequently very little confusion will arise in their explanation; these are the fourteenth and the fifteenth.

CLASS XIV.—DIDYNAMIA.

91. *Character:*—The fourth class tetrandria, and the present class didynamia have both *four* stamens; but in plants of the former class they are all *equal*, or of no fixed deviation in length, but in the class didynamia, there are *always* two long and two short. (F. 187.)

This class of plants is peculiarly characterized by Linnæus, in having flowers with four stamens, two of which are long and two short, the anthers converging, or inclining towards each other, in there being but one style, and in the corolla being of an irregular figure. It is not to be called a natural arrangement, though it is, indeed, much more natural than some of the other classes of the artificial system. Linnæus himself, appears to have been fully sensible of the few family affinities that subsist, between the plants of the class didynamia. Accordingly, in his work on the *natural orders*, he has disposed of the greater number of the didynamous plants under two great natural families, which he calls *verticillatæ* and *personatæ*.

92. *Division:*—There are two orders or subdivisions of this class; the first order called *gymnospermia*, and the second *angiospermia*. These divisions are not founded, like those of the preceding classes, on the pistils, but on the *presence* or *absence* of *the seed-vessel*.

93. *Gymnospermia:*—This order contains those didynamous plants, which are destitute of a proper seed-

vessel. In all the British species, there are four naked seeds at the bottom of the calyx.

The common bugle, ground-pine, tribes of germander, savory, cat mint, lavender, iron-wort, mint, and ground-ivy, archangel, dead-nettle, betony, hedge-nettle, horehound, mother-wort, marjoram, thyme, balm, dragon's-head, basil, skull-cap, and other families of plants may be selected as examples.

94. *Angiospermia* :—The order angiospermia, contains those plants, answering the character of the class, which have their seeds covered, that is, lodged in a proper seed-vessel.

Here we shall meet with the eye-bright, the cock's-comb, and the different genera of cow-wheat, lathræa, louse-wort, toad-flax, snap-dragon, fig-wort, fox-glove, trumpet-flower, vervain, broom-rape, monkey-flower, chaste-tree, acanthus, honey-flower, and others.

CLASS XV.—TETRADYNAMIA.

95. *Character* :—The plants of this class, have perfect flowers with *six* stamens, *four* of which are longer than the other *two*; and it thus differs from the plants of the sixth class, in which the stamens of the flowers are all of equal length. The flowers of this class are also cross-shaped, which is not the case with flowers of the class hexandria. (F. 188.)

This is unquestionably, the most natural class of the twenty-four, not only in general appearance, but also in habits and properties. Linnæus has arranged all the genera, (cleome excepted) into one great natural division, by the name of *siliquosæ*.

96. *Division* :—The *form of the seed vessel* divides the plants of this class into two orders: the first called *siliculosa* and the second *siliquosa*.

97. *Siliculosa* :—The plants of this order are furnished with that particular species of seed-vessel, which is called a *silicle* or little pod. (F. 61.)

The gold-of-pleasure, cole-wort, woad, awlwort, whitlow grass, pepper-wort, shepherd's-purse, penny-cress, scurvy-grass, swine's-cress, candy-tuft, madwort, and honesty, are all of this order.

98. *Siliquosa* :—The plants of the second order, instead of having a little pod, have a *silique* or very long pod. (F. 65)

Here we shall meet with the common wall-flower and common stocks of our gardens. We shall likewise find numerous other illustrations, as the cuckoo-flower, water-cress, water-radish, dames-violet, cole seed or rape, turnip, charlock, and the different tribes of dentaria, lady's-smock, winter-cress, lady's-mustard, sea-rocket, rocket, wall-cress, tower-mustard, cabbage, mustard, radish, and a few others.

CLASSES ESTABLISHED ON A CONSIDERATION OF THE UNION OF THE STAMENS.

99. In this division we shall explain those classes of plants, which have flowers with the stamens *united* to each other, either by their filaments, as in monadelphia, diadelphia, and polyadelphia, or by their anthers, as in syngenesia ; or on the other hand, by the *union* of the stamens and the pistils, as in the class gynandria.

CLASS XVI.—MONADELPHIA.

100. *Character* :—This vast and interesting class, embraces those plants, the flowers of which have *all* their stamens *united below*, that is by their filaments,

into *one body* or cylinder, through which the pistil passes. (F. 189.)

The class monadelphia upon the whole, is a natural class, the greater number of the genera of which, are arranged by Linnæus in his natural order *columniferæ*.

101. *Division*:—The orders of this class, are neither founded on the pistil nor on the seed-vessel, but upon *the number of the stamens*. They are eight in number, and are called after the classes, *triandria, pentandria, heptandria, octandria, decandria, endecandria, dodecandria* and *polyandria*, according to the number of stamens in each flower.

In all the preceding classes we have observed, that the stamens, whether few or many, have been evidently distinct from each other; but in the present case, you will always find them united at the bottom, though perfectly separate at the top, by which their number is very readily ascertained.

102. *Triandria*:—Including such plants of the class, as produce flowers with *three* stamens.

Here is arranged the genus tamarind, consisting of only one species. The ferraria whose fugitive flowers scarcely last one forenoon, and galaxia, whose beauty is almost as transient, are likewise found here. In this order also, is the pretty genus sisyrinchium, and the singular Cape plant aphyteia, consisting of a large flower and succulent fruit springing immediately from the root, without stem or leaves.

103. *Pentandria*:—In this order of the class, we have such plants as produce flowers with *five* stamens.

The genus erodium or heron's-bill, which of late has been separated from that of geranium, hermannia a pretty Cape genus, and a few others constitute this division. Sir J. E. Smith refers the family of passiflora or passion-flower, as unquestionable, to the class pentandria, order trigynia.

104. *Heptandria* :—This division brings together those plants of the character of the class, which have flowers with *seven* stamens.

This order is formed by one extensive genus, called pelargonium or stork's-bill, upwards of one hundred and fifty species of which are natives of the Cape of Good Hope. They are characterized by their irregular flower, and tubular nectary.

105. *Octandria* :—Embracing those monadelphous plants, the flowers of which have *eight* stamens.

This is a very small order, having only the two genera aitonia and pistia.

106. *Decandria* :—This order is intended to comprehend such plants of the class, as have *ten* stamens.

The well known genus geranium or crane's-bill, is reckoned by some, as the only family of plants of this order, while others attribute a few more.

107. *Endecandria* :—This order has been established for the arrangement of the splendid American genus brownea, the number of whose stamens is very different in different species.

The species of brownea called *Rosa del Monte*, has a stem about sixty feet high, and its heads of purple flowers, consist of five or six hundred each.

108. *Dodecandria* :—Here are to be found those plants of the class, whose flowers have from *twelve* to *twenty* stamens.

The different tribes of helicteres or screw-tree, pentapetes, pterospermum, and a few more, are the constituents of this order.

109. *Polyandria* :—In this order are included such plants of the general character, as have flowers with *more* than twenty stamens.

This order contains a much greater number of genera than any of the others in the class. Among these will be found, the sour-gourd or monkey-bread-tree, the tribes of silk-cotton-tree, mallow, marsh-mallow, lavatera, hibiscus, camellia, and others. The most known plants may be, the common marsh-mallow, the common mallow, the tree-mallow a species of lavatera, the China rose, a species of hibiscus, and the camellia japonica or common camellia.

CLASS XVII.—DIADELPHIA.

110. *Character* :—With plants belonging to this class, the flowers are either *papilionaceous* or butterfly-shaped, or else the stamens are inserted into *two sets* by their filaments. (F. 190.)

The structure and general aspect of plants arranged in this class, are very similar in their natural resemblance. They are inserted by Linnæus in his natural order *papilionaceæ*, and by Jussieu in his vast order *leguminosæ*.

111. *Division* :—There are four orders of plants in this class; viz. *pentandria*, *hexandria*, *octandria*, and *decandria*, all established on the *number* of the stamens.

112. *Pentandria* :—This order is constituted by a rare little South American plant, the monnieria, having two filaments, the upper with two anthers, and the lower with three.

The natural order of this plant is uncertain. It has a ringent corolla, ternate leaves. a simple bristly pubescence, and is besprinkled with resinous dots.

113. *Hexandria* :—In this order, are placed those diadelphous plants which bear flowers with *six* stamens.

There are only two genera of this order; viz. saraca, and fumaria or fumitory, of which last, some British species are very common.

114. *Octandria:*—Comprehending such plants of the class, as have flowers with *eight* stamens.

The extensive genus polygala or milk-wort, and a few others, compose the order in question. The polygala vulgaris or common milk-wort, is a frequent, but very beautiful little plant.

115. *Decandria* :—This order brings together numerous genera of plants characterized with the features of the class, and here arranged because their flowers have *ten* stamens.

This, as we have observed is a copious order, and the species belonging to a number of its genera, are very numerous. The most common genera of plants we can mention, are the broom, furze, rest-harrow, kidney-vetch, lupine, kidney-bean, pea, bitter-vetch, vetch, lathyrus, tare, chick-pea, milk-vetch, dhalia, trefoil, bird's-foot-trefoil, and many others. Among these and other genera, we find numerous well-known species, such as the petty-whin, scarlet runner, sweet-pea, tangier-pea, everlasting-pea, santfoin, lentil, laburnum, wild-liquorice, melilot, Dutch clover, and common clover.

CLASS XVIII.—POLYADELPHIA.

116. *Character* :—In this class, the flowers have their

stamens united into *more* than *two* parcels by their filaments. (F. 191.)

This collection of plants, has but little claim to the character of a natural class. The genera which it contains belong to very different natural orders. Thus, the genera theobroma, abroma, and symplocos, belong to the Linnæan natural order *columniferæ*. Monsonia is referred to the order *gruinales* ; citrus to *bicornes*. Hypericum and ascyrum belong to the order *rotaceæ*. Though one of the smallest classes, it nevertheless furnishes many luxuries.

117. *Division* :—The orders of this class have long been imperfectly defined, but Sir James Edward Smith, has proposed the class should be divided into three orders ; viz. *dodecandria*, *icosandria*, and *polyandria*. These are, of course, established on the *number* or *insertion* of the stamens.

118. *Dodecandria* :—In this order the plants produce flowers with stamens, or rather anthers, from *twelve* to *twenty* or *twenty-five* in number, their filaments *unconnected* with the calyx.

The orange, the lemon, and the theobroma or chocolate tree are, according to Sir J. E. Smith, decidedly of this order.

119. *Icosandria* :—The plants of this order, have flowers with *numerous* stamens, *inserted*, by means of their filaments, in several parcels, into the calyx.

Professor Willdenow has removed the genus melaleuca from the next order to this; and Sir J. E. Smith has referred the orange, lemon, &c. which have been previously arranged in this order, to the order dodecandria as above.

120. *Polyandria* :—In this order of the polyadel-

phous plants, the flowers have *upwards* of *twenty-five* stamens, all *unconnected* with the calyx.

Among a few others in this order, is the hypericum or St. John's-wort, several species of which are natives of this country. The stamens of these plants are united into three or five sets, corresponding with the number of the styles.

CLASS XIX.—SYNGENESIA.

121. *Character* :—This is a very extensive class, comprehending for the most part, those plants which produce *compound flowers*. With these *the anthers* are *united* into a cylinder or tube, whilst the filaments, by which they are supported, are separate and distinct. (F. 5.)

The class syngenesia, is a very natural assemblage of plants. It embraces the great family of compound flowers, which is, unquestionably, a natural tribe, essentially distinct from plants with simple flowers. The essence of these compound flowers is said, by Linnæus, to consist in the two circumstances of the union of the anther, into a cylinder, and a single seed placed below the receptacle, and attached to each floret. Most of the plants of this class, are referred by Linnæus to his natural order *compositæ*.

122. *Division* :—The class syngesia is divided into five orders ; viz. *polygamia æqualis, polygamia superflua, polygamia frustranea, polygamia necessaria,* and *polygamia segregata.* They are all founded on the *structure* of the flower.

123. *Polygamia æqualis* :—In the plants of this order, the florets or partial flowers are all *perfect* or *united*, that is, furnished with their own perfect stamens and

pistil, and thereby capable of bringing their seed to maturity, without the assistance of any other florets.

Here we shall meet with the old-man's-beard, goats-beard, lamb's-beard, viper's-grass, sow-thistle, lettuce, dandelion, ox-tongue, hawk-weed, hawk's beard, cat's-ear, nipple-wort, succory, burdock, sow-wort, thistle, cotton-thistle, artichoke, golden-locks, and many other well-known families of plants.

124. *Polygamia superflua:*—With the vegetables of this subdivision, the florets in the centre or disk are *perfect* or *united;* while those of the circumference or margin, are furnished with pistils only. Notwithstanding the outer florets have only pistils, they are still impregnated with the pollen from the stamens of the disk, and consequently produce seed.

The most common tribes of plants belonging to this order, are the genera tansy, wormwood, everlasting or cud-weed, flea-bane, colt's-foot, groundsel, star-wort, golden-rod, inula, leopard's-bane, daisy, chrysanthemum, feverfew, chamomile, milfoil, ox-eye, and several others.

125. *Polygamia frustranea* :—In the flowers of this order, the florets of the disk or centre, are *perfect* or supplied with both the stamens and pistil, while the flat florets (sometimes called *semi-florets*) of the margin or circumference are *neuter*, that is, are destitute both of stamens and pistils. There are a few genera, however, with the rudiments of pistils in their outer florets.

The common sunflower, Jerusalem artichoke, family of coreopsis or tick-seed-sunflower, sweet and yellow sultan, black knapweed, blue-bottle, blessed-thistle, star-thistle, and St. Barnaby's thistle, are the most familiar illustrations we can name.

126. *Polygamia necessaria* :—In this order, the florets of the centre are furnished with *stamens only*, while those of the margin or circumference, are merely supplied with *pistils*. The presence of both kind of florets, are therefore necessary for the production of seed.

The family calendula or marygold, of which the common variety in our gardens is a native of the south of Europe, belongs to this order. The three Cape genera, othonna or rag-wort, steospermum, and arctotis, are likewise of this division.

127. *Polygamia segregata* :—This order of the class syngenesia, embraces such plants as bear several flowers, either simple or compound, but with united tubular anthers, and with a partial calyx, all included in one general calyx.

We have examples of this order of plants, in the genera echinops or globe-thistle, elephantopus or elephant's-foot, and a few others.

CLASS XX.—GYNANDRIA.

128. *Character* :—The plants of this class are furnished with perfect flowers, the stamens of which are *inserted* either upon the style or germen of the pistil. (F. 192.)

This is rather a miscellaneous class of plants. Linnæus, however, deemed the first order, which he called diandria, as a natural assemblage. They constitute his seventeenth order named *orchideæ*. Many plants which were previously arranged in this class, are now removed to other divisions of the system.

129. *Division* :—Botanists are very uncertain about the correct number of orders, which should form this

class ; some assert there are only four, others more or less, but the most general division is into seven; viz. *monandria, diandria, triandria, tetrandria, pentandria, hexandria* and *octandria.* These are all established on the *number* of the stamens.

Linnæus himself attributed three more to the number we have mentioned ; viz. *decandria, dodecandria,* and *polyandria,* but these are now entirely abolished and their genera of plants referred to other places.

130. *Monandria* :—In the first order of the class, we find those plants which have flowers with *one* stamen or sessile anther.

The very beautiful and curious tribe of the orchis, are the principal productions of this order.

131. *Diandria* :—This subdivision consists of those gynandrous plants, the flowers of which have *two* stamens.

The genus cypripedium or ladies-slipper, of which the common species is a well known native of this country, is the principal family in this part.

132. *Triandria* :—This is a very trivial order, consisting of those plants answering to the character of the class, which have *three* stamens.

The rhopium of Schreber, appears to be the only certain genus of the order we are considering.

133. *Tetrandria* :—This is also a very small order, the plants of which have flowers with *four* stamens.

The genus nepenthes formerly attributed to this order, is now removed to diœcia monadelphia. The order, however, is retained for the reception of a New Holland genus named stylidium.

134. *Pentandria*:—In this department we shall find those plants of the class, producing *five* stamens in each flower.

The three genera ayenia, gluta, and passiflora or passion-flower, were formerly placed here, but the learned Schreber has very correctly removed them to the fifth class. It has been proposed to reinforce this order from the class pentandria digynia, some of the genera of which are related, as decidedly of the proper qualities for such a removal.

135. *Hexandria*:—The plants of this order, have flowers with *six* stamens.

The aristolochia or birth-wort, a curious genus, of which there are many exotic species, and but one indigenous, is the only genus of the hexandrous order.

136. *Octandria*:—Here we are to expect such plants of the class, as produce flowers with *eight* stamens.

The cytinus, a singular parasitical plant growing on the roots of cistus in the south of Europe, has been brought hither from the order dodecandria, of which it originally formed the only example.

CLASSES FOUNDED ON A CONSIDERATION OF THE SEPARATION OF THE STAMENS WITH REGARD TO THE PISTILS.

137. The classes which we have hitherto explained, are constituted by plants, the flowers of which are perfect, or in other words, furnished with both stamens and pistils, but in the classes of this division, we shall ascer-

tain, that some plants may have flowers with these organs distinct in separate flowers, as well as both in the same flower. According to the nature of these differences, there are three classes; viz. monœcia, diœcia, and polygamia.

CLASS XXI.—MONŒCIA.

138. *Character:* The plants of this class, are particularly distinguished by their producing some flowers with stamens only, and some flowers with pistils only, both growing *on the same plant*. (F. 193.)

The vegetables of the class monœcia, are arranged by Linnæus under very different natural orders. Zannichellia belongs to the order *inundatæ*. Anguria, trichosanthes, momordica, cucurbita, cucumis, sicyos, and bryonia, are referred to the order *cucurbitaceæ*. Betula, fagus, quercus, juglans, corylus, carpinus, and platanus, are of the order *amentaceæ*. Pinus, cupressus, thuja, &c. to the *coniferæ*. Zea, tripsacum, coix, olyra, zizania and pharus, are grasses, and belong to the order *gramina*. Carex, sparganium and typha are referred to the natural order *calamariæ*.

139. *Division:*—There are nine orders in this class; viz. *monandria, diandria, triandria, tetrandria, pentandria, hexandria, polyandria, monadelphia and polyadelphia;* all established on the number, or some other circumstance, connected with the stamens.

140. *Monandria:*—This order claims those plants of the monœcious character, which produce barren flowers with but *one* stamen.

The zannichellia or horned-pondweed, and the celebrated bread-fruit tree or artocarpus, may be considered as the most correct illustrations.

141. *Diandria*:—Comprehending those plants of the monœcious character, which produce barren flowers with *two* stamens.

The genus lemna or duck's-meat, a British family of plants, may be selected in exemplification o fthis order.

142. *Triandria*:—Including such plants of the proper character, which produce barren flowers with *three* stamens.

Here we shall find the typha or cat's-tail, bur-reed, Indian-corn or maize, Job's-tears, jack-in-a-box, and the extensive genus carex or sedge, of which about sixty species are peculiar to Great Britain.

143. *Tetrandria*:—In this order are arranged such plants of the monœcious character, which produce barren flowers with *four* stamens,

Though not an extensive order, there are still some very frequent and familiar specimens to be collected; such as the common and other species of nettle, the common box tree, common elder, common mulberry, gold-plant, and a few others.

144. *Pentandria*:—Embracing those plants of the class, which produce barren flowers with *five* stamens.

The different genera securinega, nephelium, schisandra, xanthium, ambrosia, and the considerable family amaranthus or amaranth, are the chief arrangements in this order. The small burdock, a native of this country is a species, of xanthium, and the well known plant of our garden, called love-lies-bleeding, is a species of amaranth.

145. *Hexandria*:—Comprehending those plants of the monœcious character, which produce barren flowers with *six* stamens.

The zizania or Canada-rice, and pharus, both grasses, compose this order, to which Schreber has added epibaterium and pometia of Forster, as well as the splendid guettarda. The sagus or sago-palm, and cocos or cocoa-nut tree are likewise said to belong to it.

146. *Polyandria*:—Including those plants of the general character, which produce barren flowers with *more than seven* stamens.

This is a very considerable order, containing numerous plants for familiar references. Here will be found the different genera of horn-wort, water-milfoil, arrow-head, begonia, burnet, oak, walnut, beech-tree, chesnut-tree, birch tree, hornbeam-tree, hazel-nut-tree, arum, and several others.

147. *Monadelphia*:—Embracing those vegetables, the barren flowers of which have their filaments united into *one* set.

The genus pinus or fir-trees, arbor-vitæ or tree-of-life, cypress, palma-christi or castor-oil-tree, and a few other tribes of plants, are to be found in this order.

148. *Polyadelphia*:—Including those plants of the monœcious character, the barren flowers of which, have their filaments united into *more than two sets.*

Sir James Edward Smith proposes this order should be established for the reception of the gourd plants, and accordingly the different genera of cucurbita or gourd, cucumis or cucumber, bryonia or bryony and others, are removed from their former supposed order, syngenesia, to their present arrangement here.

CLASS XXII.—DIŒCIA.

149. *Character*:—The twenty-second class contains those plants, which have no perfect flowers, but produce

flowers with stamens on one plant, and *flowers with pistils* on another of the same species. (F. 194.)

The genera of the class diœcia are referred, by Linnæus, to very different natural orders. Salix, populus, myrica, belong to the order *amentaceæ*. Juniperus, taxus, ephedra, to the *coniferæ*. Vallisneria and hydrocharis to the order *palmæ*. Smilax, tamus, yam, rajania, moon-seed, cissampelos, and butcher's-broom to the *sarmentaceæ*. While carica or papaw-tree, and cliffortia, are arranged in the natural order *tricoccæ*.

150. *Division*:—The class diœcia, like the preceding one, is very variously divided by different writers. Some consider there are fourteen orders, but the number usually admitted, is *nine*. These are all named and established after the classes.

151. *Monandria*:—Containing those species of diœcious plants, the barren variety of which, produce flowers with only *one* stamen.

The pandanus or screw-pine, and the brosimum or bread-nut-tree, both foreign genera, are to be found in this order.

152. *Diandria*:—When, instead of producing flowers with only one stamen, they are furnished with *two* stamens.

The entensive genus salix or willow, will afford plenty of native examples of the order in question.

153. *Triandria*:—When the flowers of the barren plant, are furnished with *three* stamens.

The genera empetrum or crow-berry, osyris or poet's-cassia, restio or rope-grass, phœnix or date-palm-tree, and a few others, are the constituents of this division.

154. *Tetrandria:*—Where the flowers of the barren plant, are furnished with *four* stamens.

Examples of this order, are presented in the different genera, viscum or misseltoe, amber-tree, ramoon-tree, sea-buckthorn and myrica or candle-berry-myrtle. The last genus affords a very familiar native species called the myrica gale or sweet-gale.

155. *Petandria:*—When the flowers of the barren plant, have *five* stamens.

The common hop, bastard-hemp, common hemp, the spinage of our gardens, the tooth-ache-tree, and a Cape genus called leucadendron, are the principal productions of this order.

156. *Hexandria:*—When the flowers of the barren plant are furnished with *six* stamens.

Here we meet with the common black bryony of our own country, the yam or dioscorea of the Indies, and the oily-palm-tree of Guinea.

157. *Octandria:*—When the flowers of the barren plant, are furnished with *eight* stamens.

The common rose-root or rhodiola, and the white, hoary, black and trembling poplar-trees of this country, have received their arrangement in this part of the system.

158. *Polyandria:*—In which the flowers of the barren plant, have more than *eight* stamens.

This order will afford us, as examples, the annual and perennial mercury, frog-bit, papaw-tree, Canadian bonduc, the hyæna-poison a Cape plant, the family menispermum or moonseed, the cycas or sago-palm, and the genera zamia, cliffortia, &c.

159. *Monadelphia:*—Embracing those plants of the

class, the barren flowers of which, have the filaments of their stamens united into *one* set.

The common juniper, prickly butcher's-broom, and common yew of this country, should be collected as specimens. Among the foreign illustrations, are the Bourbon-palm, the nutmeg tree, Sir Joseph Banks' pine, and the singular pitcher-plant of Ceylon.

CLASS XXIII.—POLYGAMIA.

160. *Character:*—This class includes such plants, as produce three different kinds of flowers; viz. some with *pistils* only, some with *stamens* only, and others with *both;* and these flowers situated on *the same* individual plant, or on *two* or *three* different plants of the same species.

This class possesses a considerable number of genera, some of which, have very natural affinities to each other. Holcus or Indian millet, ischæmum, manisuris, ægilops or hard-grass, andropogon or man's-beard, belong to the order *gramina;* mimosa, gleditschia, and ceratonia or carob-tree, to the *lomentaceæ;* musa to the *scitamineæ;* the ash to *sepiariæ;* the nettle-tree or celtis, pellitory and fig, to the order *scabridæ.*

161. *Division:*—The orders of this class are three; viz. *monœcia*, *diœcia*, and *triœcia*, all established on a consideration of the separation of the stamens and pistils.

162. *Monœcia:*—Embracing those plants of the class, which have *perfect* flowers accompanied with *barren* or *fertile* flowers, or both, on *the same* plant.

Among the plants of this character, are the banana-tree and plantain-tree, two Indian species of musa; the white helebore, a species of veratrum; the sycamore and common maple, the sensitive plant, and humble-plant, two species of mimosa; the Egyptian-thorn, the balsam-tree, the elephant-apple, looking-glass plant, and the different families of atriplex or orach, parietaria or pellitory, valantia or looking-glass plant, ægilops or hard-grass, acacia, and several others.

163. *Diœcia:*—Embracing those plants of the class, which have the different flowers on *two* of the same species.

The common and one-leaved ash-tree, are the only two illustrations to be collected from British botany. The foreign species of ash, together with the genera gleditschia or honey-locust-tree, brosimum or bread-nut, diospyros or date-plum, and a few others, appear to compose this subdivision of the class.

164. *Triœcia:*—Embracing those plants of the class, which have the different flowers on *three* different plants; or in other words, one plant producing *perfect* flowers, another *barren* flowers, and a third plant of the same species, *fertile* flowers.

This order only claims two genera of plants; the ceratonia or carob-tree, and the large family of ficus or fig.

CLASS DERIVED FROM A CONCEALMENT OF THE STAMENS.

165. This division brings us to the last class of the Linnæan Artificial System. The plants which it embraces, will be found to differ very materially from those we have already considered, and to constitute Nature's gradual steps to another division of her kingdom.

CLASS XXIV.—CRYPTOGAMIA

166. *Character:*—The class cryptogamia, contains a

vast assemblage of vegetables in which the parts of fructification are, either from their minuteness, or from their particular situation, entirely concealed, or imperfectly visible. (F. 33, 35, 57, 195, 196.)

The vegetables of this class, are referred by Linnæus to several distinct natural families. Thus the ferns constitute the fifty-fifth order of his natural system, the mosses his fifty-sixth, the algæ his fifty-seventh, and the fungi his fifty-eighth order.

167. *Division*:—This class has always been divided into five natural orders; viz. *filices*, *musci*, *hepaticæ*, *algæ*, and *fungi*, each established on the distinguishing characters of the productions they embrace.

168. *Filices or Ferns*:—This order contains a selection of plants, the fructifications of which, are essentially different from all others, at least in point of situation, being generally diffused in spots or lines on the under surface of the leaf. (F. 33.)

Specimens of this order are furnished by several plants; such are the horse-tail, adder's-tail, adder's-tongue, moon-wort, osmund-royal, various species of polypody, shield-ferns, spleen-wort, hart's-tongue, and the common brake or fern, a well known plant, found upon almost all the heaths and open hilly places in the kingdom.

169. *Musci or Mosses*:—These plants, which form the second order of the class cryptogamia, have roots and leaves something like those of other plants, but the fruit is very different. Small threads, like the filaments of stamens, generally grow out of the bosom of the leaves, and support little roundish bodies that resemble

anthers, but which are really the capsules that contain the seed. These capsules are hollow, of various figures, and in general furnished with a peculiar appendage (F. 58, a) called a veil or calyptra, and when this is removed, the mouth of the capsule itself, is found to be surrounded with one or two rows of fringe, of great delicacy, and of surprising regularity in the number of teeth that compose it. (F. 58.)

The different kinds of bog-moss, are distinguished by having their capsule without any fringe. Earth-moss is known by its ovate capsule without any separate lid and its very small veil, which soon falls off. The gland-moss, has a cylindrical capsule placed on a fleshy receptacle, and a single fringe of sixteen teeth standing in pairs. Fork-moss is distinguished by an oblong capsule, and a fringe of sixteen flat and cloven teeth somewhat bent inwards. The other kinds of mosses have their peculiar characters, and some of them are extremely beautiful.

170. *Hepaticæ or Liverworts*:—The productions of this order, are a tribe of small plants resembling mosses, in which the herbage, generally speaking, is leafy, and the fructification originates from what is at the same time, both leaf and stem. The capsules have no lid or operculum, as in the mosses.

The principal genera are jungermannia and marchantia. Of the former, the distinguishing characteristic is, that the barren flowers are sessile or setting; the capsule has four valves, and is situated on a stalk which rises from a sheath, and the seeds are attached to elastic filaments. In the latter, the barren flowers have a salver-shaped calyx, with numerous anthers embedded in its disk; the calyx of the fertile flower is shield-shaped, and open beneath, the capsules burst at their summit, and the seeds are attached to elastic fibres.

171. *Algæ or Flags*:—The fourth order, is consti-

tuted by plants in which the herbage is sometimes leafy, sometimes a mere crust, and sometimes of a leathery or gelatinous texture. The seeds are either embedded in the frond itself, or in some peculiar receptacle, and the barren flowers are very imperfectly known.

The most common distribution of the tribe of algæ, is that by which they are divided into the six following genera.

a. The Lichenes or Lichens—a numerous tribe growing in all climates and in most situations ; the fructifications of which, for the most part, consist of a smooth round disk, flat, convex, or concave, with or without an adventitious border, in the substance of which disk, the seeds are lodged. In some others, they are placed in powdery warts or in fibrous receptacles. (F. 196.)

b. Tremellæ—Those species of algæ which appear on rotten wood, grass, and in moist weather, in the form of heaps of jelly. Their organization is not yet known.

c. Fuci—Comprehending the different vegetable productions commonly called *sea-weeds ;* the seeds of which are collected together in tubercles or swellings, of various forms and sizes.

d. Ulvæ—The plants of this division are also aquatic, and their character well defined by the seeds being dispersed under the cuticle, throughout the membranous or gelatinous substance of the frond.

e. Confervæ—Likewise a division of aquatic algæ, characterized by their capillary and articulated structure, and by the seeds of some species being lodged in external capsules or tubercles, and of others, in the joints of the frond. (F. 195.)

f. Byssi—comprehending such species of algæ, as exist in the form of a most delicate downy substance. They are usually found on old wood, in moist situations.

172. *Fungi or mushrooms :*—This order is composed by a tribe of plants of a fleshy substance, generally of quick growth and short duration, differing in firmness, from a watery pulp to a leathery or even woody texture.

Belonging to this order we have the following illustrations. Mushrooms or agarics, are a very extensive genus, grow horizontally, and are furnished with laminæ or gills on the under surface. The spunk or boletus, is another genus which grows horizontally, but differs from the last, in having pores instead of gills on the under surface. The phallus or morell is known by a smooth surface underneath, and a kind of net-work on the upper part. The lycoperdon or puffball is of a roundish form, and filled with a mealy powder, supposed to be the seeds. The tuber or truffle used for food, has no root, but grows beneath the surface of the ground; it is round and solid, and of a rough exterior.

SECTION III.

GENERAL RULES FOR ASCERTAINING THE CLASS AND ORDER OF PLANTS.

1. If the *class* of the plant about to be investigated is desired, you must bear in mind that the classes are taken either from the number, the number and insertion, number and proportion, and so on, as before arranged.

The divisions into which the system has been related, should be perfectly understood, because an intimate knowledge on this point, will render more clear and familiar the following steps of enquiry.

FIRST DIVISION.

2. If the flower under examination is perfect, and not furnished with more than *ten* stamens, it is a very easy task to discover the class, because the ten first classes of the system are founded on the number of the stamens alone, each flower having no relation to any of the other classes.

Therefore, if the plant produces perfect flowers with *one* stamen, (F. 174.) as in the common mare's-tail, it belongs to the first class *monandria;* if with *two* stamens, (F. 175.) as in the lilac, to the second class *diandria;* if with *three* stamens, (F. 176.) as in the crocus, to the third class *triandria;* and so on in progression to the tenth class. The orders of all these classes being founded on the number of pistils are very clear.

SECOND DIVISION.

3. The class of the plant in hand, not being any of the preceding, we will pursue our attempts to decide

if it does not belong to one of the three classes established on the number and insertion of the stamens.

4. Does the plant produce flowers with *twelve to nineteen* stamens fixed to the *receptacle?* (F. 184.) If it does, you must consult the *eleventh* class or *dodecandria.* If there are *more than twenty* stamens attached to *the calyx* (F. 185.) or *corolla,* to the class *icosandria.* But if there are *more than nineteen* stamens, inserted into *the receptacle,* (F. 186.) then the plant must belong to the thirteenth class, or *polyandria.*

These classes are simple in their characteristics, and the orders into which they are divided being founded on the number of pistils in each flower, they are soon made familiar.

The class monadelphia has an *order polyandria ;* the class poly adelphia, an *order dodecandria, icosandria,* and *polyandria :* and the classes monœcia and diæcia have both an *order polyandria.* But as the essential qualities of either of these classes are not present in plants of the second division, very little confusion can result to an accurate observer.

THIRD DIVISION.

5. We have already given rules for investigating plants which belong to those classes founded on the number and insertion of the stamens; we will now speak of those which are founded on their number and proportion.

We shall hereafter hear, that the filaments of the stamens may be united, but we have now to know that the filaments of the first fifteen classes of the system, are separate and distinct.

6. If the flowers of your plant should have *four stamens, two long* and *two short,* the fourteenth class or *didynamia* would be indicated. (F. 187).

The plants of this class might be confounded with those of the fourth class *tetrandria*, which are also furnished with *four* stamens, but in the last case they do not have any determinate inequality in length, but are generally equal. (F. 177.)

7. Should the plant you are wishing to analyze produce flowers furnished with *six stamens*, you must be particular in assuring yourself that there are *four long* and *two short*; and if there are, the fifteenth class or *tetradynamia* is correct. (F. 188.) Flowers always of four petals and cross-shaped.

This class is only likely to be mistaken for the class *hexandria*; in the plants of which, there are also *six stamens*, but these are all nearly equal in their height. (F. 179.) The orders of the fifteenth class are established on the kind of seed-vessel, and being only two, are easily comprehended.

FOURTH DIVISION.

8. If the plant about to be examined, does not arrange in one of the first fifteen classes, you must ascertain whether it does not belong to either of the classes founded on a consideration of the union of the stamens either with themselves or with the pistil.

9. If the *filaments* are united with each other into *one set* only, (F. 189.) the plant must belong to the sixteenth class, or *monadelphia*; if the *filaments* are united into *two sets*, (F. 190.) to the class *diadelphia*; or if they are united into *more than two*, (F. 191.) then the class *polyadelphia* would be the proper one.

These three classes are very fairly distinguished from each other. Nevertheless, it will be as well to observe, that both the classes *monœcia* and *diœcia* have an *order monadelphia*, and that the former class has also an *order polyadelphia ;* but as the plants arranged in these orders possess the true *monœcious* and *diœcious* character, a careful observer will find no difficulty in knowing to what class his plant may belong. The orders of the three classes monadelphia, diadelphia and polyadelphia, are very simple and readily ascertained.

10. If the *anthers are united with each other*, so as to form a tube through which the pistil passes, or that the flowers are *compound*, your plant belongs to the nineteenth class *syngenesia*. (F. 5.)

The plants which constitute this class are generally compound, and the exact order to which any plant may belong, is readily discovered by referring to the construction or foundation of the orders.

11. If the *stamens arise* from *any part* of the *pistil*, or from a pedicle or column elevating the pistil, the plant is then of the twentieth class, or *gynandria*. (F. 192.)

The particular origin of the filament will very effectually prove the certainty of the plant being of this class, and the respective orders may also be attained with very little trouble.

FIFTH DIVISION.

12. Plants not corresponding to any of the divisions we have mentioned, carefully examine whether they are not of the fifth division, that is, whether they produce flowers with stamens only, and flowers with pistils only, and with both.

The plants of this division are said to have *united* or *perfect flowers*, when they have both stamens and pistils inclosed within the same corolla : *separated flowers* when their stamens are in one flower called the *barren* flower, and their pistils in another, called the *fertile* flower. But if a plant bears united flowers, as well as barren or fertile flowers, the plant is said to have *mixed flowers*.

13. If the stamens and pistils are *distinct* in *separate* flowers (F. 193.) *on the same plant*, the plant must be referred to the class *monœcia.*

This class is only likely to be confounded with the *order monœcia*, of the twenty-third class, but by a strict analysis of the flowers produced by plants of the *class monœcia*, you will not detect any which produce *both* stamens and pistils in the same flower. The orders of this class are easily understood.

14. If on the other hand, the *barren* or stamen-bearing flowers, are on *one* plant, and the *fertile* or pistil-bearing flowers on *another* of the same species, (F. 194.) then the plant must be arranged in the class *diœcia.*

There is a probability of this class being mistaken for plants belonging to the two *orders diœcia* and *triœcia* of the class polygamia; you are therefore required to ascertain precisely, that there are *no united flowers* on any species of the plant you are examining, and if there are not, you have obtained a true diœcious plant. The orders of this class are very simple, and easily understood.

15. Having made the necessary examination, if the flowers are *mixed*, you are certain the plant belongs to the twenty-third class, or *polygamia.*

To convince yourself that the polygamia class is the correct one, you must not be content to examine different flowers on the same plant, but you must collect them from several plants of the same species, otherwise you will be led to imagine the plant is of the class monœcia or diœcia, or if you should only chance to have plucked the *united flowers*, of some of the classes established on a different principle from the present one. Thus, the sycamore has *united flowers* with barren or fertile flowers on *the same* plant, consequently belongs to the first order of the class polygamia. The common ash-tree has the different flowers on *two* plants of the same species, and belongs to the second order; whilst the fig-tree, has the different flowers on *three* plants of the same kind, and is of the third order.

If the stamens and pistils are invariably *separate*, you must pursue your purpose by an attempt to convince yourself, whether the plant belongs to the class *diœcia* or *monœcia*.

SIXTH DIVISION.

16. If the parts of fructification are *not visible* by the naked eye, the plant belongs to the last division or class *cryptogamia*.

To ascertain the *orders*, you have only to examine the natural resemblance which the production in hand bears to the character peculiar to each order. Thus, no one would, for a moment suspect the puff-ball to be a sea-weed, or on the other hand, ferns to be mushrooms. The distinctions are therefore too evident to require any observations.

RULES FOR ASCERTAINING THE GENERA AND SPECIES OF PLANTS.

17. The *class* and *order* being fixed upon, to which a plant is suspected to belong, a general plan may be laid down for a knowledge of the precise *genus* and *species*.

Having so far prosecuted your investigation, as to be certain of the *class* and *order* to which your plant belongs, refer to the said class and order, in a good systematic arrangement or *genera plantarum*, and taking notice of the different genera by which the order is constituted, carefully examine the principal characters of the flower under examination, and mark which genus it most resembles. The *genus* being fixed upon to which you think the plant belongs, read over the *species*, and by comparing the flower in your hand with what you read, there will be no difficulty in finding *its name*, though you might never have seen or heard of the plant before.

18. We will here likewise observe, that most plants

have two *Latin* words for their name; the first word is said to be its *generic* term, and the second its *specific* name.

Thus the term *primula* or primrose is the name of a genus or family of plants agreeing in certain characters, and the individual plants which compose this family, bear the *generical* term *primula* first, and a *specific* term afterwards, expressive of their individuality, so that the common species of our hedges is systematically called the *primula vulgaris;* the cowslip another species, *primula veris;* and the auricula of our gardens, a foreign species of the same genus, is denominated *primula auricula.* By this simple principle in naming of plants, we know that the cowslip, auricula and primrose, are all of the same genus. In the same way every plant is to be known by their technical appellations.

THE

LINNÆAN

NATURAL SYSTEM.

PART V.

BEING A SIMPLE ARRANGEMENT OF PLANTS, ACCORDING TO SOME STRIKING PECULIARITIES IN COMMON TO SEVERAL, WHEREBY THEY ARE REGULARLY DIVIDED INTO FIFTY-EIGHT ORDERS OR ASSEMBLAGES.

THE

LINNÆAN

NATURAL SYSTEM.

1. In addition to the artificial arrangement just explained, the immortal Linnæus, gave much of his time and labour to establish a system on the natural character of plants, and as the result of his investigations, he has presented to the world, the following fragments of a natural arrangement.

Linnæus never gave any distinct marks to his natural orders, we can therefore only take a cursory view of them as they follow each other, with such indications of their characters, as have been traced by modern botanists.

ORDER I.—PALMÆ.

2. The tribe of palms is an entirely natural and very distinct order, constituted by families of lofty plants with very peculiar frondose tops. Phœnix, cocos, &c.

With the genera of this order some have a three-leaved calyx, others none at all; some have a corolla of three, others one of si petals; most have six stamens, some three, others nine. The germens are three in some, solitary in others, and the style and stigma are subject to like diversity in different genera. The fruit is in some, as in the phœnix dactylifera or date, a single drupe, in others composed of three; in some like the cocoa, a nut with a cariaceous coat. The seeds are mostly solitary, but in several instances, two or three in each fruit.

ORDER II.—PIPERITÆ.

3. The plants of this division have an acrid flavour, whence they are commonly named *pepper-plants*. Piper or pepper, arum, acorus and others.

They afford no common character to discriminate the order, except possibly the elongated receptacle and sessile anthers, but some *amentaceæ* have the same.

ORDER III.—CALAMARIÆ.

4. This order consists of such plants as are usually called *reeds*, and most of which are very closely related to the true grasses or fourth order, and have almost the same kind of leaves. Scirpus or club-rush, &c.

Their seed is solitary and naked; stamens three; style one, not unfrequently three-cleft at the summit; glume generally one-valved; stem a culm, mostly triangular, rarely round, often leafless or nearly so.

ORDER IV.—GRAMINA.

5. This order is constituted by the *true grasses*, a very peculiar and extensive tribe of plants.

Their stem is a hollow culm; inflorescence either a spike or panicle; calyx two-valved; stamens from one to six; the germen is superior, with two styles, sometimes raised on a common stalk or elongated base; seed generally solitary and without a capsule.

ORDER V.—TRIPETALOIDES.

6. The plants of this order have flowers with *three petals* only, and are nearly allied to the grasses, but possess no very striking characters. Juncus, calamus, alisma, butomus, and so on.

ORDER VI.—ENSATÆ.

7. The plants in this order usually having sword-shaped leaves, are naturally called *sword-leaved plants*, and their order established on that circumstance. Iris or flower-de-luce, eriocaulon or pipewort, sisyrinchium, and others.

The calyx is a kind of spurious spathe; corolla usually of six petals; seed vessel a capsule of three cells and three valves, with many seeds, generally inferior.

ORDER VII.—ORCHIDEÆ.

8. The plants of this order are of the *orchis-tribe*, forming a peculiar selection of vegetables.

Their roots are generally tuberous and fleshy; stem solitary and herbaceous; leaves simple, alternate, undivided, sheathing the stem. Inflorescence, terminal, either spiked or racemose; fructification irregular and very singular; corolla of five petals with a sixth or nectary; stamens consist of two anthers, nearly without filaments, very singular, and peculiar to this order, concealed in a double pouch or hood; germen inferior; style short; the fruit a capsule of one cell and three valves; seeds numerous.

ORDER VIII.—SCITAMINEÆ.

9. The name of this order is an ancient word synoni-

mous with *aromatic*, consequently answers to nearly all the plants it contains. These plants nearly approach the *orchideæ* in aspect. Ginger, cardamoms, zedoary, &c.

Their roots are fleshy, mostly acrid and aromatic; stem simple; leaves lanceolate, quite entire, even, stalked, convoluted contrary to the direction of the sun; their stalks sheathing the stem. Inflorescence either a spike or cluster; flower superior; calyx a perianth of three valves; corolla always irregular. Pericarp in most instances a capsule of three cells and three valves, with many seeds in each cell; stamen one; anther consists of two parallel distinct lobes, united lengthwise with the filament; germen roundish, with a thread-shaped style, lodged between the lobes of the anther, and a dilated cup-like, often fringed stigma.

ORDER IX.—SPATHACEÆ.

10. In this order are arranged those plants which produce flowers with a *spathe* or *sheath*. They are further distinguished by their bulbous root consisting of a radical bulb formed from the basis of the last year's leaves, which envelopes the rudiments of the future foilage. Meadow-saffron, narcissus, and many more.

In this order the leaves are sheathing at the root, and with a few exceptions, linear or linear-lanceolate. Stem, a round, two-edged or triangular scape. The flowers are stalked within the sheath, and in most instances they are superior; corolla usually monopetalous; stamens six, except in githyllis; pistil one, except in colchicum; capsule three celled with many seeds.

ORDER X.—CORONARIÆ.

11. This order has received its name from the flowers of many of its plants being formerly used to decorate a

coronary or garland, in consequence of their beauty. Hyacinths, lilies, crown-imperial, asphodel, &c.

With this order the root is tuberous ; the stem is simple, often a mere scape, occasionally leafy, in consequence of a partial elevation of the radical leaves ; flower destitute of a spathe or any sort of calyx, consists of six petals ; stamens six; germen superior ; capsule three celled and three valved, the sides placed one above another.

ORDER XI —SARMENTACEÆ.

12. Sarmenta among the ancients meant unarmed, prostrate, weak branches, unable to support themselves ; hence this name is applied to the order before us, many plants belonging to which, answer to that character, being of a long, weak, trailing or twining habit. Paris, aristolochia, asparagus, smilax, and many more.

All the sarmentaceæ are monocotyledonous, and entirely without pubescence, but they differ so much in their natural appearances, that no common character derived from the fructification, can be made applicable to the whole order. The roots are oblong and fleshy ; the stem at first coming forth is smooth and leafless, mostly branched; in some prostrate—leaves in every instance simple and undivided, sometimes linear, sometimes lanceolate and acute, or heart-shaped, uniform, mostly alternate. Flowers mostly on simple stalks ; stamens six, except in menospermum ; styles three, or three cleft; calyx or corolla generally deficient; fruit generally three celled.

ORDER XII.—HOLERACEÆ.*

13. This denomination, literally meaning *pot-herbs*, is given to plants that are tender or brittle in the mouth, and usually used for culinary purposes. Beet, rhubarb, amaranth, &c.

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* Incorrectly printed in many works *holoraceæ*.—Sir J. E. Smith.

The plants of this order have been divided into several sections, but there is not yet discovered a mark of distinction common to them all.

ORDER XIII.—SUCCULENTÆ.

14. This division is intended to embrace those plants which are of a fleshy and juicy nature. Cactus, tamarind, saxifrage, hydrangea, &c.

The succulentæ grow, and become very turgid, in the driest soil, nor are any found in watery places. If moistened too much they perish and their roots decay. They afford, on putryfying, a fine vegetable mould, whereas dry plants, like heath and fir, scarcely yield any.

ORDER XIV.—GRUINALES.

15. This order brings together those plants which have flowers somewhat resembling a crane's-bill. Geranium, flax, sun-dew, wood-sorrel, and others.

Their roots and habits are various. Calyx, usually of five leaves, and corolla of five petals; stamens various in number and connexion; pistils mostly five or ten; fruit, various. Many of the plants have acid leaves.

ORDER XV.—INUNDATÆ.

16. So called, because they grow in water, many of them under the surface, except their blossoms. Hippuris, potamogeton or pond-weed, elatine, &c.

The qualities of the inundatæ are very obscure. They are mostly inodorous, except a fishy scent in some, nor have they any particular taste.

ORDER XVI.—CALYCIFLORÆ.

17. The plants of this order have the stamens in-

serted into the calyx, and are of the shrub or tree kind, such is the elæagnus or wild olive, osyris or poet's-cassia, trophis, &c.

No observations relative to this order have been made, except that the genera of which it formerly consisted, are removed elsewhere.

ORDER XVII.—CALYCANTHEMÆ.

18. These plants have the corolla and stamens inserted into the calyx. Epilobium, œnothera, ammannia, &c.

With the plants of this order there is a great diversity of character. They are mostly inodorous and insipid; chiefly herbaceous, with opposite or alternate leaves; stamens from four to twelve; pistil always solitary; the stigmas either four or one; germen inferior in some, superior in others; seed-vessel for the most part, a capsule usually of four or five cells.

ORDER XVIII.—BICORNES.

19. So called because many of the tribe of plants belonging to this division, have the anthers terminating, in two beaks or horns. Vaccinium or whortleberry, erica or heath, citrus or orange, royena, and so on.

The plants are rigid, hard and evergreen, almost all more or less shrubby. The leaves are alternate, simple, undivided, scarcely crenate, permanent. Calyx of one leaf, more or less deeply, four or five cleft; corolla usually monopetalous; nectaries none, except in kalmia; stamens from four to ten, answering to the divisions of the corolla or twice their number; pistil one, except in royena; germen, in some superior, in others, inferior; fruit, sometimes a capsule, sometimes a berry; in each four or five cells; seeds one or more in each cell, mostly small, chaffy.

ORDER XIX.—HESPERIDEÆ.

20. This natural order has not been fairly related. It is said, to consist of aromatic and elegant shrubs and trees; such as the eugenia or clove-tree, myrtus or myrtle, psidium or guava, &c.

ORDER XX.—ROTACEÆ.

21. This order has likewise been indifferently defined, but the wheel-shaped corolla of many of its plants has evidently suggested its name. Anagallis or pimpernel, gentiana or gentian, and so on.

ORDER XXI.—PRECIÆ.

22. The plants of this order, have been so named from *precins*, early; because they flower early in the spring. The genus primula or primrose, together with its elegant relatives, form the foundation of this arrangement.

These plants are all destitute of stems; leaves simple; flower regular; calyx as well as corolla, five-cleft; stamens five; style one fruit a simple superior capsule.

ORDER XXII.—CARYOPHYLLEÆ.

23. Here we have the tribes of pink and campion, with numerous other plants having natural affinities to the same. Dianthus or pink, saponaria or soap-wort, silene or catch-fly, arenaria or sand-wort, stellaria or stitch-wort, and others.

The whole order is harmless, without any peculiar taste or smell, except in the flowers. The roots are fibrous; stem herbaceous, scarcely shrubby, jointed; its branches commonly alternate; leaves simple, more or less of a lanceolate figure, undivided, hardly crenate in any degree, sessile, with no other appearance of a foot-stalk than their elongated narrow base, opposite, obvolute. Flower rarely sessile; stamens never numerous, but either the same in number as the petals, or twice as many; pistils from one to five, not more; fruit a capsule, either of one cell, or of as many as there are styles, the cells usually with many seeds.

ORDER XXIII.—TRIHILATÆ.

24. So called to comprehend plants with three-celled and three-grained fruit, all the cells being distinct, and each seed marked with the hilum or scar. The genus melia, however, has five cells. Trichilia, guarea, malpighia or Barbadoes cherry, &c.

The whole order scarcely contains any thing acrid, except tropæolium, nor any thing either fragrant or noxious. The leaves of the plants are inclined to be compound, and are both opposite and alternate. The calyx is either of four or five leaves, or of one leaf in five deep segments; petals four or five; stamens eight or ten. One part of the fructification is often diminished as to number; for instance the petals, and when they become but four, the stamens are only eight. A nectary is always present, hence the corolla is frequently irregular.

ORDER XXIV.—CORYDALES.

25. This order embraces a selection of plants which have irregular flowers somewhat resembling a helmet. Impatiens or balsam, melianthus or honey-flower, fumaria or fumitory, and so on.

There is a certain fragility and delicacy of texture characteristic of the corydales, with a glacuous hue, which points out their affinity:

They have also a bitter flavour, and scarcely any of the order are odoriferous, except melianthus, which is extremely fœtid. The plants are smooth and unarmed; a few of them climbing by means of tendrils. The leaves are alternate in all, except in calceolaria, and many bear stipules. Their mode of flowering is spiked, racemose, or solitary, their stalk naked or leafy, different in different species. The calyx is of two leaves, except in pinguicula, where it is only cloven; and melianthus, where it consists of four leaves.

ORDER XXV.—PUTAMINEÆ.

26. This order consists of a few genera of plants allied in habit, whose fruit is covered with a strong rind or hard woody shell. Cleome, cratæva or garlic-pear, capparis or caper-tree, &c.

ORDER XXVI.—MULTISILIQUÆ.

27. Containing an arrangement of plants with more seed-vessels than one, such are those of the genera pæonia or peony, aquilegia or columbine, aconitum or aconite, delphinium or larkspur, helleborus or hellebore, anemone, ranunculus, and several more.

Most of the order, with a few exceptions, are of European growth, acrid taste, and generally of a disagreeable odour; none esculent, and most poisonous; rarely arboraceous or shrubby, except such species of climatis as climb trees. The roots are fibrous, sometimes tuberous; leaves often many-cleft or compound, but in a few instances simple; all alternate, except in the climatis integrifolia. There are no stipules, spines, or prickles. Flowers never monopetalous; stamens for the most part more than eight. Fruit in some capsular, in others single-seeded.

ORDER XXVII.—RHŒADEÆ.

28. The order under consideration consists of the

poppy genus and a few genera which resemble it in habit and structure. Papaver or poppy, argemone, chelidonium or celandine, podophyllum or duck's-foot, &c.

There are no marks of distinction mentioned for the rhœadeæ. Upon being cut, they emit a juice which is white in poppy, and yellow in others. They are all more or less narcotic.

ORDER XXVIII.—LURIDÆ.

29. The Luridæ are an order of plants whose pale and gloomy appearance indicate their baneful and noxious qualities. Digitalis or fox-glove, datura or thorn-apple, solanum or night-shade, &c.

None of these plants are arboraceous, though some are shrubby. Colour of the herbage mostly dull and lurid; the taste disagreeable, smell nauseous, hurtful to the nerves, hence their poisonous qualities. Leaves alternate in all; calyx five cleft; corolla monopetalous, folded in a plaited manner; stamens four or five; pistil one; germen superior; seed-vessel of two cells, in some a berry, others a capsule.

ORDER XXIX.—CAMPANACEÆ.

30. An order consisting of plants with campanulate or bell-shaped flowers, such as the genera convolvulus and campanula, with their respective allies.

Leaves in every instance alternate. Calyx and corolla five-cleft; stamens five; pistils usually one; fruit a capsule. They are milky plants, at least while young, and more or less bordering on a poisonous nature.

ORDER XXX.—CONTORTÆ.

31. This order derives its name from the corolla being

twisted in the bud contrary to the course of the sun, its limb being wheel-shaped when expanded, in such a way that each of its segments unequally proportioned in their margin, is curved inward under the next segment, the shorter side of the former being beneath the longer one of the latter. Vinca or periwinkle, nerium or rose-bay, asclepias or swallow-wort, &c.

The plants have perennial roots; leaves simple and undivided, and with a very few exceptions, opposite; sometimes ternate or quaternate; rarely alternate. The inflorescence is often peculiar, in having its flower-stalks not axillary, but proceeding from the side of the stem between the insertion of the leaves. Calyx of one leaf, five-cleft; corolla of one petal, regular, its segments contorted, as above described, and often notched in the margin; nectaries in many instances singularly formed; stamens five; pistils two, or one with a double stigma; germen superior in most; fruit in many, two distinct follicles not observable in other plants.

ORDER XXXI.—VEPRECULÆ.

32. Derived from *veprecula* or little briar, and consisting of plants resembling the daphne. Daphne, lachnæa, passerina or sparrow-wort, guidia, and so on.

The plants of this order are known by their tough branches, silky inner bark, simple entire leaves, acrid and even burning flavour and sweet scented flowers, whose calyx and corolla are united into one integument, most coloured within.

ORDER XXXII.—PAPILIONACEÆ.

33. This is an extensive and very natural assemblage of plants, having papilionaceous or butterfly-shaped flowers, embracing the leguminous vegetables, such as

the different families of vicia or vetch, lathyrus, lupinus or lupin, pisum or pea, and numerous others.

Perianth of one leaf, irregular, inferior, generally withering Corolla nearly the same in all; its standard either emarginate or entire, either reflexed or not at the sides, for the most part very large compared with the other petals; wings, if present, always two, opposite, frequently large; keel simple, either pointed, obtuse, or abrupt; stamens ten, united by their filaments into sets; pistil generally uniform; the style downy or woolly, either above or below; stigma either acute or capitate; seed-vessel a legume of two-valves.

ORDER XXXIII.—LOMENTACEÆ.

34. This order is named from *lomentum*, a colour used by painters, because some of its plants are much employed in the art of dyeing. Polygala or milk-wort, bauhinia or mountain-ebony, cassia, cæsalpinia or brasiletto, &c.

The plants of this order are all shrubby or arboraceous. Leaves alternate, compound, pinnate or bipinnate, without a terminal leaflet, moringa excepted. Stipules always large. Calyx five-cleft; corolla in some degree irregular, polypetalous, except ceratonia and several mimosæ; stamens differing in number, mostly ten; pistil universally single; fruit a legume, for the most part having transverse partitions.

ORDER XXXIV.—CUCURBITACEÆ.

35. This order has received its name from *cucurbita*, a gourd, on account of its being constituted by plants similar in their habits and character to the gourd family. Cucurbita or gourd, cucumis or cucumber, momordica, bryonia or bryony, and so on.

In this order there are, properly, no trees. Some of the plants, indeed, have a climbing, woody, perennial stem; root perennial or annual; leaves in all alternate, simple, always accompanied at their origin by stipules, and mostly with glands, either on the foot-stalk, at the base of the leaf, or on its disk—all have tendrils. The calyx is either of five leaves, or five deep segments; corolla of one petal, in five deep divisions; stamens inserted not into the receptacle, but into the interior surface of the calyx, to which also the corolla is attached; the filaments are often five, but frequently so combined as to appear only three; the style is of considerable thickness, with three, frequently eleven stigmas; fruit internally of three cells, fleshy, and somewhat juicy.

ORDER XXXV.—SENTICOSÆ.

36. So named from *sentis* a briar, on account of its embracing the briar and bramble tribe; such as the genera rubus or bramble, rosa or rose, tormentilla or tormentil, fragaria or strawberry, and others.

ORDER XXXVI.—POMACEÆ.

37. Pomaceæ from *pomum*, an apple, embracing the apple and plum tribe. Pyrus or pear, mespilus or medlar, cratægus or hawthorn, punica or pomegranate, prunus or cherry, and so on.

This and the preceding order have been described by Linnæus together. The plants are said to be mostly perennial, very few annuals; rarely smooth. The leaves are alternate, mostly compound. Stipules always two, large. Receptacle of the stamens equally that of the germen, but raised at the sides of the calyx, above the germen. There is nothing acrid in any, nor much fragrance; there is much of a styptic, little of a mucilaginous quality, nothing poisonous.

ORDER XXXVII.—COLUMNIFERÆ.

38. So called from *columna*, a pillar, and *fero* to bear;

consisting of plants whose stamens are united in the form of a column or pillar. Malva or mallow, althæa or marsh-mallow, lavatera, gossypium or cotton, &c.

This order contains no disagreeable or hurtful plants, nor are any esculent: none are fœtid, but some agreeably fragrant. The roots of all are fibrous; stem often herbaceous. All have stipules in pairs. The leaves are alternate, never opposite; in numerous instances stalked; plaited in the bud, and what is remarkable, many of them have glandular pores under the rib. Infloresence is various; calyx in some simple and five cleft; in others, double; petals generally five, often adhere to the united filaments, giving the flower a monopetalous appearance; the corolla somewhat abrupt and twisted, contrary to the sun's motion; pistils usually corresponding in number to the parts of the fruit; as do the stigmas, where the style is simple.

ORDER XXXVIII.—TRICOCCÆ.

39. Derived from two Greek words, the first signifying three, and the second a grain; it will therefore be found to comprehend plants (usually) with a single three-cornered capsule, having three cells each, all containing a single seed. Euphorbia or spurge, trewia and others.

The plants of this order bear alternate, mostly simple leaves, often furnished with glands. Many afford a most acrid milk; they are generally offensive, nauseous, purgative or poisonous. The style is in several highly remarkable, being more or less deeply three-cleft, and each of its branches divided. The calyx as well as corolla, have always something unusual in their formation, or in their nectary; and many of the genera are monœcious or diœcious.

ORDER XXXIX.—SILIQUOSÆ.

40. The plants of this order are of the class tetrady-

namia, and consequently are furnished either with a silicle or short pod, or with a silique or long pod. Alyssum or mad-wort, cardamine or ladies'-smock, brassica or cabbage, and so on.

The plants of the order siliquosæ, are distinguished into siliculosæ and siliquosæ, from the circumstance just mentioned; but it being difficult to define the precise limits of each, Linnæus refers to the *siliculosæ*, such as have a stigma without a style, and to the *siliquosæ* such as have a style to elevate the stigma.

ORDER XL.—PERSONATÆ.

41. Personatæ originates from *persona*, a mask, from the flowers of its plants being furnished with an irregular, gaping or grinning petal, in figure somewhat resembling the snout of an animal. Anterrhinum or snap-dragon, justicia, &c.

ORDER XLI.—ASPERIFOLIÆ.

42. The plants of this order are very generally called rough-leaved plants, because of their usual rough or harsh habit. Borago or borage, echium or viper's-bugloss, pulmonaria or lung-wort, and others.

The plants have a fibrous root. Cotyledons two; stem branched; the branches alternate and round; leaves alternate, simple; neither divided nor compound, for the most part nearly entire, rough with rigid scattered hairs; convolute before they expand. A common flower-stalk having the flowers ranged along one side; calyx in five divisions; corolla inferior, of one petal, regular except in echium, five-cleft; its mouth either furnished with vaulted valves, or crowned with teeth, or naked stamens, five; fruit superior.

ORDER XLII.—VERTICILLATÆ.

43. The order verticillatæ consists of herbaceous vegetables, having four naked seeds, and the flowers placed in whorls round the stalk. Hyssopus or hyssop, lavendula or lavender, galeopsis or dead nettle, and others.

There is much difficulty in defining the limits of this order, but Linnæus has divided it into two sections according to a character of the calyx. The first section comprehends such as have a five-cleft calyx, that is, where all the teeth of this part are nearly of equal size and shape. The second consists of those with a two-lipped calyx, which is indeed five-cleft, but its two upper segments are, in a manner, united into one, which might almost be termed emarginate only; while between these two united segments, and the remaining three, there is so deep a fissure at each side, that the calyx is nearly divided into two parts or lobes.

ORDER XLIII.—DUMOSÆ.

44. The Dumosæ from *dumus*, a bush, are all of the shrub and tree kind, thick and bushy, rising from six to thirty, and even forty feet high. Rhamnus or buckthorn, sambucus or elder, viburnum, cassine, &c.

ORDER XLIV.—SEPIARIÆ.

45. Sepiariæ from *sepes* a hedge, the plants of which, from their use and habits are particularly calculated for hedges. Ligustrum or privet, olea or olive-tree, syringa or lilac, &c.

Leaves opposite, with scarcely any evident stipules. Flowers disposed in a more or less dense panicle; calyx four cleft; corolla four cleft, regular; stamens two; pistil one, with a cloven stigma; fruit a drupe, with one, two, or many seeds; or a capsule.

ORDER XLV.—UMBELLATÆ.

46. This is a very true and natural order of plants furnished with umbels; though all plants which bear umbels do not belong to it, but only those with five stamens, two styles, and two seeds.

With the umbellatæ the root is mostly simple; stem mostly hollow; leaves generally alternate, and repeatedly compound. Of the fructification the germen is inferior, simple, solitary, separating when arrived at maturity into two equal naked seeds, each of which is furnished with a thread inserted into its summit; stamens, &c. as above mentioned.

ORDER XLVI.—HEDERACEÆ.

47. Hederaceæ from *hedera*, ivy, consisting of both herbaceous and shrubby plants, most of which, particularly ivy and vine, have creeping branches, which attach themselves by roots or tendrils to other bodies. Vitis or vine, hedera or ivy, panax, &c.

ORDER XLVII.—STELLATÆ.

48. This order has received its name from the leaves of most of the plants which compose it, being placed, four, six, or eight together, in the form of a star or *stella*, round the stem. Spigelia or worm-grass, cornus or dog-wood, &c.

The plants of this division are chiefly small herbs, growing in barren earth or coarse sand. The roots generally perennial ; leaves opposite, horizontal, mostly rough. Stipules of the form and aspect of leaves ; stem jointed, with mostly tumid knots. Corolla of one petal, either flat, wheel-shaped, or funnel-shaped; in one genus, bell-shaped; mostly four-cleft, sometimes almost down to the base; rarely five-cleft, stamens usually four ; pistil solitary, divided ; fruit for the most part, inferior.

ORDER XLVIII.—AGGREGATÆ.

49. Embracing those plants which are furnished with aggregate flowers, or in other words, with flowers consisting of a number of partial flowers, each of which have a proper and common calyx. Dipsacus or teasel, scabiosa or scabious, &c.

With this order there is a shrubby stem ; leaves often opposite ; a common receptacle, either naked, villous, hairy or scaly ; corolla generally of one petal, regular or irregular, in four or five divisions, rarely polypetalous ; stamens four with separate anthers; germen inferior ; fruit single-seeded.

ORDER XLIX.—COMPOSITÆ.

50. In this order are purposed to be arranged, numerous plants with compound flowers, or in other terms, with many florets enclosed in one common calyx. Carduus or thistle, and numerous others.

There is a great diversity of structure and appearance in the plants of this order; so much so, that no essential character can be mentioned.

ORDER L.—AMENTACEÆ.

51. Plants bearing an amentum or catkin ; which is, a species of calyx very like a spike, consisting of a com-

mon receptacle, drawn out like a thread, on which the flowers stand in alternate order. Salix or willow, populus or poplar, quercus or oak, &c.

They are all either trees or shrubs, with alternate leaves and monœcious or diœcious flowers. Many of them produce but one seed from each flower. The styles are usually two or three. The flowers come before the leaves.

ORDER LI.—CONIFERÆ.

52. The plants of this order, are denominated coniferæ, because they bear a strobile or cone, a species of seed-vessel formed by a catkin with hardened scales, each scale containing a seed at its base. Pinus or fir-tree, cupressus or cypress, juniperus or juniper, &c.

All the coniferæ properly bear cones, though in some instances, (as in juniper, &c.) their fruit seems of a very different nature.

ORDER LII.—COADUNATÆ.

53. The coadunatæ from *coadunare*, to join, are so termed from the general appearance of the seed-vessels, which are numerous, and being slightly joined below, form altogether a single fruit in the shape of a sphere or cone; the parts of which however are easily separated. Such are magnolia, tulip-tree, &c.

ORDER LIII.—SCABRIDEÆ.

54. Scabrideæ, derived from *scaber* rough, consists of plants with rough leaves, which seem to be a kin to the *asperifoliæ;* only their degree of roughness is much greater. Hemp, fig, &c.

ORDER LIV.—MISCELLANEÆ.

55. This order consists of miscellaneous plants, or such genera as are not connected together by very numerous relations. Reseda, datisca, coriaria, &c.

ORDER LV.—LVI.—LVII. AND LVIII.

56. The four last orders, viz. filices or ferns, musci or mosses, algæ or flags, and fungi or mushrooms, are natural divisions of the class *cryptogamia* in the artificial system, therefore do not require, another explanation.

PLANTÆ DUBII ORDINIS.

57. Linnæus found numerous genera which he could not reduce to any of the foregoing orders; he has in consequence thrown them into an appendix, as plants of uncertain or doubtful order.

JUSSIEU'S

NATURAL SYSTEM.

PART VI.

A MODERN AND EXTENSIVE DIVISION OF PLANTS INTO NATURAL CLASSES AND ORDERS, FOUNDED CHIEFLY UPON A CONSIDERATION OF THEIR ANATOMICAL STRUCTURE AND CORRESPONDING CHARACTERS.

JUSSIEU'S

NATURAL SYSTEM.

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1. The grand character upon which the Jussieuan system is established, is derived from a consideration of the *cotyledons* or *seed-lobes*.

On examining the seeds of plants, they will be found to differ in this point of their anatomical structure; some will be found to have no lobes, as with the genus equisetum or horse-tail; others with one lobe; and some with two lobes or more.

2. Upon the structure of the seed, therefore, Jussieu first arranges all vegetable productions into *three general divisions;* for which he has proposed the terms of *acotyledones*, *monocotyledones*, and *dicotyledones*.

Acotyledones when the seed-lobes are not present or indistinct; *monocotyledones* when there is one lobe; and *dicotyledones* when there are two or more lobes.

3. These three general divisions are further subdivided into *fifteen classes*, the characters of which are derived, first, from the number of cotyledons; next

from the number of petals, and finally from the situation or place of insertion of the stamens, calyx or corolla, and petals.

These classes we shall regularly explain upon the authority furnished by Jussieu ; but of the *hundred and forty-one orders* by which they are composed, we can only state the family or genus upon which they appear to have been founded.

4. From a consideration of the situation of the stamens with respect to the pistil, the stamens are said to be *hypogynous* or *inferior*, *perygynous*, and *epigynous* or *superior*.

Hypogynous when they are inserted into the receptacle, or *below* the germen ; *perygynous*, when situated around the germen, and inserted into either the corolla or calyx, the germen being superior ; and *epigynous*, when inserted *above* the germen.

5. The other points of distinction connected with the *calyx*, *corolla*, and *petals*, are similarly expressed ; as *epicalyciæ*, *epicorolleæ*, *epipetaleæ*, and so on.

I.—ACOTYLEDONOUS PLANTS.

SEEDS WITHOUT COTYLEDONS.

6. This division is constituted by those plants which are supposed to have seeds with no lobes or cotyledons ; or in other terms, the plants which compose it, produce such minute seeds, that the cotyledons are not to be detected with any degree of certainty. There is but one class in the division.

CLASS I.—ACOTYLEDONES.

7. Here are included all plants that are considered to be destitute of cotyledones, in which vegetable organization exists in its most simple state.

They present no other appearance than a nearly homogeneous substance, of an uniform cellular tissue, without the usual vessels. The parts of fructification are indistinct or imperceptible.

8. The orders or families of plants which compose this class are eleven, viz. *algæ*, *fungi*, *hypoxileæ*, *lichenes*, *hepaticæ*, *musci*, and others.

1.	Algæ	Fucus.
2.	Fungi	Agaricus.
3.	Hypoxileæ	Verrucaria.
4.	Lichenes	Usnea.
5.	Hepaticæ	Marchantia.
6.	Musci	Polytrichium.
7.	Lycopodiaceæ	Lycopodium.
8.	Filices	Pteris.
9.	Cycadeæ	Cycas.
10.	Equisetaceæ	Equisetum.
11.	Salvineæ	Salvinia.

II.—MONOCOTYLEDONOUS PLANTS.

SEEDS WITH ONE COTYLEDON.

9. The plants of this division, have seeds with one cotyledon. They are more perfect in their organization than the acotyledones. The parts of fructification are very distinct; and the seed, when developed gives out the plumelet, consisting of one leaf only, but the leaves which grow on the stem subsequently, are alternate.

10. This division consists of the second, third, and fourth classes; all established on the situation of the stamen with respect to the pistil; and hence called *hypostamineæ*, *peristamineæ*, and *epistamineæ*.

CLASS II.—HYPOSTAMINEÆ.

11. In addition to the character of monocotyledones, these plants have stamens of definite number, *hypogynous,* that is, fixed into the same receptacle as the pistil.

The floral envelope is generally composed of scales; in some its place is supplied by a membranous sheath. The ovary is superior, and surmounted with one or more styles, and sometimes by sessile stigmas. Their fruit are one-celled, containing one or many seeds, or consists of a seed apparently naked, or covered with a coriaceous envelope.

12. The families of plants which enter the present class are seven, from the twelfth to the eighteenth, viz. *nympheaceæ*, *saurureæ*, *piperitæ*, *aroideæ*, *typhaceæ*, *cyperaceæ* and *gramineæ*.

12.	Nympheaceæ	Nymphæa.
13.	Saurureæ	Saururus.
14.	Piperitæ	Piper.
15.	Aroideæ	Arum.
16.	Typhaceæ	Typha.
17.	Cyperaceæ	Cyperus.
18.	Gramineæ	True grasses.

CLASS III.—PERISTAMINEÆ.

13. Besides the structure peculiar to monocotyledones, the plants of this class have *perigynous* stamens, that is, stamens situated around the pistil, and inserted into the calyx or corolla.

In the peristamineæ the corolla is of one piece, tubular, and sometimes deeply divided, and occasionally accompanied with a partial sheath, which encloses each flower before its expansion. These flowers contain one or more ovaries, surmounted with an equal number of pistils. The früit is one-celled, one or many-seeded, and opens in the form of two valves.

14. The divisions or orders of this class are twelve, from the nineteenth to the thirtieth; viz. *palmæ*, *asparagineæ*, *restiaceæ*, *junceæ*, *commelineæ*, and so on.

19. Palmæ	Palms.
20. Asparagineæ	Asparagus.
21. Restiaceæ	Restio.
22. Juncéæ	Juncus.
23. Commelineæ	Commelina.
24. Alismaceæ	Alisma.
25. Colchiceæ	Colchicum.
26. Liliaceæ	Lilium.
27. Bromeliaceæ	Bromelia.
28. Asphodeliaceæ	Asphodelus.
29. Narcisseæ	Narcissus.
30. Irideæ	Iris.

CLASS IV.—EPISTAMINEÆ.

15. This class very much resembles the third, but it is distinguished by the stamens being *superior* or *epigynous*, which is, situated over the ovary or style, and always of a definite number.

In these plants the ovary is solitary and inferior, generally surmounted by a single pistil, and a simple or divided stigma. Their fruit is a berry or capsule, with several cells.

16. There are only four orders in this class, from

the thirty-first to the thirty-fourth; viz. *musaceæ*, *amomeæ*, *orchideæ* and *hydrocharideæ*.

31.	Musaceæ	Musa.
32.	Amomeæ	Amomum.
33.	Orchideæ	Orchis.
34.	Hydrocharideæ	Hydrocharis.

III.—DICOTYLEDONOUS PLANTS.

SEEDS WITH TWO OR MORE COTYLEDONS.

17. This division includes plants, the seeds of which, have two, if not more, cotyledons. They are of a very complex organization, and form, at least, four-fifths of the vegetable kingdom.

Dicotyledonous plants, in consequence of their number, are first divided into three sets, according to the petals of the flower; hence some are called *apetalous*, a second set *monopetalous*, and a third series *polypetalous*. There is also a fourth class, constituting the last or fifteenth.

APETALOUS DICOTYLEDONES.

18. Dicotyledonous plants with no petals. Divided into three sets or classes, founded on the situation of the calyx, viz. *epicalyciæ*, *pericalyciæ* and *hypocalyciæ*.

CLASS V.—EPICALYCIÆ.

19. The plants of this class, or we should rather say, of this order, are of course apetalous dicotyledones, in addition to which, they have the distinguishing character of a single pieced calyx, *epigynous* or *superior* to the germen.

With the plants by which it is constituted, there is a definite number of epigynous stamens; the germen is inferior; the pistil is scarcely evident; the stigma is simple or divided; and the fruit consists of a berry or capsule, with one or several cells.

20. The thirty-fifth order *aristolochiæ*, from the genus *aristolochia* is the only constituent of the fifth or present class.

CLASS VI.—PERICALYCIÆ.

21. The plants of this class are characterized by their *perigynous calyx;* also by the stamens being of a definite or indefinite number, and *perigynous*, or attached to the orifice of the calyx.

The calyx is single, entire, or has several divisions; and sometimes petaloid scales are attached to its edges. The germen is superior or inferior, with one or more pistils, and simple or divided stigmas, sometimes sessile. The fruit is one-seeded; rarely many-seeded; or it is naked and superior.

22. The orders of this part of the system are eight, from the thirty-sixth to the forty-third, viz. *osyrideæ, mirobalaneæ, eleagneæ, thymeliæ, &c.*

36.	Osyrideæ	Osyris.
37.	Mirobalaneæ	Terminalia.
38.	Eleagneæ	Eleagnus.
39.	Thymeliæ	Daphne.
40.	Proteaceæ	Protea.
41.	Laurineæ	Laurus.
42.	Polygoneæ	Polygonum.
43.	Atripliceæ	Atriplex.

CLASS VII.—HYPOCALYCIÆ.

23. With the plants of this class the *calyx* is *hypogy-*

nous or *inferior* to the germen, single, deeply divided into several pieces, and generally no corolla.

The place of the calyx is sometimes supplied by hypogynous stamens, bearing scales, or by scales alternating with the stamens; their filaments are separate or united into a single bundle; pistil is single, superior, or with one or more stigmas; stigma simple or cleft, sometimes sessile; fruit one or many-seeded, or a naked seed, superior.

24. The orders of hypocalyciæ are four, from the forty-fourth to the forty-seventh, viz. *amaranthеæ*, *plantagineæ*, *nyctagineæ* and *plumbagineæ*.

44. Amarantheæ	Amaranthus.
45. Plantagineæ	Plantago.
46. Nyctagineæ	Mirabilis.
47. Plumbagineæ	Statice.

MONOPETALOUS DICOTYLEDONES.

25. Dicotyledonous plants with one petal. Divided into three sets, distinguished by the situation of the corolla; viz. *hypocorolleæ*, *pericorolleæ* and *epicorolleæ*.

CLASS VIII.—HYPOCOROLLEÆ.

26. The plants of this department, besides the monopetalous dicotyledonous characters, are further distinguished by their *hypogynous* corolla, that is, the corolla is placed on the receptacle, below the germen.

In these plants the calyx is of one leaf; corolla regular or irregular, bearing the stamens which are definite, and generally alternate with its segments when of equal number; germen superior, in general simple with one style. Seeds either naked, or more frequently in a pulpy or capsular seed-vessel, of one or many cells.

27. Here we have as many as eighteen orders, from the forty-eighth to the sixty-fifth; viz. *primulaceæ*, *utriculariæ*, *pediculares*, *orobancheæ*, and others.

48. Primulaceæ	Primula.
49. Utriculariæ	Utricularia.
50. Pediculares	Rhinanthus.
51. Orobancheæ	Orobanche.
52. Acantheæ	Acanthus.
53. Jasmineæ	Jasminum.
54. Urticeæ	Verbena.
55. Labiatæ	Salvia.
56. Personatæ	Antirrhinum.
57. Solaneæ	Solanum.
58. Boragineæ	Borago.
59. Convolvulaceæ	Convolvulus.
60. Polemoniaceæ	Polemonium.
61. Bignoniæ	Bignonia.
62. Gentianeæ	Gentiana.
63. Apocyniæ	Apocynum.
64. Sapotæ	Sapota.
65. Ardisiaceæ	Ardisia.

CLASS IX. —PERICOROLLEÆ.

28. The pericorolleæ are characterized by a calyx of one leaf, sometimes deeply divided, bearing the corolla, which is monopetalous, though occasionally so deeply divided as to become polypetalous.

The corolla is regular, rarely irregular; stamens inserted either into the corolla or calyx, definite, seldom indefinite; germen simple, superior or inferior; style generally single; stigma rarely divided, fruit pulpy or capsular, of one or many seeds. The insertion of the corolla, characteristic of this class is not very evident, and in some plants, indeed, is denied to exist.

29. There are eight orders of pericorolleæ, from the

sixty-sixth to the seventy-third inclusive; viz. *ebenaceæ*, *klenaceæ*, *rhodoraceæ*, *epacrideæ*, *ericeæ*, *campanulaceæ*, *lobeliaceæ* and *hylideæ*.

66. Ebenaceæ	Diospyrus.
67. Klenaceæ	Sarcolæna.
68. Rhodoraceæ	Rhododendron.
69. Epacrideæ	Epacris.
70. Ericeæ	Erica.
71. Campanulaceæ	Campanula.
72. Lobeliaceæ	Lobelia.
73. Hylideæ	Hylidium.

CLASS X.—EPICOROLLEÆ—SYNANTHERÆ.

30. This class embraces compound flowers, in which *the anthers* are *united*. The florets are tubular, inserted together on a common receptacle, which is either naked, scaly or hairy. Each corolla is *epigynous* or inserted above the germen.

The flowers usually consist of one tubular petal; in some instances flosculous, having a regular limb, almost always divided into five segments; in others ligulate, the limb being extended into a lateral flat expansion, entire or toothed at its extremity; stamens definite, almost always five, with distinct filaments inserted into the corolla; anthers united into a tube, very rarely approximated only; germen inferior, simple, standing on the common receptacle; style one, passing through the tube formed by the anthers; stigma generally deeply divided, rarely single; seed one, either naked or crowned with a border, wing or down; albumen none; radicle inferior; flowers sometimes all flosculous or all ligulate, in the same calyx; or those of the centre are flosculous, while those of the margin are ligulate.

31. This is a very natural class, composed of only three orders; viz. *cichoraceæ*, *cynarocephalæ* and *corymbiferæ*.

74.	Cichoraceæ	Cichoreum.
75.	Cynarocephalæ	Carduus.
76.	Corymbiferæ	Aster

CLASS XI.—EPICOROLLEÆ—ASYNANTHERÆ.

32. The *separated anthers* is made the difference in naming this class and the last, for as in the tenth, the flowers are compound and the anthers united, the present division consists principally of aggregate flowers in which the anthers are distinct.

With the epicorollæ asynantheræ, the calyx is proper, of one leaf, and superior; corolla of one petal, rarely of several united by their broad bases, superior, often regular; stamens definite, inserted into the corolla; germen simple; style usually one, sometimes several, or wanting; stigma simple or divided; seed-vessel either capsular or pulpy, inferior, of one or many cells; with one or many seeds.

33. The orders which constitute this class are five; viz. *dipsaceæ*, *valerianeæ*, *rubiaceæ*, *caprifoliæ* and *lorantheræ*.

77.	Dipsaceæ	Dipsacus.
78.	Valerianeæ	Valeriana.
79.	Rubiaceæ	Rubia.
80.	Caprifoliæ	Caprifolium.
81.	Lorantheræ	Loranthus.

POLYPETALOUS DICOTYLEDONES.

34. Dicotyledonous plants with more than one petal to each flower, divided into three classes according to the situation of the petals, and hence named, *epipetaleæ*, *hypopetaleæ* and *peripetaleæ*.

CLASS XII.—EPIPETALEÆ.

35. Polypetalous dicotyledones, with the petals of a definite number, *epigynous*, standing on the pistil, that is, on the margin of a gland crowning the germen.

The calyx is one leaf, superior ; stamens definite, distinct, epigynous, or inserted into the same part, as many as the petals, and alternate with them ; germen single ; styles several, definite ; stigmas as many ; seeds as many, naked or rarely in a pericarp, the number of whose cells answers to the styles ; embryo minute, oblong, in the upper part of a hard alburnum. Flowers umbellate, with or without a general or partial involucrum, or both.

36. The eighty-second and eighty-third orders, *araliaceæ* and *umbelliferæ*, are the only two divisions of this class ; the former established on the genus *aralia*, and the latter embracing the umbelliferous plants.

CLASS XIII.—HYPOPETALEÆ.

37. Polypetalous dicotyledones with the pistils *hypogynous*, that is, inserted under the pistil, definite ; very rarely indefinite ; mostly distinct, sometimes united at the base into a kind of monopetalous corolla ; rarely entirely wanting.

Calyx of one or many leaves ; very rarely wanting ; stamens hypogynous, definite or indefinite, their filaments usually distinct, but sometimes united into a tube, or more rarely collected into several bundles ; anthers usually distinct ; germen superior, in numerous instances single, in some multiplied ; style one, or several, or wanting ; stigma one or several ; fruit superior, either single, with one or many cells, or more rarely multiplied, each separate pericarp being of one cell.

38. This is a very extensive class, consisting of

thirty-three orders, from the eighty-fourth to the hundred and sixteenth, commencing with *ranunculaceæ*, *papaveraceæ*, &c.

84.	Ranunculaceæ	Ranunculus.
85.	Papaveraceæ	Papaver.
86.	Cruciferæ	Brassica.
87.	Capparideæ	Capparis.
88.	Sapindeæ	Sapindus.
89.	Aceræ	Acer.
90.	Hippocrateæ	Hippocratea.
91.	Malpighiaceæ	Malpighia.
92.	Hypericoideæ	Hypericum.
93.	Guttiferæ	Cambogia.
94.	Olacineæ	Olax.
95.	Hesperideæ	Citrus.
96.	Ternstromiæ	Ternstromia.
97.	Theaceæ	Thea.
98.	Miliaceæ	Milia.
99.	Vites	Vitis.
100.	Geraniaceæ	Geranium.
101.	Malvaceæ	Malva.
102.	Magnoliæ	Magnolia.
103.	Dilleniaceæ	Dillenia.
104.	Ochnaceæ	Ochna.
105.	Simaroubeæ	Quassia.
106.	Annoneæ	Annona.
107.	Menispermoideæ	Menispermum.
108.	Berberideæ	Berberis.
109.	Hermanniæ	Hermannia.
110.	Tiliaceæ	Tilia.
111.	Cistoideæ	Cistus.
112.	Violæ	Viola.
113.	Polygaleæ	Polygala.
114.	Diosmeæ	Diosma.
115.	Rutaceæ	Ruta.
116.	Caryophylleæ	Dianthus.

CLASS XIV.—PERIPETALEÆ.

39. Polypetalous dicotyledones with a *perigynous*

corolla, that is inserted into some part of the calyx, of several petals, sometimes wanting, more rarely monopetalous from an union of the petals into one.

Calyx of one leaf, superior or inferior, more or less deeply divided; stamens perigynous, or inserted into the calyx or corolla, definite or indefinite, for the most part distinct, though sometimes with combined filaments; germen superior, single or multiplied, or rarely inferior and simple; each germen has one or more styles, or none at all; stigma undivided or divided; fruit sometimes single, whether superior or inferior, of one or many cells; more rarely aggregate, superior, each pericarp of one seed.

40. The orders of this class are seventeen, from paronychiæ to rhamnoideæ; viz. *paronychiæ*, *portulaceæ*, *saxifrageæ*, *cunoniaceæ crassulariæ*, *opuntiaceæ*, *&c.*

117.	Paronychiæ	Paronychia,
118.	Portulaceæ	Portulaca.
119.	Saxifrageæ	Saxifraga.
120.	Cunoniaceæ	Cunonia.
121.	Crassulariæ	Crassula.
122.	Opuntiaceæ	Cactus.
123.	Loaseæ	Loasa.
124.	Ficoideæ	Mesembryanthemum.
125.	Cercodeæ	Cercodia.
126.	Onograriæ	Œnothera.
127.	Myrtoideæ	Myrtus.
128.	Melastomæ	Melastoma.
129.	Lythrariæ	Lythrum.
130.	Rosaceæ	Rosa.
131.	Leguminosæ	Pisum.
132.	Terebinthaceæ	Terebinthus.
133.	Rhamnoideæ	Rhamnus.

CLASS XV.—DICLINIÆ.

41. This class consists of those dicotyledonous plants,

the flowers of which are without petals, and the stamens *idiogynous*, or in a different flower from the pistils.

These plants are either monœcious, diœcious, or polygamous. Calyx in each flower of one leaf, or substituted by a scale; corolla none, but sometimes there are scales, or inner segments of the calyx, assuming the appearance of petals. The *barren* flowers have stamens inserted into some part of the calyx, or of the scales supplying its place, definite, or more rarely indefinite, their filaments either distinct, or sometimes united into a stalk proceeding from the centre of the calyx. Germen of the *fertile* flowers simple, or sometimes several, superior or rarely inferior; style one or more, or occasionally wanting; stigma simple or divided; fruit various in structure, as well as in the number of its cells.

42. This class is composed of the eight remaining orders of the system; among which will be found *euphorbiaceæ*, *cucurbitaceæ*, *passifloræ*, *myristaceæ*, and others.

134.	Euphorbiaceæ	Euphorbia.
135.	Cucurbitaceæ	Cucurbita.
136.	Passifloræ	Passiflora.
137.	Myristiceæ	Myristica.
138.	Urticæ	Uritica.
139.	Monimiæ	Monimia.
140.	Amentaceæ	Salix.
141.	Coniferæ	Pinus.

43. We shall here finish our general view of this beautiful and celebrated system, and although but superficially explained, it may probably serve as an easy introduction to a more detailed study of its ulterioı division.

The Jussieuan system from its usual agreement with nature, will undoubtedly continue to claim the attention of the botanical world, not only for its superiority to any previous natural arrangement, but also for its utility, and comparatively speaking, easy application. We have long had the advantage of an excellent *artificial system*, in that of the immortal Linnæan, yet however clear and practicable the plans of art may appear, they can only serve the single purpose of directing us to *the names* of plants. A *natural system*, on the other hand, by displaying the similarity of structure, and the natural affinities which exist between plants of one family and another, not only answers the same object, it likewise presents us with a general and immediate knowledge of the conformation and essential habits of the whole vegetable kingdom.

THE

ANATOMY & PHYSIOLOGY

OF

PLANTS.

PART VII.

EXHIBITING THE ANATOMICAL STRUCTURE AND PHYSIOLOGY OF THE VEGETABLE ORGANIZATION, WITH GENERAL REMARKS ON THE PECULIAR FLUIDS CONNECTED WITH THE ECONOMY OF PLANTS.

THE

ANATOMY AND PHYSIOLOGY

OF

PLANTS.

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1. To set aside all difference of opinion with respect to the definition of a plant, we shall consider vegetables as organized bodies, consisting of solid and fluid parts; and possessing certain functions and properties hereafter to be explained.

In the following pages, we shall therefore have to show the general nature of the vegetable organization, whereby we shall learn, that both the solid and fluid constituents are under the influence of a living principle; that the solid parts frequently change their structure; that the fluid parts, often differ widely in chemical properties, and are not only retained within certain vessels, but are constantly undergoing certain alterations resulting from a specific action of the solids or other causes. We shall, also have to enumerate other circumstances more or less immediately connected with the subject.

ON VEGETABLE SOLIDS.

1. Under the *solids* we must investigate the structure

and functions of the elementary textures, which by their various unions, constitute the different organs of a plant; these are, the membranous and cellular textures, the vascular and glandular structures, and the epidermis.

MEMBRANOUS TEXTURE.

2. The membranous texture is an exquisitely thin, transparent, colourless, film-like membrane or pellicle, which is found in every species of vegetable.

It has been observed by some, that this membrane is composed of organic fibres, but it has not been distinctly proved to be an organized structure.

3. The use of the membranous texture as a component of the organization of plants, is to constitute the basis of the vegetable structure.

In its lax state, it forms the cellular and the glandular textures, and the epidermis; a little condensed, the vascular structure, and perhaps still more consolidated, the ligneous fibre.

CELLULAR TEXTURE.

4. On dissecting a plant, immediately under the epidermis will be found a succulent cellular substance, for the most part of a green colour, called the cellular texture or integument. This is formed from the membranous texture.

In the leaves, the cellular membrane is generally of a green colour, and in the seed-lobes white; while in flowers and fruit, it assumes almost all varieties of shade, according to the species of plant, or circumstance in which it is placed. It is, indeed, the seat of colour.

5. It is a soft and juicy substance, constituting the principal mass of succulent plants, and a great proportion of many parts even of woody plants. It is also very conspicuous in the leaf and flower, with their footstalks, when stripped of the epidermis.

When viewed without the microscope, its appearance is that of an assemblage of small and minute granules imbedded in a soft and glutinous substance, as in the greater part of leaves and succulent fruits, in which last, the fracture often presents an appearance resembling that of a piece of lump-sugar, as in the case of the apple and pear. But when inspected minutely with a good glass, its structure is found to be very different.

6. Many excellent experiments have been made to ascertain the real structure of this tissue, but the description which is said to be most correct, and the most applicable, is that of M. Mirbel.

Malpighi and Grew were the first vegetable anatomists who investigated the structure of the pulp; and their experiments were followed by those of Du Hamel, Saussure, Comparetti, and others, but none have given so clear and plausible a result as M. Mirbel's.

7. Mirbel describes the cellular integument as composed of cells similar to the geometrical cells of a honey comb, although sometimes of a longitudinal figure, and that the divisions of the membrane which forms them, are common to contiguous cells. He further asserts, that these cells communicate with each other by means of pores and slits, about the three hundredth part of a line in diameter; and that through these perforations the vegetable juices they contain, are slowly transferred.

Mirbel likewise relates, that the pores are surrounded with borders; and that the perforations are few, and scattered in the true hexagonal cells, but numerous and arranged transversely in regular series in the longitudinal.

8. In succulent and many other plants, according to Mirbel's theory, the cellular substance consists of two parts; viz. cells, and the fluid contained therein: the former he terms the *herbaceous tissue*, and the latter he has denominated *parenchyma;* but if we are to consider the cellular integument as a *simple* solid component of the vegetable organization, we must pronounce such a distinction inadmissible.

In viewing the cellular substance as the *pulp* or chief mass of many plants, we may then very properly divide it into the cells or herbaceous tissue, and into a fluid or parenchymatous material; using the term parenchyma as expressive of something intermediate of a solid and fluid.

9. We are not yet satisfactorily convinced of the true nature of the cellular membrane, but of this we are well acquainted, it enters, in one form or another, into the composition of almost every vegetable organ.

The roots, the stem, the leaves, and every part of the plant, even the pollen itself, are formed of this cellular texture, filled with different juices, according to the intention and economy of the part.

VASCULAR SYSTEM.

10. The vascular system consists of numerous hollow tubes of different forms and structure, which are destined either to convey the circulating juices from one

part to another, or to retain the proper juices secreted by the plant.

The vascular portion of the vegetable structure composes a kind of net-work, owing to the free communication or asastomosis of the vessels with one another, which pervades almost every part of the plant. The particular vessels vary both in form and in the diameter of their calibers. They are composed of the membranous texture, are firm, comparatively thick, and somewhat pellucid.

11. The vessels appear to constitute the bulk of all plants, and under an idea that some conveyed sap and others air, the phytologists of former days, called the former sap vessels, and the latter *tracheæ* or air tubes. This opinion is now entirely rejected, and many beautiful experiments have yielded ample evidence to substantiate the division into *common vessels* and *proper vessels*.

The former are stated to convey the sap or nutrient fluids from one organ to another; and the latter to retain the proper juices formed from the sap by the vital powers of the plants.

12. The *common* or *sap-vessels* are most numerous, usually occupying the chief substance of the internal parts, and generally found to be of a *spiral* form.

In a young branch of a tree or shrub, or in the stem of an herbaceous plant, are found, ranged round the centre or pith, a number of longitudinal tubes or vessels, of a much more firm texture than the adjacent part, and when examined minutely, they often appear to have a spiral character. They are in fact, the *common* vessels. They may also be discovered in the young twigs and leaf-stalks of the elder, syringa, and many other shrubs, as well as in numerous herbaceous plants, as the peony, and more especially many of the lily tribe. If a branch or stalk of any of these plants be partially cut through or gently broken, and its divided portions slowly drawn asunder, the spiral coats of their vessels will unroll, exhibiting a curious spectacle even to the naked eye.

13. Considerable difference in opinion, has always been entertained concerning the real nature, form and structure of the common vessels. From what we can collect upon the subject, it would appear, the specific varieties of *spiral, annular, beeded* and so on, frequently mentioned in modern authors, are nothing more than common sap-vessels under different states of transformation.

It appears, that the common vessels, though they may originally have a spiral character, do not continue the same. By the action of the vital principle on their structure, they not only sometimes acquire the annular or other specific quality, but are in their regular turn, completely transformed to proper vessels, in the same manner that the liber is annually converted into outer bark.

14. The *proper vessels* are simple tubes formed of imperforated membrane. They are cylindrical, firmer and larger than the central, and are generally disposed in the cellular part of the bark.

Entire vessels may be found in the young shoots of almost every kind of plant; and in the fasciculated state, may be readily detected and examined by the aid of magnifying glasses, in the leaf-stalks of the common fern, in the arrow-head, and in the common hop.

15. The proper vessels are intended to convey the proper juices of the plant.

They are always found to contain the peculiar or proper juices of the plant. Thus, the juice with which they are filled is milky in the various species of spurge, in the common dandelion, and several other kinds of syngenesious plants. It is yellow or orange-coloured in celandine, in puccoon, and many others. It is red in patience dock, and green in the periwinkle. The substance of the proper juice is gummy in the cherry, plum and peach; it is resinous in the fir and juniper, and pine; it is the astringent principle of the oak and willow; the aromatic oil of the cinnamon, and so on, with a variety of plants.

16. To draw out a general view of what we have said on the vascular system, it seems there are, in fact, but two sets of vessels—the common or sap-vessels of the interior parts, and the proper or entire vessels of the bark.

Many illustrative experiments have been made to discover the actual function of each set, the results of which very faithfully prove, that the sap or nutrient fluids of the plant are conveyed by the common vessels to the leaves, where the superabundant watery portions are exhaled, and the remaining juice altered in its nature by their organization, and conveyed by an appropriate apparatus, into the proper vessels of the bark. The common vessels, therefore, may be considered as the *ascending* vessels, and the proper vessels as the *descending*. This course of the fluids is further proved, by the sap always being found ascending in the spring, and descending in the autumn, and by there being no kind of communication with the vessels of the bark and of the centre.

GLANDULAR TEXTURE, ETC.

17. In addition to the membranous, cellular, and vascular structures and epidermis, there are also glandular, ligneous, and other textures, which are sometimes enumerated as solid components of the vegetable organization. Their names are sufficient to imply their structure and general functions.

THE EPIDERMIS.

18. In animals, we find there is an exterior covering

to their bodies, called the cuticle or scarf-skin, so in vegetables, we detect an external envelope or integument, extending over their whole surface, called the *epidermis* or cuticle.

In the currant-bush, the epidermis is very readily discernible, being that part which is constantly peeling off from the older branches. It may also very easily be detected in most plants by maceration, boiling, or putrefaction; being, if not absolutely incorruptible, much less prone to decomposition than the parts it covers.

19. Although the epidermis is extended over the whole surface of the plant, it is not of equal consistence throughout.

In the root and trunk, it is a tough and leathery membrane, or it is a crust of considerable thickness, forming a notable portion of the bark, and assuming some peculiar shade of colour which it seems to acquire from age; while in the leaves, flowers, and tender shoots, it is a fine colourless and transparent film not thicker than a cobweb.

20. Du-Hamel describes the epidermis as being formed of a multiplicity of fine and delicate fibres, placed in a parallel direction, and inosculating at regular intervals, or united by means of small and lateral fibres so as to constitute a net-work, the meshes of which, are filled up with a thin and transparent pellicle. Throughout the whole cuticular surface, he relates, every part is pierced with pores, which permit the mouths of the absorbing, transpiratory and air vessels to open to the air.

Comparetti also describes it, as composed of fibres interwoven so as to form hexagonal meshes, the areas of which, are filled up with opaque or diaphanous vesicles, inflated as if extended with air or water, and having a small black point in the centre.

21. Bauer, on the contrary, conceives the structure to be altogether cellular, and varying in different plants.

So far as the experiments go, which have been instituted with a view of ascertaining the structure of the epidermis, we must admit the presence of cellular structure, and also be assured of the various results which have ensued from different experiments on the epidermis of different parts of a plant, and also on the epidermis from the same plant, but at another period of its growth.

22. Dr. Thomson joins his opinion with the elder Saussure, that the epidermis is a fine, transparent, unorganized pellicle.

In their idea of this texture, the pores, by which the insensible perspiration escapes, are so minute, that they are quite invisible, and with difficulty permit the passage of air through them.

23. Saussure describes it, as constituting a bark of two layers; the interior layer composed of a net-work, which he calls the cortical net-work, interspersed with a multiplicity of what he calls cortical glands, and the exterior layer consisting of a fine and transparent membrane, which he regards as the true epidermis, capable of being partly detached but totally destitute of organization.

The cortical glands, Saussure describes as being small and oblong or circular bodies, encompassed by a fine thread or fibre, not immediately attached to them, but separated by a narrow interval, and communicating with the cortical net-work. *Observ. sur l'Ecorce des Feuilles, &c.*

24. Mirbel will not allow the epidermis to be a distinct organ; but supposes it to be the external layer of

the cellular integument, altered by exposure to the air and light.

Although we cannot deny the extreme resemblance which the cuticle bears to cellular tissue which it covers, it is, nevertheless, a distinct organ: the simple exposure of the cellular membrane will not form epidermis, but on the contrary, it is more apt to be destroyed by atmospheric influence, an evident refutation of Mirbel's opinion.

25. From the generality of experiments, the cuticle is proved to consist either of a simple and individual layer, as in the epidermis of most plants, or of several distinct and separate or separable layers, as in some.

In the paper-birch, Du Hamel counted six or more. The same thing is also to be observed in the stem or branches of the currant; the outer layer of the epidermis of which, after acquiring from age, a tinge of brown, splits into a number of fragments that spontaneously detach themselves to make way for a new layer, which on its first exposure to the air, is of a fine and delicate green. If this layer is now stripped off, it will be found to invest one or two more, which are yet, indeed, colourless and embedded in pulp, being only in a state of preparation for future exposure, when the layer that is now exterior shall have detached itself in its turn.

26. The precise structure of the cuticle is not yet sufficiently proved; but whatever may be its real nature, it is very evident, it will admit of the passage of fluids from within as well as from without, in a due and definite proportion in every plant; consequently it must be porous, and the microscope shews what reason would teach us to expect, that its pores are different in different kinds of plants.

In very succulent plants, as the American aloe, a leaf of which being cut off, will lie for many weeks without drying entirely, and yet when partly dry, will become plump again in a few hours, if plunged into water, the cuticle therefore must be very curiously constructed, so as to admit of ready absorption, and very tardy perspiration.

27. The epidermis allows also of the passage of air, as is proved by experiments on the functions of leaves.

28. The epidermis is usually transparent and colourless, particularly in young and succulent twigs, and consequently, in such cases, light is very readily admitted.

When the epidermis is applied very closely to the cellular integument below it, which is the case in herbaceous plants and in young stems and branches, the greater portion of the light is transmitted through the cuticle and reflected from the cellular layer.

29. In trees and shrubs which annually renew their epidermis, it is found, when it begins to peel off, to become more opaque, and does not transmit the light, but reflects it from its own surface.

By way of illustration, the whole cuticle of the plane is dark coloured, while the new is of a light green hue, and the old branches of the currant are of a dark brown, while the young shoots are of a very light colour.

30. In the permanent parts of the woody and perennial plants, the old epidermis often disengages itself spontaneously, but in herbaceous plants, and in the leaf, flower, and fruit of other plants, it never disengages itself spontaneously.

Where the cuticle spontaneously separates, as in the currant, birch and plane-tree, in which it appears to be undergoing a continual waste and repair, it is again regenerated, even though destroyed by accident; but if it does not separate spontaneously, it is not renewed when once destroyed.

31. The last sentence intimates, that it is not usual in all plants for the epidermis to separate spontaneously, but in every case it is constantly renewed, or in other words, it is continually accumulating.

Where it remains, the old cuticle cracks as the diameter of the stem or branch increases; it is then gradually pushed outwards, and the accumulation of successive layers in this manner, forms the rugged coats which are peculiar to many trees, as the elm, the oak, and others.

32. The vegetable epidermis is capable of extension, but not to that extent which has been supposed.

As there is a constant renewal of cuticle, there must be a proportional growth of its parts, so that it is not simple extension which enables it to cover the whole surface of the plant, but a new cuticle is added to produce this effect.

33. The use of the epidermis is, to defend the interior parts from the action of the air, and to regulate the perspiration and absorption of the plant.

34. The powers of the cuticle in regulating these functions is fixed according to the nature of the plant.

In succulent plants, which require much moisture to be retained in their leaves, the cuticle is so constructed as to assist absorption, and rather to prevent transpiration, as we have already instanced with the American aloe; on the other hand, in plants which do not require much moisture, the epidermis is accordingly constructed.

35. Probably the most important intention of the

epidermis is, to prevent the action of the atmosphere from destroying the plant, by an undue influence on the vitality of the inner bark.

If it so happen, that the inner bark should be injured to any great extent, so that the air gets access to it, exfoliation and the death of the part and sometimes of the whole plant follow, the cuticle forming, as it were, a fine but essential barrier between life and destruction.

ON THE CONSERVATIVE ORGANS.

1. We have hitherto given a general outline of the simple textures which enter into the composition of vegetables. We have now to consider the structure and use of the conservative organs, formed more or less, by a combination of the elementary textures.

ROOT.

2. The roots of plants, to the most common observer, must appear of a very different structure; but we will first repeat, most roots are divided into the main body or *caudex*, and the *radiculæ* or rootlets.

The varieties in their figure have been noticed in the enumeration of their names, and other peculiarities mentioned in the terminology or Language of Botany.

3. With respect to structure, the body of the root of *trees*, may be regarded as a production and elongation of the trunk beneath, and is constructed of the same textures, disposed nearly in the same manner.

Exteriorly is placed the cuticle, beneath which is the cellular tissue of the bark, with its accompanying cortical layers, the vessels of which have a reticular form. The bark is thick; its vessels frequently contain the *proper juice*, as those of the trunk, and its cells are alike filled, in some roots, with concreted matter. From the bark to the centre, the two orders of transverse septa are observed to proceed; and are interposed between the rays of vessels, as in the trunk. These vessels, in the root, are often larger than those of the trunk, and instead of a pith, the central part of the root is commonly occupied by vessels.

4. In *shrubs*, the arrangement of the parts of the root, is commonly distinct, and corresponds with that in the trunk.

5. The structure of *herbaceous* roots is very different to either of the preceding, not only in form and appearance; but also in their internal organization.

The skin of these roots is of a very different colour and thickness. In the early state, it is represented by Grew, as an extension of that which covered the radicle of the seed; but in more aged plants, the exterior covering is derived from the cellular tissue of the bark. It is usually, if not always, compounded of vessels and cellular tissue; beneath the skin, a cortical texture is observed, making up in some herbs, the greater portion of the root, while in trees it is commonly thin. It is composed of cellular tissue and fasciculi of vessels variously dispersed through it, and forming a net-work, the meshes of which are filled with the tissue. In these vessels, various gummy and resinous juices are frequently contained. The woody part of herbaceous roots is described as consisting of vessels and cellular tissue.

6. From these remarks, we learn that the roots of all vegetables, in their internal structure, do not differ very materially from the stem or herbage.

7. The root being the part by which plants are

attached to the ground or to the substance on which they feed; we find they all agree in being fibrous at their extremities, and it is by these fibres chiefly, that they are fitted to draw nourishment.

All parts of the root possess the power of emitting rootlets or fibres when they are placed in favourable circumstances; which fiibres are made up chiefly of the ligneous texture of the stem.

8. The fibres are therefore, the organs which *absorb* nutriment from the earth, and convey it to the larger root, by which it is transmitted to the plant itself.

Hence, as Du Hamel observed, the earth is exhausted of its nutrient matter, chiefly where these capillary fibres are distributed, and not in the neighbourhood of the larger roots.

9. According to Du Hamel, the natural direction of most roots is the perpendicular; but if they meet with any obstacle, they then take an horizontal direction, not by the bending of the original shoot, but by the sending out of lateral shoots. The same effect also follows, if the extremity of the root is cut off.

Du Hamel made some cherry-stones, almonds and acorns to germinate in wet sponge; and when the roots had grown to the length of two inches, he then placed them in glasses as bulbous roots are placed, so that the extremity of the root touched the water. Some were previously shortened by the cutting off of a small piece from the point; others were put in entire. The former sent out lateral shoots, but elongated no farther in a perpendicular direction; the latter descended perpendicularly to the bottom of the glass. He cut off also the tips of some roots vegetating in the earth, and had the same result; the wound cicatrized, and the root sent out lateral divisions.

10. The same phytologist also made many obser-

vations and experiments on the effects of the soil, in determining the form of roots.

All roots that spring from seeds, in his opinion, have a spindle-shape, if they are made to grow in soil that is easily penetrable.

STEM.

11. The stem is that part which supports the foliage or fructification, consisting of a number of fine capillary tubes, through which, during the time of growth, sap is carried from the root throughout the whole plant.

The varieties of stem have been previously mentioned in the Elements, from whence we shall infer, an equal variety must exist in their structure.

12. A perfect stem is said to consist of six parts; viz. the epidermis, the outer bark, the inner bark, the wood, the alburnum, and the pith.

The *epidermis* is a covering common to all parts of the plant; consisting sometimes of one layer, and sometimes of several, with the other properties mentioned, in speaking of the epidermis as one of the elementary textures.

13. The *cortex* or *outer bark* is the second integument or covering of the vegetable, the texture of which, in its component parts, resembles that of the wood.

Thus the bark appears constructed of cellular tissue, and of vessels collected into sets, which at first are straight, and run parallel to each other; but by the subsequent augmentation of the parts within, are separated at certain places, and touch only at a few points, so as to form a reticulated appearance.

14. In the annual shoot of trees, only a single ring

of vessels is observed, and these, with the tissue in which they are placed, form the *cortical layers* of that period.

Within this cortical layer, a new production of vessels and of cellular tissue takes place, which being annually repeated, constitutes the series of layers of which the bark is ultimately composed.

15. The new annual layer is of a more membranous, juicy, and flexible nature, and is commonly called the *liber* or *inner bark*.

There is every reason to believe, that the liber is the most important part of the bark. This is evident, not only from its annual re-production, but also from the injury which trees receive, when they have been deprived of this layer.

16. Next to the bark is placed the *wood*, constituted, like the bark, of vessels and cellular tissue.

Like it, too, it consists in the young plant, and in the annual shoot of the older one, of a single ring of vessels, which immediately surrounds the pith. In the following year, a new ring of vessels is formed around the first, and in every succeeding year this process is repeated, so that the wood consists at last of a series of rings enclosing each other, the number of which denotes the age of the tree.

17. The outer ring of new formed vessels is more succulent than those of older growth, and is generally of whiter colour, whence it has received the name of sapwood or *alburnum*.

The vessels which are annually formed and constitute the alburnum, are disposed in *radii* which extend more or less completely from the circumference to the centre. In some trees these vessels are more numerous than in others; and in the process of vegetation they frequently undergo great alterations in size and external figure, losing the spiral character, and becoming straight or proper vessels.

18. The *pith* is the soft part situated in the centre of the wood, commonly surrounded by a ring of vessels, but sometimes, in part, by thickened cellular tissue.

In the new productions of trees, the pith is found to consist of oval, green, and succulent bladders, which are very similar to those of the bark and wood. At the expiration of one or two years, more or less, these bladders become empty, exsiccate, assume a spherical shape, and finally take the consistence and the colour of pith, which, in the greater number of vegetables, is of a white or cream colour.

19. The use of the pith has been a subject of critical dispute among botanists, for many years. It appears, however, to be essential to the growth of other parts in their young state.

In most plants, it gradually dies away as they approach to maturity; and in old trees it is almost entirely obliterated. In those plants which have hollow stems, the central cavity, though not filled with pith, appears to be lined with it.

20. The different species of stem, as the stalk, the scape, the culm, and so on, although they do not possess the exact characters we have mentioned, they all partake of them in a measure, or at least, a modification of them.

THE LEAF.

21. The leaf is a very important part of vegetables, consisting of an epidermis, parenchyma, and numerous beautiful and delicate vessels.

22. The *epidermis* is merely an extension of the general covering of plants, though unquestionably, more or less delicate in comparison to the epidermis of the stem and other parts.

If a leaf is taken and torn asunder, either in a transverse or longitudinal direction, fragments of the epidermis, a fine and transparent pellicle, will be seen projecting from the edge of the torn part.

23. The *parenchyma* is a green and pulpy substance constituting for the most part, the mass of the leaf, interspersed with the fibres or vessels of the leaf.

24. The *vessels* of the leaf are the prolongations of the petiole, divided into an immense number of ramifications, mutually embracing and intersecting one another, and forming a sort of fabric similar to a piece of fine net-work. This net-work, however, is double.

The upper set of vessels corresponding to the upper surface of the leaf, are considered as air vessels, through which the perspirable matter is discharged; whereas, the lower or under set, are imagined to receive, prepare, and convey, the moisture imbibed from the rising vapours of the earth, throughout the whole plant.

25. There have been innumerable opinions advanced to explain the use or functions of leaves; but whatever may be their precise intention in the vegetable economy, it is generally agreed among botanists, that a different office belongs to their upper and under surface, as hinted in the last note.

26. The upper surface is usually admitted as the organ of respiration.

Thus it is justly remarked, that the upper surface of the leaves in some plants, strongly repels moisture, as in cabbage leaves, where the particles of rain have the appearance of globules of quicksilver. It appears, likewise, from actual experiments, that the leaves of many plants, when they were laid with their upper surfaces upon water, withered almost as soon as in the dry air, though the same leaves, when they were placed with their under surfaces upon the water, continued green many days.

27. The under surface has been proved, by repeated experiments, to be the part particularly destined for absorption.

28. Admitting this relation of the structure and functions of leaves to be correct, their grand use to the plant, is to assist in supporting vegetable life, by exhalation on the one hand, and absorption on the other.

In our remarks on the passage of the fluids from the common vessels to the proper vessels, we have also shown a very important circumstance connected with the leaf, wherein it appears, the leaves have the power of secreting from the common juices of the plant, peculiar and sometimes powerful fluids or even substances, as the resin of the fir, the gum of the Egyptian thorn, and so on.

ON THE REPRODUCTIVE ORGANS.

1. Having spoken of the root, stem and leaf, we will now analyze the reproductive organs, or those parts which are necessary for the reproduction of the individual; viz. the flower and the fruit.

The parts, therefore, which will come under our present attention, will be, the calyx, corolla, stamen, pistil, nectary, seed-vessel, seed, and receptacle.

OF THE CALYX.

2. The calyx is said to be constructed, like the leaves, of a cuticle, a pretty thick cellular tissue, and of vessels, all of which exist in the foot-stalk, and are derived from the common textures of the plant.

This organ of the flower assumes a variety of forms. It is sometimes a single leaf, and has a tubular form; in others, of many leaves, giving it a great change in appearances. Its colour is usually green but sometimes coloured.

3. The purport of the calyx, is unquestionably, to protect or assist the economy of fructification.

Its principal use is said to be, to protect the infant flower, which observation contributes to confirm. In some instances, the calyx falls when the flower has expanded or the fruit has set; in others, it continues till the seed is mature; while in a few instances, the fruit or seed is formed within it, to which it becomes a permanent receptacle or covering, and performs the office of a seed-vessel.

OF THE COROLLA.

4. With regard to the structure of the corolla, it is described as composed of the same textures as the common leaf, as is distinctly seen in the thicker varieties of it.

Grew showed it to possess spiral vessels, a proof, as Du Hamel observes, that it is partly derived from the woody textures of the plant, since such vessels are not found in the bark.

5. The undoubted object of the corolla, is to defend the interior organs of the flower from the changes of the atmosphere, and to assist either directly or indirectly,

in moderating or increasing the influx of light and heat on the fecundating organs.

OF THE STAMEN.

6. The stamen may be described as consisting of the filament, anther and pollen.

7. The *filament* is said to originate from the woody texture, being formed of vessels and elongated cells. But as they derive their origin sometimes from the corolla, they must necessarily be composed of the same parts.

It is well known that, by cultivation, many single flowers become double. The stamens, in these cases, are converted into petals.

8. The *anther* is a little case or sac, formed by a thin but vascular membrane, and filled with the fecundating dust or pollen.

The anther is of very different size, figure and colour, in different flowers; and its attachment to the filament is not less subject to variation.

9. The *pollen* or *farina* is the subtle powder upon which depends the fertility of the flower.

In the Language of Botany (p. 82.) we have alluded to the different forms of the pollen, in different plants; and it only remains here to observe, that each particle is a distinct and perfect production capable of assisting in reproducing the individual.

10. The stamen has been chosen by Nature, as one of the two principal organs, to which is entrusted the important office of continuing the species.

The object of the flower is solely directed to the production of seed; consequently its parts become gradually developed; the sap of the plant with other agents bring these to maturity, among which, her solicitous care is to mature the stamen. As soon as maturity is effected in this organ, the pollen is no longer moist, but of a subtle nature, and being acted upon by heat or other causes, bursts forth from the anther, and is dispersed upon the summit or sides of the pistil, there to be submitted to the laws of vegetable life, and to impregnate the embryo seeds in the germen.

OF THE PISTIL.

11. The pistil has already been represented as consisting of the germen, style, and stigma.

12. The *germen* or *ovary* consists at first of a simple cellular structure, which, at a later period, assumes the form of distinct cells; but its shape, size and structure differ in different plants.

It is the part in which the seed is formed, and if you examine it, in many plants, you will readily detect viscicles or small bladders, which are, in fact, the rudiments of the seed, hereafter to be perfected by the action of the pollen.

13. The *style* is the part of the pistil situated upon the germen, consisting of a small tube communicating with the germen from the stigma.

It is through the tube of the style, that the pollen passes from the stigma to fertilize the seed in the germen. It is not, however, altogether essential to the formation of a perfect flower, as we have before observed.

14. The *stigma*, as described in the Elements of Botany, is a small and glandular body situated at the top of the pistil.

At the period of fructification the stigma is rendered moist by a peculiar secreted fluid, the object of which, appears to be, to detain the pollen by adhesion.

15. The pistil is the second grand organ of fructification, on which depends the perpetuation of most plants.

In a note on the use of the stamen, we have alluded to the discharge of the pollen on the pistil. We have now to mention, that as soon as the pollen arrives at the summit of the pistil, a specific action is excited, the influence of which is communicated through the tube of the style to the germen; the embryo seeds, in consequence, receive a fresh and necessary principle which causes their developement, and makes them capable of continuing the species. In this manner has Nature provided for the propagation of most plants, the simplicity and beauty of whose laws, we must all confess, are faithfully delineated in this duty of her vegetable economy.

OF THE NECTARY.

16. The nectary is usually a part of the corolla, but very different in its shape, structure, and general appearance.

Sometimes it resembles a tube or cylinder; sometimes a petal, a pore, or gland. In others it is a kind of slipper, or cowl, while in another set of flowers, it may be a tuft of hairs or an assemblage of long and slender threads on a small and minute scale.

17. The chief purpose or intention of the nectary, is to prepare a secretion which is generally sweet, and hence called honey.

OF THE SEED VESSELS.

18. For a general description of the various kinds of

seed vessels, it is only necessary to refer to what has been given on them in the Elements of Botany. Whatever may be their character, they are formed from the germen or ovary, and consist of the solid components of that part, in a peculiar state of transformation.

The changes of the ovary to a seed vessel is a very gradual process. After the embryo seeds have been acted upon by the pollen, the calyx, corolla, stamens, and even style of the pistil, commonly fade and fall; the ovary alone remains, and undergoes very different changes of form, structure and properties in different plants, until it becomes the fruit or seed vessel. Thus the pear, the apple, the peach, and so on, during the blooming of the flower, were nothing more than the small germen of the pistil.

19. The valves of the *capsule*, but particularly the partitions by which it is divided into cells, are composed of a thin and skinny membrane, or of an epidermis covering a pulp more or less indurated, and interspersed with longitudinal fibres.

The usual parts into which capsules are divided, has been mentioned under the Language of Botany.

20. The *pods* and *legumes* are composed of an epidermis enclosing a firm but fleshy pulp, lined for the most part with a skinny membrane; and of bundles of longitudinal fibres, forming the seam.

21. The *drupe* consists of an epidermis enclosing a fleshy pulp, which is sometimes so interwoven with a multiplicity of longitudinal fibres as to seem to be formed wholly of threads.

22. The *pome* is composed of a fine but double epidermis, or, in other words, of two skins, enclosing a soft and fleshy pulp, with bundles of longitudinal fibres passing through it, contiguous to, and in the direction of its longitudinal axis.

23. *Berries* are composed of a very fine epidermis, enclosing a soft and juicy pulp.

24. The scales of the *strobile* are composed of a tough and leathery epidermis, enclosing a spongy but often highly indurated pulp, interspersed with longitudinal fibres that pervade also the axis.

OF THE SEED.

25. In the Elements and Language of Botany we have mentioned the nominal divisions of a seed, but it remains for us now to detail their structure and functions in an anatomical and physiological view.

The structure and properties of the seed of plants, has furnished an extensive field for investigation and experiment. The celebrated Gœrtner, has probably, deduced the most correct inferences, many of which, if not all, agree with the few observations we have to make upon the subject.

26. In the present place, seeds may be conveniently divided into two principal parts; viz. the integuments and nucleus, or embryo and its envelope.

The first will include the *umbillical cord*, *hilum* and *seed coats*; and the second, the *albumen*, *vitellus*, *cotyledon*, *radicle* and *plumelet*.

27. The *umbilical cord* is the small peduncle or stalk by which a seed is attached to the pericarp or seed-vessel.

It is through the umbelical cord the vessels are supposed to pass to nourish the seed, for there are no seeds without it.

28. The *hilum* or *eye* is the external mark or scar, formed by the breaking off or separation of the stalk or umbilical cord.

29. The *seed-coat* is the external covering, and according to its situation, it is said to be either an *exterior* or *interior* integument.

These integuments, are sometimes however, enveloped by an additional covering called the *pellicle* or seminal epidermis.

30. The *exterior integument* or *testa* is the original cuticle of the nucleus, not easily separable in the early stages of its growth, but detachable when the fruit is ripe, when it is generally of a membranous or leathery texture; though sometimes soft and fleshy, and sometimes crustaceous and bony.

When a seed is furnished with two proper coats, the testa or shell is the outer one: when there is only one coat, this is accounted the shell; and when there are more than two coverings, the second from the nucleus is named the shell.

31. The use of the testa or shell is, to contain and give form to the kernel or seed.

It is deemed an essential part of the seed, because the kernel, which originally was wholly fluid, could not have been formed unless a coat had been placed round it. It is a part, also, never wanting.

32. The *interior integument* lines the testa and immediately envelopes the nucleus. Like the outer coat, it consists only of one piece, of a soft and pulpy texture till the embryo has reached maturity, at which period it becomes membranaceous, and may generally be separated with ease from the nucleus.

It is said to derive its origin from the interior portion of the umbilical cord, which after perforating the outer coat, disperses into a multiplicity of ramifications connected by a fine membrane.

33. On the outer surface of the interior covering, is found in many, but not in all seeds, a small deep-coloured areola, or a small spongy or callous tubercle, called the *chalaza* or internal scar.

It is placed near the external scar, or diametrically opposite, as it frequently occurs that the umbillical cord, after penetrating the testa, passes on without ramifications to the opposite side of the cavity, and there forms the *chalaza*, as in the case of the cherry.

34. The *nucleus* is that part of the seed which is contained within the proper integuments, consisting of the albumen, the vitellus, the cotyledon, the radicle and the plumelet.

35. The *albumen* is that portion of the seed which invests the cotyledons, resembling both in consistence and colour, in many seeds, the white of a boiled egg.

Although the albumen is wanting in some seeds, it must be admitted, when present, to be a substance of considerable importance. It supports and defends the embryo, whilst this essential part is imprisoned in the seed, and serves for the nutriment of the embryo, when it begins to germinate.

36. The *vitellus* is an organ of a fleshy but firm texture, situated, when present, between the albumen and embryo; to the former of which it is attached only by adhesion, but to the latter by incorporation of substance, so as to be inseparable from it except by force.

The vitellus is said not to rise out of the earth during germination; but like the albumen, seems destined to afford nutriment to the embryo.

37. The *embryo* is the most essential part of a fertile seed, considered to be formed from a more or less perfect medulary point, called the *corculum*, which exclusively forms the *nova progeneis*, or new plant, and to which all the other parts are added for its temporary use only. It is commonly said to consist of the *cotyledon*, *radicle* and *plumelet*.

38. The *cotyledon* or *seed-lobe* is a very necessary portion of the seed, which, together with the radicle and plume, form the body of the embryo.

Some seeds are said to be without this part, and hence called *acotyledones*; others have one, called *monocotyledones*; a third set, *dicotyledones*, have two lobes; while those seeds having more than two lobes, are denominated *polycotyledones*.

39 The cotyledons, in the most perfect seeds, are formed of cellular tissue, through which vessels are every where distributed, covered with a very fine pellicle or coat, which prevents their adhering to each other or the plume. The cells of the cellular structure are generally filled with albumen.

The cellular structure of the cotyledon is well displayed in a slice

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of a lobe of the recent bean; and it is easily seen in a thin slice of almost any mature seed, if it be held up to the light after it has been soaked in water.

40. The use of the cotyledon is, to supply the plume with nourishment until its root is sufficient to support it by nourishment from the earth.

Accordingly we find, upon planting, for instance, a dicotyledonous seed, as the lupin, that after some days it will protrude above the ground in the form of two thick, orbicular fleshy leaves. These, before the seed germinates, composed its two sides or cotyledons; the juices they contain in this leaf-like state, go to the nourishment of the young plant, and by the time that they are exhausted and dead, the root is strong enough to depend on its own exertions for support.

41. The *radicle* or *rostellum*, is by far the most constant part, not only of the embryo, but of the whole kernel, for it is to be found in those seeds which have no other vestige of the embryo.

Its most simple form, is that of a white point or speck upon the surface of the nucleus, though it is also often to be found in the form of a cylindrical or conical process.

42. The *plume or plumelet* is so called, from its resembling, in some examples, a small feather issuing by a small stem immediately from the radicle; in other words, it is the first bud of the new plant.

In plants which possess but one cotyledon, it is very generally wanting, and even in those having two lobes, it is not unfrequently absent. In most of the latter sort of seeds, however, the plume is met with placed on the top of the radicle, lying between the cotyledons, by which it is variously compressed and folded on itself.

43. We have now described the different organs of

the nucleus, through all of which, vessels are distributed, to form a medium of communication from one part to another.

In some cases, the vessels are seen to branch off on each side from the radicle, and spread themselves by innumerable ramifications through the cotyledons. From the radicle, vessels also pass upwards to the plume.

44. The intention of the seed, as a perfect body, can require no particular remarks for the present; at another time, we shall introduce it under an article on germination.

RECEPTACLE.

45. The receptacle, as we have already observed, is the part to which the flower or fruit is attached, and as these parts do not have one common situation, receptacles necessarily differ in their anatomical structure, according to the plants to which they belong.

In a general way, they are composed of the same texture as the parts from which they proceed, only in a different state of modification.

ON THE APPENDAGES TO PLANTS.

1. The subject of our present treatise, will be the anatomy and physiology of those extra organs, which have been previously arranged as appendages to the vegetable organization, viz. the branch, the bulb, the bud, the petiole, and so on.

THE BRANCH.

2. The branches being nothing more than elongated members from the main stem, exhibit nearly the same appearance on dissection, as the trunk from whence they proceed.

Their apparent use to the vegetable economy is, to afford a more extended surface for the evolution of leaves.

THE BULB.

3. Bulbs, we must first remember, are of two kinds; the one called radical or root-bulbs, and the other caulinar or stem-bulbs.

4. The *radical bulbs* display themselves, upon anatomical enquiry, to be of three kinds; all formerly mentioned under the names of *solid, scaly, and coated bulbous roots.*

The *solid bulb* consists of an external, fibrous, or membranous envelope, separable into two or more layers, and internally of a fine epidermis enclosing a firm but succulent pulp, in the centre of which are lodged the rudiments of the future plant. The *coated bulb* is formed of a number of concentric layers, gradually diminishing from the circumference to the centre; the outer layer may be either a fine and delicate membrane, or of a thick and leathery coat, and the interior layers of a fine epidermis enveloping a succulent pulp, united together by a viscid juice. The *scaly bulb* will be found to consist externally of the base of the sheathing part of the root-leaves of the former year, transformed into the shape of scales, and internally of the rudiments of the root-leaves of the following year, with the incipient stem and stem-leaves occupying the centre.

5. The *caulinary bulb* is always of a scaly description,

resembling the bud in the structure of its scales and the developement of its parts.

6. The common apparent object of both radical and caulinar bulbs, is the perpetuation of the plant.

THE BUD.

7. The buds of plants, whether producing leaves only, flowers only, or both, consist of the necessary constituents in an undeveloped state.

They are usually composed, externally, of a number of concave and overlapping scales, with others of a more delicate nature internally, and are connected with the stem or branch by means of a short fleshy pedicle.

8. Buds are not an essential part of the plant, but when present, their indubitable office is to protect the germ in its infant state.

All plants are not furnished with them; annuals have none, and even trees and shrubs, to which they are proper, do not produce buds in hot climates; because, perhaps, in those climates, the tender germ requires no covering to protect it. In this, and all cold countries, trees and shrubs are universally furnished with them, and without the intervention of a bud, no new part is added to the plant.

THE LEAF-STALK OR PETIOLE.

9. This part is nothing more than a prolongation of the branch or stem, exhibiting upon dissection, an epidermis, a pulp or parenchyma, and bundles of longitudinal

fibres; the peculiarities of which. are more or less depending on the plant by which they are produced.

THE FLOWER-STALK OR PEDUNCLE.

10. The flower-stalk is also a simple elongation of the stem or branch, consisting of an epidermis, parenchyma, and bundles of longitudinal fibres, originating in the stem or branch, and passing through the whole extent of the parenchyma.

STIPULES, FLORAL-LEAVES, THORNS, ETC.

11. The remaining appendages, viz. stipules, floral-leaves, thorns, prickles, tendrils, glands, and pubescence, bear a greater or less agreement in structure, to the parts from which they proceed.

The intention of these parts are obviously not very clear in every instance; but with some, as the tendril, thorn, &c. there can be no hesitation in drawing a conclusion.

ON VEGETABLE FLUIDS.

1. Having made our general remarks on the appendages to plants, and closed the subject of *solid* components, we will now say a few words on the *fluid* constituents; which are, the sap and proper juice.

OF THE SAP.

2. Vegetable life, like the animal, cannot be sup-

ported without the aid of nourishment, we therefore find, that the root is an organ adapted for the absorption of nutrient matter from the earth, from whence it is conveyed, in a somewhat altered state, to every part of the plant, and constitutes its food or *sap*.

From several experiments which have been tried to exhibit the properties of sap, it is plain, it consists of a great variety of ingredients, differing in different species of plant; but there is too little known on the subject to establish any general conclusion.

OF THE PROPER JUICE.

3. In speaking of the structure of the leaf, we have alluded to the course of the sap from the root upwards. When it has received its gradual changes from the different organs through which it has to pass, by the time it passes the structure of the leaves, it is converted into a peculiar fluid, called the *proper juice*.

This fluid may be distinguished from the sap, by means of its colour, which is generally green, as in the periwinkle; or red, as in logwood; white, as in spurge; or yellow, as in celandine. Its principal seat is in the bark, where it occupies the proper tubes; but sometimes it is situated between the bark and wood, as in the juniper tree; or in the leaf, as in the greater part of herbs; or it is diffused throughout the whole plant, as in the fir and hemlock; in which case, either the proper juice mixes with the sap, or the vessels containing it have ramifications which are so fine as not to be perceptible.

THE HARMONIES

OF

VEGETATION.

PART VIII.

A GENERAL VIEW OF THE RELATIVE AGREEMENTS WHICH ARE SO PROFUSELY AND BEAUTIFULLY DISPLAYED IN THE ECONOMY OF VEGETATION, AND THE ADAPTATION OF PLANTS TO DIFFERENT PURPOSES.

THE

HARMONIES OF VEGETATION.

HARMONIES OF VEGETABLE LIFE.

1. Having in the preceding parts of the work, explained the nominal and natural division of plants into distinct organs, we will endeavour in the commencement of this division, to show how beautifully they are respectively adapted to perform the offices apparently destined them by nature, to continue and support the vegetable. We shall therefore have to consider their germination, food, nourishment, functions, vitality and propagation.

GERMINATION OF THE SEED.

2. To trace the growth and general evolution of plants, we must begin with the germination of the seed, or that process by which it is converted into a plant. This is universally the first part of the process of vegetation.

3. Germination is accomplished by different circumstances, which are more or less necessary to excite the vital principle of the seed.

Although the earth is the natural bed for seeds, it is not absolutely necessary. Various parasitical plants vegetate very well in the chinks of the bark of other vegetables. Some seeds vegetate upon the most barren rocks. But what is most to our purpose, the seeds of many plants vegetate in water, and continue, during the whole course of their lives, very completely detached from the earth.

4. When a seed is placed in the soil, or in circumstances favourable to vegetation, the vital principle is immediately stimulated into action, producing a variety of combinations, and effecting a gradual change in the parts of the plant.

After the seed has been deposited in the soil, it begins, for the most part, very soon to imbibe air and moisture, and increase in size. The next step is the evolution of the radicle; the cotyledons begin to get soft and expand, and put on the appearance of seminal leaves; the plumelet then becomes extricated and rises to expand in the air, as the real leaf. The last and concluding step is the developement of the rudiments of a stem, provided the plant is furnished with a stem.

5. There are several conditions, which are in a measure essentially necessary to germination. These are, the maturity of the seed, the exclusion of light, a proper degree of heat, and the access of moisture and air.

6. Unripe seeds seldom germinate, because their parts are not prepared to form the chemical combinations on which germination depends.

Although there are some instances in which the seed will germinate before it is properly matured, most seeds retain their living principle for many years, if kept under proper circumstances.

7. Light has been pronounced by some as necessary to the process of germination, but it appears the presence of this agent is rather injurious than requisite.

Many plants originating from seeds, grow and come to perfection in the darkest ruins and similar places.

8. A certain degree of heat is indispensably necessary.

During the severe weather of the winter season, the seeds which have been placed in the earth do not germinate, but remain inactive, in a state perhaps very similar to the torpid condition of many animals; but on the coming on of the spring, the increased powers of the sun, rouses the embryo from its slumbers, into animated life.

9. Without an appropriate portion of humidity a seed will not vegetate.

10. The vast influence of air upon the vegetation of the seed is very evident. No seed will germinate *in vacuo*.

It is, no doubt, owing to the want of air, that seeds which are placed very deeply in the ground, refuse to vegetate; but they germinate very readily when the ground has been ploughed or turned up, whereby they are more exposed to the action of the atmosphere.

11. In order that seeds may readily germinate, it is not only necessary, that they be exposed to the influence of the air, but that the air is pure.

Many experiments have plainly proved that the principa fagent to forward germination is the presence of oxygen gas. Germination wiil not take place in azotic gas, in carbonic acid-gas, nor in hydrogen gas.

12. From these paragraphs on germination, we learn how nature has suited the seed to the circumstances necessary for its vegetation, and the requisite application of foreign agents to complete the process.

The first thing we have observed necessary, was the maturity of the seed; next the disposing of the seed in a proper situation, where through the influence of heat, moisture and air, its structure might be acted upon, and its vital principle called into exertion. The first change, is the softening and alteration of its substance; the cotyledons swell, and become seminal leaves, the radicle is sent out, and nourished with the juices of these leaves until it is sufficiently strong to absorb nutriment from the earth; then the plumelet begins to ascend, and when the new plant has acquired sufficient strength, the seminal leaves are exhausted of their nourishing fluids and die, being no longer required.

FOOD OF PLANTS.

13. The new plant being produced as described in the last essay, we shall now endeavour to show how nature has provided to support the new individual.

14. The same agents which were mentioned as necessary to give life to the embryo, are also requisite to assist the plant in all its stages of economy. We must therefore say, the food requisite to continue vegetable life, is derived, conjointly from the earth and atmosphere.

The earth or soil, in general, may be regarded as consisting of different earths, water, salts, and other substances, from which the oot can absorb nourishment. The atmosphere has been found to be formed of elementary gases and vapours, which also assist either directly or indirectly, in the support of vegetable life.

15. That the food of plants is derived from these two sources, no one can deny, not only because there is no other medium to offer nutriment, but from the proof which nature herself displays, by the luxuriance and beauty of most plants in their *natural* soil and climate.

What are the precise constituents of soil, &c. for every kind of plant, can only be decided on by patient and accurate trials.

NOURISHMENT OF PLANTS.

16. The nourishment of plants must evidently be secured to them by the process of absorption; that of non-elastic fluids by the root, and those of a gaseous nature, principally by the epidermis.

It is known, fruits will not ripen, and that roots do not thrive if wholly deprived of air; and hence it is probable that they inhale it by their epidermis, though the pores by which it enters should not by visible. In the root, it may possibly enter into combination with the moisture of the soil, but in other parts of the plant, it enters, no doubt, in the state of gas. The leaves not only contain air, but exhale it.

17. The absorption of air and moisture by the leaves and epidermis, gives us an opportunity to remark the harmony which is displayed in consequence.

The roots of all vegetables are furnished with innumerable small fibres for the express purpose of deriving nourishment irom the earth. With herbaceous plants, the whole surface of the plant absorbs air and humidity by the pores of the epidermis. But with trees and some shrubs, the case is somewhat different, the stems of which, have such indurated crust, that no gas can penetrate them. A provision, however, is made for this failing: during the winter, the vitality of the tree is in its least developed state, consequently derives sufficient air by absorption with the nutriment of the root: as spring comes on, the life of the plant is invigorated, abundance of leaves are sent forth, and thus an additional surface for absorption of air and moisture is created, to meet the increasing demands to support life.

18. The grand support of the plant, however, is chiefly that of absorption by the root.

The fluids existing in the soil when absorbed by the root, are designated by the appellation of sap or lymph; which, before it can be rendered subservient to the purposes of vegetable nutrition, must either be intermediately conveyed to some viscus proper to give it elaboration, or immediately distributed throughout the whole body of the plant.

FUNCTIONS OF PLANTS.

19. As plants are organized bodies requiring food and air to support them, they are therefore endowed with absorbing, circulating, and excretory functions.

Plants are very similar in their functions to animals, requiring food to nourish, organs to convey and alter the food received, and a structure to inhale air and to expel adventitious particles.

20. The *absorbing* process is principally effected by the root and leaves.

The root is the grand organ by which plants extract nourishment from the earth; while the leaves, and even the surface of the whole plant are calculated to absorb moisture and air from the surrounding atmosphere.

21. The nourishment or support of vegetable life, is

transmitted from one part to another through the medium of the vessels for *circulation.*

The circulation of the sap is in particular assisted by caloric, which is a stimulant, by light, electricity, the rarefaction and condensation of air in the vessels, and by capillary attraction.

22. There are three modes of *excretion* in plants; the first called exudation, the second respiration, and the third transpiration.

23. *Exudation* is the process by which the circulating fluids of the plant, are converted into proper or peculiar juices.

By exudation, therefore, the overplus common juices of the plant, are not wasted by transpiration, but wonderfully changed by the laws of vegetation, to furnish many valuable and elegant additions to the comforts of man.

24. *Respiration,* which includes also absorption, is the function by means of which, oxygen and carbonic acid gas are evolved.

Plants, like animals, require air to breathe or to support their vitality; but Nature, always the greatest economist and unerring in her calculations, has so ordained, that the atmospheric air which has been injured by animal respiration, shall be calculated to continue vegetable life; and on the other hand, that the respiratory gases of plants shall be adapted to the wants of animals. Thus we perceive, how harmonious these two grand principles combine to equalize the wants of both.

25. *Transpiration* is the economy by which plants emit such particles as are unnecessary or useless.

The transpiratory fluid is generally composed of a certain quantity of water, reduced to vapour, and mixed with other principles, capable of solution and evaporation.

VITALITY OF PLANTS.

26. That plants are possessed of a living principle, the previous essays on germination, food, nourishment and functions, unite to convince us. The point is further proved by the excitability, irritability and apparent sensation and instinct, which some plants in particular evince.

27. By *excitability* is meant the capacity of a plant being acted upon by the application of natural causes, impelling it to the exertion of its vegetative powers.

The most effectual sources or stimulants to display the excitability of plants, are heat and light. By the former the germination and developement is more or less brought about; and from the latter, the position, colour, and vigour of the individual, is in part derived.

28. Vegetables are not only acted upon by the natural causes we have alluded to; they are susceptible also to the influence of a variety of accidental or artificial stimulants, from the application of which they evince a property of *irritability*.

This property is well exemplified in that species of mimosa known by the name of the *sensitive plant*. If a leaflet of this plant is but touched, however slightly, by any extraneous body, it immediately shrinks into itself, and communicates the impulse, if strong, perhaps to the whole wing, each pair of leaflets colapsing in succession, and the leaf-stalk itself sinking downwards as if by a joint at its point of union with the stem. Illustrations of iritability are also met with in the leaves of Venus's fly-trap, and species of sun-dew; in the stamens of the berberis and cactus tuna, and in the styles of stylidium glandulosum.

29. The power of *sensation* in plants is advocated by some phytologists, but the phenomena on which such an opinion has been founded, are yet too imperfectly understood to place the theory beyond doubt.

30. There is also a variety of phenomena exhibited throughout the extent of the vegetable kingdom, some of which are common to plants in general, and some peculiar to certain species, that have been thought to exhibit indications, not merely of sensation, but of *instinct*.

The tendency of plants to incline their stem and to turn the upper surface of the leaves to the light, the direction which the extreme fibres of the root will often take to reach the best nourishment, the folding up of the flower on the approach of rain, the rising and falling of the water-lily, and the peculiar and invariable direction assumed by the twining stem in ascending its prop, the ascending of the plumelet and descending of the radicle, are among the phenomena that have been attributed to instinct.

31. Having seen that plants are organized bodies, endued with organs and their vitality sustained by peculiar properties, we have now to learn, that the usual manner in which plants are perpetuated, is by seed, and accordingly, nature has endued that organ with qualities and appendages suited to its intention.

When the seed has reached maturity in the due and regular course of the developement of its several parts, it detaches itself sooner or later from the parent plant either singly or along with its pericarp, and drops into the soil, where it again germinates and takes root, and springs up into a new individual.

32. Germs, before described as being either *bulbs* or *buds* are a second means of propagation. The first a natural process, the second by means of ingrafting or budding. *Runners, slips, layers, suckers* and *grafts* are, likewise, auxiliaries for the continuance of plants.

The sources of reproduction are numerous, and the earth would be overrun with its vegetable production, had not Nature instituted a counterpoise by the power and wants of man, the necessities of animals, the effects of climate, and many other calls to harmony and convenience.

HARMONIES OF PLANTS.

1. Here we shall find that plants have different relations with different things as concerns their vitality and promulgation. We shall however more particularly allude to the relation of the root to the soil, of the stem to the situation, of the leaves to the air and water, and lastly, of the flowers to the sun, &c.

HARMONIES OF THE ROOT.

2. Very little has been written on this individual subject, but it is plain to common understanding, that the form and shape of roots is harmonized with the soil and situation of the plant.

Those which are very bushy, seem most proper for sandy situations. The cocoa, which is a large tree of the shores of the torrid zone, grows in pure sand, which it interlaces with such a prodigious quantity of fibres, as to form around it a solid mass. It is on this basis, that it withstands the most furious tempests in the midst of a moving soil. There are other vegetables of the shores whose roots resemble cords, such as the alder, the reed, &c. Bulbous plants appear, in like manner, to delight in soft mud, into which they cannot sink far from the rotundity of their roots.

HARMONIES OF THE STEM.

3. With the stem, the chief relation must be to the situation of the vegetable.

The most probable intention of the stem, as necessary to the plant, is to raise the herbage to a proper situation where it may effectually perform the relation it has to the earth, air, sun, water, and so on.

HARMONIES OF THE LEAVES.

4. The leaves by their construction are calculated to change the sap of the vegetable into proper juice, and to hold a scale of harmony with the air, by their upper surface, and with moisture by their under surface.

The relation of the leaves to water, has different bearings. In the first place, we must confess them to absorb moisture by their under surface; in the second place, in dry situations they are so disposed as to convey the rain to the root; while in aquatic plants, or vegetables growing near water, they are disposed, for the contrary purpose of conveying it from the root.

HARMONIES OF THE FLOWER.

5. Whatever may be the form, structure or habits of plants, they have all one great object to perform in order to continue the species from one generation to another.

We therefore, shall see how solicitous nature has been to harmonize the reproductive organs.

In the extreme limits of this work, we have been obliged to pass over many interesting facts of the harmonies of the root, stem and leaves, and are at once, come to describe, as connected with the reproductive process, the harmonies of the flower.

6. In looking upon the flower as the organic part destined for the important office of producing seed, our first attention is secured by the *calyx* or external covering which most flowers have to protect them in their infant state.

Most flowers have this external envelope, because of the tender structure, of their interior parts; but where the calyx is altogether wanting, the petals or corolla is of a more hardy and permanent structure, and therefore of itself capable of preserving the immediate organs of fructification within.

7. As the developement of the flower goes on, the *corolla* gradually increases in bulk, and the calyx expands to give it evolution.

In this way, the corolla or beauty of the flower is expanded to view, which, while it pleases the eye, and sometimes diffuses a sweetness around, it also appears to be intended to reverberate the rays of the sun upon the parts of fecundation.

8. The colour of the corolla in different plants is very various, but of whatever shade it may be, it is suited to the situation, or other circumstances which affect its properties, as a reflector of heat.

White is the best adapted for the purpose, hence nature bestows white to flowers which blow in cold seasons and situations, as we see in the snow-drop, the lily of the valley, the hyacinth, the narcissus, the wild anemone, which blossom early in the spring. Under this colour must likewise be classed those that have faint tints of rose or azure, as various species of hyacinths, and also such as have yellow and brilliant hues, as the flowers of the dandelion, the butter-flower and the wall-flower. But such as blow in warm seasons and situations, like the poppy, the corn-flower, which grow in summer among the corn, have dark colours, as purple, deep-red and blue, which absorb heat without much reflecting it.

9. In addition to the effect produced by the colour of the corolla, the forms of flowers appear equally calculated to reflect heat.

Thus in some flowers, as in the colewort, the corolla is cruciform; in the daisy there is an entire circle; portions of a sphere in the rose; perfect spheres, in the bells of the lily of the valley; and truncated cones in the fox-glove and others. These are some of the numerous kinds of corolla, all of which certainly appear peculiarly adapted to fulfil the intention we have mentioned.

10. Heat being so essential to the fecundity of the flower, besides colour and form, nature has other means of multiplying the reflections of heat.

Sometimes she places the flowers on stems of little elevation, that they may receive warmth from the reflections of the earth; sometimes she glazes them with a brilliant varnish, as in the yellow ranunculus or common butter-cup of our meadows. Sometimes she witholds the corolla, and causes the parts of fecundation to issue from the sides of an ear, from a cone, or from the branch of a tree.

11. There are also several other illustrations which might be mentioned, to display the adaption of the corolla to regulate the heat commuicated by the sun.

What confirms the idea that the flowers of plants are adapted to the action of heat, is this, that many of our European plants, though they thrive very well in the Antilles, never produce seed there. Father de Tertre observed in those islands, that the cabbage, the santfoin, the savory, the sweet basil, the nettle, the plantain, the wormwood, the sage, the liverwort, the amaranth, and all our species of gramineous plants grow there wonderfully well, but never yielded any seed. This proves that it is neither the air nor the soil which is objectionable, but the sun, which acts too powerfully on the flowers: for most of these plants have theirs aggregated into ears, which greatly increase the repercussion of the solar rays.

12. A certain degree of solar heat is necessary to the economy of the flower, the extent of which, must differ more or less with the kind of plant and its natural soil.

Some flowers are rendered susceptible of reflecting heat under different degrees of latitude, with scarcely any alteration in their form. Thus, between the tropics most flowers are placed upon trees, to raise them above the reflexion of the soil. In those regions very few are to be found in the meadows, but a great number in the forests. There you are obliged to look aloft to discover flowers, here you must cast your eyes on the ground, for with us, they grow mostly among the grass and on shrubs.

13. There are a variety of other causes by which nature has harmonized the flower of plants with that powerful agent on vegetation, the solar heat.

Sometimes she expands her floral beauties beneath the shade of leaves, sometimes she destines them to bloom when the sun retires to cherish another clime; sometimes she provides them with suitable appendages; but in all cases, and under all circumstances, a careful observer will discover, how wisely they are provided for by the wisdom of Providence.

14. While some flowers are so formed, coloured, or situated, as to reflect heat on the immediate parts of

fecundation, there are others which are equally intended for an opposite purpose.

Though the greatest number of flowers are withdrawn from the too violent action of the sun, there are others which like to appear in all the splendour of his rays. In these cases, the colour will be found of a darker hue, either generally or only in the centre of the flower, which, instead of reflecting heat, has the contrary action of absorbing it.

15. Nature, we have already intimated, has given curves to most flowers, in order to collect the heat at the centre; but she likewise employs the same curves when she pleases, to dissipate it, and places their focusses externally.

It is thus that she has disposed the petals of the lily, which are so many sections of a parabola. Notwithstanding the large size and whiteness of its cup, the more it is expanded, the more it disperses the heat of the sun; and while at midsummer, all other flowers, scorched by his noon-tide rays, either close or incline towards the ground, the lily, rearing its head like a king, contemplates face to face, the luminary that blazes aloft in the heavens.

16. There are flowers, such as the compound, which, being in a horizontal situation, and completely exposed, behold the sun, like the horizon itself, from his rising to his setting.

The common dandelion is a flower of this kind, but it possesses a very extraordinary method of sheltering itself from heat; it closes whenever it becomes too powerful. It has been observed, that it opens in summer at half past five in the morning, and contracts its petals towards the centre at nine. The flower of the lettuce, which on the contrary, is on a vertical plane, opens at seven and shuts at ten. The sunflower of our gardens is said to meet the sun at its rising, to follow it in its course, and to cherish its setting rays;

during the night undergoing a gradual change till it acquires its morning aspect.

17. One more point worthy of observation, with respect to the harmony of the flower with the sun, is that their time of duration is regulated by the quantity of heat they are intended to collect.

While some flowers require weeks to fulfil their vegetable economy, there are others which flower so rapidly, (as the common thorn) that there is scarcely time to observe its expansion. St. Pierre mentions, that in the garden of plants at Paris, there is a species of serpentine aloe, without thorns, whose large and beautiful flower emits a strong smell of vanilla, at the time of its expansion, which is extremely short. It blows only about the month of July, at five in the evening; you then see it gradually open its petals, expand itself, and die. By ten at night it is totally faded.

18. Such then, are the important relations of the corolla to the sun and heat; besides which, it undoubtedly has numerous other harmonies with the wind, foreign objects, and so on.

It is very easy to suppose the carolla is in many instances, intended for other purposes than the regulation of heat. Why has nature given to several plants pending bell-shaped corollas, as with fox-glove, lily of the valley, and others, but to defend the interior parts from rain, wind, &c. Some are provided externally with hair to shelter them from the cold. Others are formed to blow on the surface of the water; such are the yellow roses of the nymphæ, which float on the lakes, and consign themselves to the different motions of the waves, without being wetted by them, by means of the long and flexible stems to which they are attached. There are other flowers adapted to the wind and to the rain, as those of pease, which have little boats that shelter the stamens and pistils. They have, besides, large flags, and are fixed on stalks curved and elastic as a nerve; so that when the wind blows on a field of pease, you see all the flowers turn their backs to it like so many weather-cocks.

19. As nature has entrusted the production of seed to the *stamens* and *pistils*, this intention shows itself, by the care which appears to be taken, to protect and favour by every advantage of situation, these two essential parts of the flower.

The stamens and pistils are usually lodged in the centre, the recesses, or the labyrinths of the flower; during their tender and immature state, are shut up in the stalk, or sheltered in the bud; as soon as they have acquired firmness of texture sufficient to bear exposure, and are ready to perform the important task which is assigned to them, they are disclosed to the light and air, by the expansion of the petals; after which, they have the effects of heat beautifully modified by the structure, colour, or other particularities of the corolla.

20. Before the embryo seeds in the germen of the pistil can be perfected, it is necessary that the farina or pollen should come in contact with them; therefore there must be a necessary point of harmony between the length of the stamens and the pistils.

Confirming this argument, it is said, in flowers which are erect, the pistil is shorter than the stamen; and the pollen, shed from the anthers into the cup of the flower, is caught in its descent, by the stigma or head of the pistil. When the flowers hang down, the stamens on the contrary are shortest, and the pistil lengthened, so that its protruded stigma receives the pollen as it drops to the ground. In some cases, as in the nigella, where the styles of the pistils are disproportionably long, they bend down their extremities upon the anthers, that the necessary approximation may be effected.

21. As soon as the embryo seeds are fertilized by the influence of the pollen, the other parts of the flower

fade and drop off, while the germen, on the contrary, proceeds to increase its bulk, and forms the *seed-vessel.*

By virtue of this process, so necessary but so diversified, we have the seed at length, in a variety of reservoirs and situations. We have the seeds in the pea tribe regularly disposed in parchment pods, which, though soft and membranous, completely exclude the wet even in the heaviest rains. In some cases, as in the bean, the pod is lined with a fine down; at other times, as in the senna, distended like a blown bladder, or we have the seed enveloped in wool, as in the cotton-plant—lodged between the hard and compact scales of a cone, as in the pine, or barricaded, as in the artichoke and thistle with spikes and prickles. In this way, the continuance of plants is secured by a variety of contrivances, though widely differing in themselves, yet all tending to the same object, the preservation of the seed.

22. When Nature has perfected her seeds, her next care is to disperse them. The seed cannot answer its purpose, while it remains confined in the capsule. After the seeds are ripened, the seed-vessels open by a certain rule in each plant, to let them out.

A spontaneous gradual opening of the pericarp, is the usual way by which seeds are set at liberty; but in some instances, particularly in the common furze or goss, the opening of the seed-vessel is instantaneous and accompanied with a noise; this is also the case with other plants both foreign and native.

23. The structure and foim of seeds are very different; but be their form and construction what it may they will always be found to harmonize with the circumstances to which they have relations.

Most seeds have defensive coverings or tunics, some hard or pulpy seed-vessels. Most seeds are comparatively smooth, and destined to grow in the immediate vicinity of the mother plant, while others are furnished with appendages to promote their wide distribution, not only from one part to another part of the same kingdom, but even to a different quarter of the globe.

24. The fertility of plants in the production of seeds, is almost incredible, and is a circumstance well calculated to display the unbounded liberality of nature.

A single stalk of Indian corn, has been known to produce in one summer, two thousand seeds; in the same period, a plant of elecampane produced three thousand, the common sunflower four thousand, the poppy thirty-two thousand, and a single stalk of tobacco thirty-six thousand seeds. This immense increase in plants, however, has been wisely harmonized by the non-fertility of many, and by the requisition of others for a variety of purposes.

HARMONIES OF COLOUR, ETC.

25. Nature, in the creation of the universe, has very beautifully moderated the influence of colour. To the firmament above, she has given a pleasing azure tint, to the earth itself, a variety of shades, all more or less harmonizing with the blue on high, and the agreeable green of plants.

If she had given to plants a yellowish hue, they would have been confounded with the soil, and if she had dyed them blue, they would have been confounded with the sky and waters. In the first case, all would have appeared earth, in the second, all would have been sea; but their verdure forms the most delightful contrast between them and the grounds of the grand picture, as well as consonances highly agreeable with the yellow colour of the earth, and with the azure of the heavens.

26. In giving to vegetable productions a green shade, though only one single colour is employed, there

are certain tints which appear to be given according to the situation or circumstances under which a plant may grow.

Those that are destined to grow immediately on the earth, on strands, or on dusky rocks, are entirely green, leaves and stem, as the greater part of reeds, grasses, mosses, taper-trees, and aloes; such on the contrary, as are intended to issue from amidst herbage, have stems of a brownish hue, like the trunks of most trees and shrubs. The elder, for example, which thrives in the midst of green turf, has the stems of an ash grey; but the dwarf elder, which otherwise resembles it in every respect, and grows immediately on the ground, has them quite green.

27. Not only the green of the plant is given to harmonize with other objects, but even the flower and fruit have their shades apparently proportioned accordingly.

It seems correct, that the blue colour is not to be found in the flowers or in the fruits of lofty trees, for in that case, they would assimilate with the sky, but is very common on the ground in the flowers of herbs, as in the corn-bottle, the scabiosa, the violet, the liver-wort, and others. On the contrary, the colour of the earth is very common in the fruits of lofty trees, as in those of the walnut, the cocoa, the pine, and so on.

28. In the form of flowers, the most perfect specimens of harmony might be selected, which would faithfully shew, that even in pleasing the sight, the greater object of utility is combined, if not increased.

This is very sweetly shown in the structure of compound flowers, particularly such as the sunflower and daisy. What would these flowers be in appearance, without their radii? Yet are the radiated petals of the circumference, not only given to complete a pleasing harmony of sight to the tubular florets of the centre, but they answer an important purpose of moderating the influence of heat, &c. thus is the double object of utility and beauty combined.

29. Another point productive of some very pleasing deductions, is founded on the harmonies from contrast. Plants opposite in nature, are almost always associated.

Thus round the faded trunks of trees, twines the creeping ivy, or the great convolvulus, compensating the apparent want of blossom. The fir rises in the forests of the north, like a lofty pyramid of a dark green colour, and with motionless attitude. Near this tree, you almost always find the birch, which grows to the same height in the form of an inverted pyramid, of a lively green, and whose moveable foliage is incessantly playing with every breath of wind. The reed, on the banks of rivers, raises erect into the air its radiated leaves and its embrowned stem, while the nymphæa spreads at its feet its broad heart-shaped leaves, and its gold-coloured flower; the dark blue violet is contrasted in the spring with the yellow tints of the cowslip and the primrose. On the herbaged angles of the rock, in the shade of ancient beech trees, the fungus, white and round, rises from amidst beds of moss of the most beautiful green.

30. We have now given a general outline of the harmonies of plants; whereby we learn, in addition to the relations of the root, stem, and leaves, the careful protection of the infant flower by its calyx, the use of the corolla in moderating the effects of heat, the relative agreements of the stamens and pistils, the adaptations of the seed-vessel to the necessities of the seeds, the means adopted by nature to extend vegetation, and finally, the harmonies of colour, &c.

ANIMAL HARMONIES OF PLANTS.

1. After the same goodness in which Nature has made relative agreements between the structure of plants with vegetable life, the harmonies of one organ

with the necessities of the other, and the adaptation of peculiarities in plants to different circumstances; with the same wisdom, she has made vegetables to answer to the wants, the calls, and the comforts of both man and animals.

HARMONIES OF PLANTS WITH MAN.

2. There is not a single plant on the face of the earth, but what has some relation to the wants of man, and serves in some part or other for his food, his clothing, his habitation, his pleasures, his medicine, &c.

Of these different relations, we shall not pretend to enter very deep; a few general observations will be sufficient to show our dependancies on the vegetable kingdom.

3. Our first relation to vegetation, is for the essential support of life, by their rendering the air we have breathed again capable of preserving animal life.

We have alluded to this subject in a previous part, but here it must stand as illustrative of the harmony between the necessities of animal and vegetable life.

4. Another highly important relation by which we are obligated to vegetation, is for the principal support of food. For this reason, Nature has caused those articles which are most necessary to be produced in large quantities, and under most circumstances.

Thus corn, which serves for the general subsistence of the human race, is not produced by vegetables of great size, but by mere grasses. If our harvests were the produce of forests, when these are destroyed by war, levelled by winds, or swept away by inundations, it would require whole ages to re-produce them. On the contrary, the principal food of man is produced by plants peculiarly formed to stand the shock of winds and rains, and singularly constructed in the flower to secure fertility. Again, if corn-plants are destroyed, they require but a short time to be replenished.

5. The anxiety of nature to furnish a sufficient support for man and animals, is more beautifully conspicuous by rendering every spot on the face of the globe capable of producing some species of corn.

It is, in fact, formed for growing in every situation, from the Line to the Coast of the Frozen Ocean. Some species a'e adapted to the humid districts of hot countries, as the rice of Asia, which yields an abundant produce in the mud of the Ganges: other are suited to the marshy grounds of cold regions. Other kinds of corn thrive wonderfully in hot and dry soils, as the millet and the pannic in Africa, and the maize in Brazil. In our climates, wheat thrives best in a strong soil; rye, in sands; buck-wheat on rainy hills; oats in humid plains, and barley among rocks.

6. Corn, including grasses, being most plentiful, and of one kind or other, distributed over the whole habitable globe, is also most serviceable, of all plants, to the comforts and necessities of man.

Its straw furnishes him with the means of lodging, of covering, of warming himself, of feeding his sheep, his cow and his hoise. With its grain he composes aliments and liquids both pleasing to the palate, and valuable to his life.

7. Though corn is sufficient for the food of man, yet has nature not been so parsimonious as to prohibit other auxiliaries to his comforts and support.

Corn is the undoubted fountain from which he must draw his subsistence; but there are other vegetable productions, which not being so numerous, are not so essential.

8. In the dispensation of the auxillary vegetable blessing, we find they do not all come at the same time of the year.

Thus in this country, the spring is ushered in with the goosberry and the currant, to these succeed a regular and constant supply of vegetables and fruit, till the autumn banquet, again reminds us of a declining season. Were the gooseberry, the cherry, the plum, the peach, the apple and the pear, all to come together, we should be surfeited with the profusion; but nature is a better economist; she has given them a period for their perfection, and that period calculated to our wants and appetites at the individual season of their maturity.

9. In addition to the agreement of vegetables and fruit, to the time we most stand in need of them as luxuries or comforts, we also find they are adapted to the necessities of the climate in which they grow.

In the torrid zones, we accordingly hear of the most delicious fruits, while in the colder climates, there is only a corresponding character of their fruits and vegetable productions.

10. The next point in which we find vegetation so truly harmonizes with the necessities of man, is derived from the general configuration of plants; so that some are adapted to one purpose and others to another.

In addition to the variety and beauty of plants to decorate the face of the earth, there are some which serve only for ornament; others which combine utility with elegance; while a third set appear to be distinctly calculated to protect man's property, and to secure his habitation. Of the first kind are many flowers of our gardens; of the second, the mulberry and the almond tree; and of the last, the hawthorn, the oak, and the fir tree.

11. The configuration or shape of plants, is not only instanced in their relation to the protection and comforts of man; but even their internal properties correspond to his requisites and desires.

From the luxurious reed of the sugar-plant, is derived a valuable domestic article; from the juice of the grape, an enervating wine; and from the substance of the apple, a delicious beverage in the form of cider. From the body of the fir is distilled immense supplies of tar; from the bark of the oak, an active principle for tanning; and from the leaves of most herbs, peculiar extracts for the cure and treatment of diseases. In this way has nature made plants as well as animals, subservient to the use of man.

12. Plants also appear very singularly adapted to the climate or situation in which they are destined to grow.

In the regions of the north, and on the summit of cold mountains, grow the pine, the fir, the cedar, and most of the resinous trees, which shelter man from the snows by the thickness of their foilage, and furnish him, during winter with torches and fuel. In the south, on the contrary, the leaves appear to increase in proportion as we approach to the line, evidently intended to harmonize with the heat of the climate by affording shelter from a vertical sun.

13. Nature has placed in humid and watery situations, such plants as best correspond to the necessities of the inhabitants in those places.

By the sides of water grow the plants and trees which are the the dryest, the lightest, and consequently the most proper for crossing them. Such are the reeds which are hollow, and the rushes filled with inflammable pith.

14. In contra-wise to the supply of dry and light vegetables to moist situations, Providence has given

an equal testimony of his benevolence, by a provision for the thirst of man in dry and almost sterile lands.

Among the scorching sands of Africa, he has placed a plant, whose leaf, twisted into the form of a cruet, is always filled with a large glassful of fresh water; the neck of this cruet is stopped by the end of the leaf itself, so that the water cannot evaporate. There are also planted on some parched districts of the same country, a great tree, called by the negroes *Boa*, the trunk of which, of prodigious bulk, is naturally hollowed out like a cistern. In the rainy season it is replenished with water, which it keeps cool during the most intense heat, by means of the foliage which crowns its summit.

15. These are, among many, a selection of the most beautiful illustrations of the wisdom of nature, in the disposal of her vegetable treasures, as far as respects their relation to the comforts of man in their simple state

There are an infinite number of pleasing harmonies which might be deduced from the application of vegetable productions to purposes of domestic economy, from their use in the manufactories, and indeed from their causual and general uses.

HARMONIES OF PLANTS WITH ANIMALS.

16. Plants, bear one or two properties in relation to animals, in common to man.

The one whereby they purify air once breathed, and make it again capable of supporting animal life; the other, in being the chief source of their nourishment, or at least, the nourishment of most.

17. With regard to the relation of plants to the food of animals, we find there are certain species, calculated in particular to certain species of animals.

Thus the large family of grasses is the grand support of the most numerous and most valuable animals to man, as the sheep which yields him food, the cow which furnishes him with milk, and the horse which labours and contributes to his comforts. So again, do the birds of the air, thrive upon the benevolence and profusion of the vegetable kingdom.

18. We have observed, in a preceding part, that vegetables are distinguished from the ground by their green colour; so are animals, which live among the herbage, detached from it, in their turn, by their colours.

Those which live on the dusky bark of trees, or other dark grounds, are clothed with brilliant colours, and sometimes with green, while such as inhabit the green and herbaceous parts are usually of a brown or dusky nature. So, accordingly, with several species of the birds of India, which reside among the foliage of the trees, as the greatest part of the parrots, many of the humming birds, and even of the turtle doves, are of the most beautiful green: but independently of the spots and marbling, white, blue, and red, which distinguish their different tribes, and which render them perceptible at a great distance in the trees, the brilliant green of their plumage distinguishes them to great advantage from the dull and embrowned verdure of these southern forests.

19. Nature appears to have associated the species of animals invested with the most pleasing colours, with the species of plants whose flowers are the least vivid, as if, by way of compensation.

There are much fewer brilliant flowers between the tropics than in the temperate zones; but to make amends, the insects, the birds, and even quadrupeds, as various species of monkeys and of lizards, have the most lively colours. When they rest on the vegetables peculiar to themselves, they form the most beautiful contrasts, and the most delightful harmonies.

20. The vegetable and animal kingdom do not bear

any relative agreement with the point of proportion; for instead of large animals being attached to large vegetables, they are united by contrast, the class of trees associating with small animâls, and that of herbs with the great quadrupeds. By this arrangement, Nature has given protection to the feeble, and convenience to the powerful.

This law is so general, that in every country where there is no great variety of herbage, the quadrupeds which live upon them are few in number; and that wherever the species of trees are numerous, those of the smaller animals are likewise multiplied. This is particularly the case in various parts of America, among others. Guiana and Brazil are noted for their trees, and it is well known that those countries have, in fact, few indigenous quadrupeds, but that on the contrary, there are an infinite variety of birds and insects.

21. If we cast a glance on the relations of grasses to quadrupeds, we shall find that, notwithstanding their apparent contrast, a multitude of real correspondencies exists between them.

The moderate elevation of grasses places them within reach of quadrupeds, whose heads are in an horizontal position, and frequently inclined towards the ground. Their loose leaves seem formed to be laid hold of by broad and fleshy lips, their delicate stems to be easily cut by incisive teeth, and their farinaceous seeds to be easily bruised by the grinders. Besides, their softness and elasticity afford an excellent litter for ponderous bodies.

22. If, on the other hand, we examine the conformities which exists between trees and birds, we shall see how justly the natural agreement has been estimated.

The branches of trees are easily grasped by the four claws of most birds, which are disposed in such a manner that there are three before and one behind. In addition to this, birds find in the different stages of the foliage, a shelter against the rain, the sun, and the cold, towards which purpose, the thickness of the trunk still further contributes. The seed and the fruit also appear to contribute to substantiate their relation.

23. Nature has likewise formed animals of a third order, which find in the rind or in the flower of a plant, as many accommodations as a quadruped enjoys in a meadow, or a bird in an entire tree. These are insects, the relations of which, to the parts of the plant they are most attached to, are in some instances very beautiful.

Thus butterflies and bees are furnished with tubes for sucking the juices from the nectary of flowers. The flies, like the bees, have cavities scooped out of their hairy thighs for collecting honey, and four wings to carry off their booty. The common fly and the gall insect, have pointed and hollow piercers for the purpose of making incisions in leaves and drinking their fluids. The weevil is designed to bury itself in the seed, to live upon its substance, is provided with a rasp to set itself free, and with wings to make its escape. These are among a variety of illustrations, by which the adaptation of insects to plants, is very pleasingly displayed.

24. As birds, insects, and even some quadrupeds are supported entirely or chiefly by vegetable productions, Providence has not regulated the fecundity of plants by their size or strength, but to the ratio of animal species for whose food they are destined.

The pannic, the smallest millet, and several other gramineous plants, so useful to animals and to man, produce beyond comparison, more seeds than many plants much larger and much smaller than themselves. There are many which perpetuate themselves by their seed once a year; but the chickweed, which affords sustenance, at every season of the year, to the small birds of our climate, is renovated by its seed seven or eight times, without being interrupted even by winter.

25. Since birds live on the seeds or fruits of plants, and require shelter from the too great influence of solar heat; so do they require also, when vegetation is apparently sleeping in the winter months, some kind of provision for their sustenance and growth.

It is true, many species of birds emigrate, and seek in a warmer climate the luxuries they desire; but there are, on the other hand, some few which remain throughout the year. Nature, never forgetful of her offspring, has caused various evergreen shrubs, as the ivy, the privet, and others, to continue covered with black or red berries, forming a striking contrast with the snow, as the hawthorn and eglantine, and presenting to winged animals both habitation and food.

26. The fruit or seed of most plants, both exotic and indigenous, are usually of a colour, calculated to attract the different animals for which they are said to be destined. There are some anomalous cases, however, in which the fruits do not invite by any external vivid colour, but by other properties both singular and excellent.

The heavy cocoa-nut, in falling from the summit of the tree that bears it, makes the earth resound to a considerable distance. The black pods of the caneficier, when ripe and agitated by the wind produce in clashing together, a noise resembling the clack of a mill. When the greyish fruit of the *genipsa* of the West Indies, falls from the tree in a state of maturity, it cracks upon the ground with a noise equal to the report of a pistol, whereby the land-crabs, which are very fond of it, immediately hasten to seek a repast. Many other singular phenomena could be mentioned, all tending to illustrate the same point of harmony.

27. There are many other beautiful harmonic occurrences between plants and animals, but too extensive to be included in the pages of this little volume.

CONCLUSION.

28. In viewing what we have termed the Harmonies of Vegetation, whether we look only to the regularity of the organic functions by which vegetable life is supported; to the relative agreement of these functions one with another; or to the wonderful provisions for the propagation and support of plants, we must all be impressed with admiration of their accuracy and beauty. But if we look to the application of plants, to the necessities of animals, and more particularly their intimate correspondence with the comforts and happiness of man, we ought, not only to court the truth of philosophy so powerful in displaying the works of Providence, it should also teach us, by contemplation, to look through Nature up to Nature's God.

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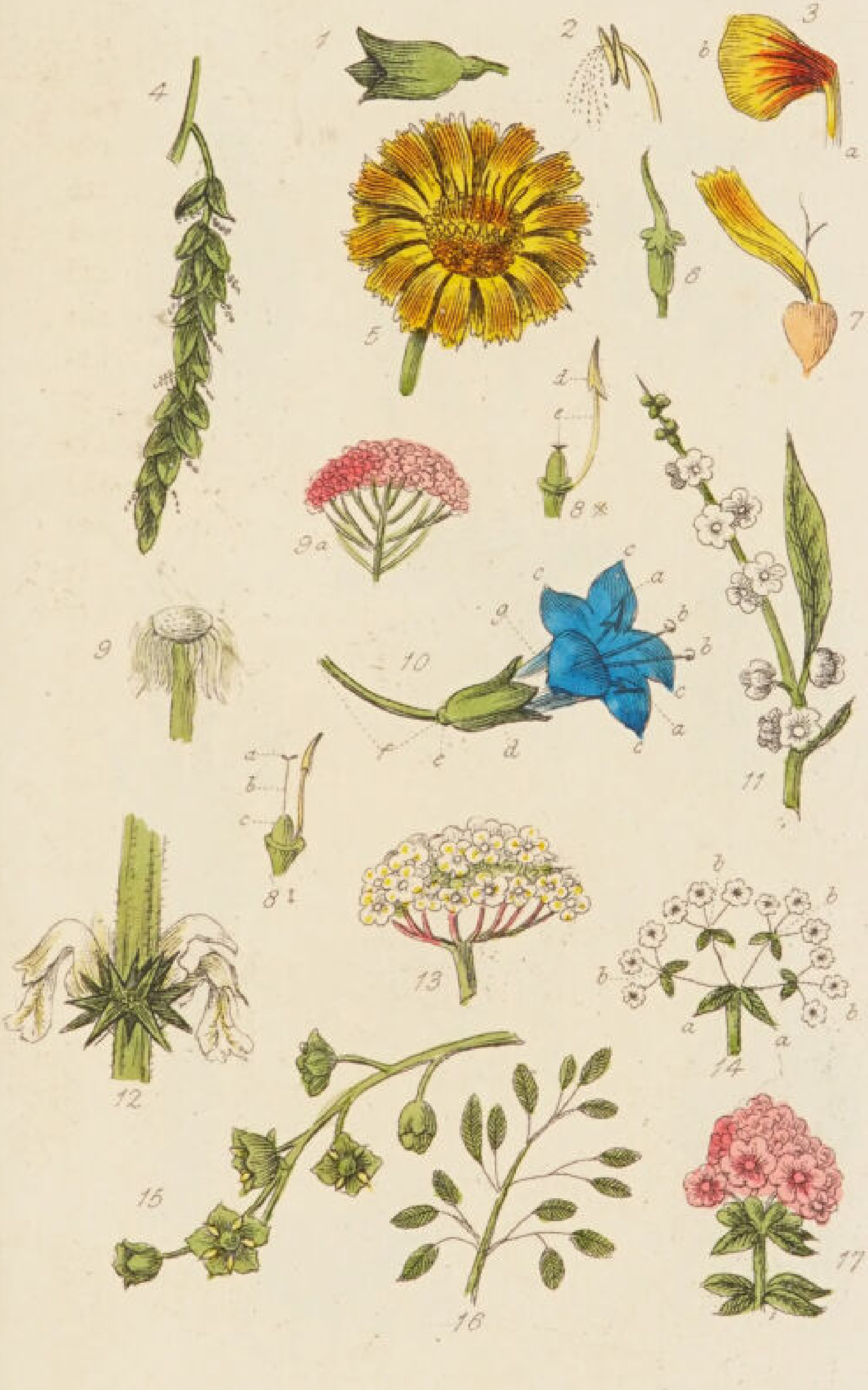

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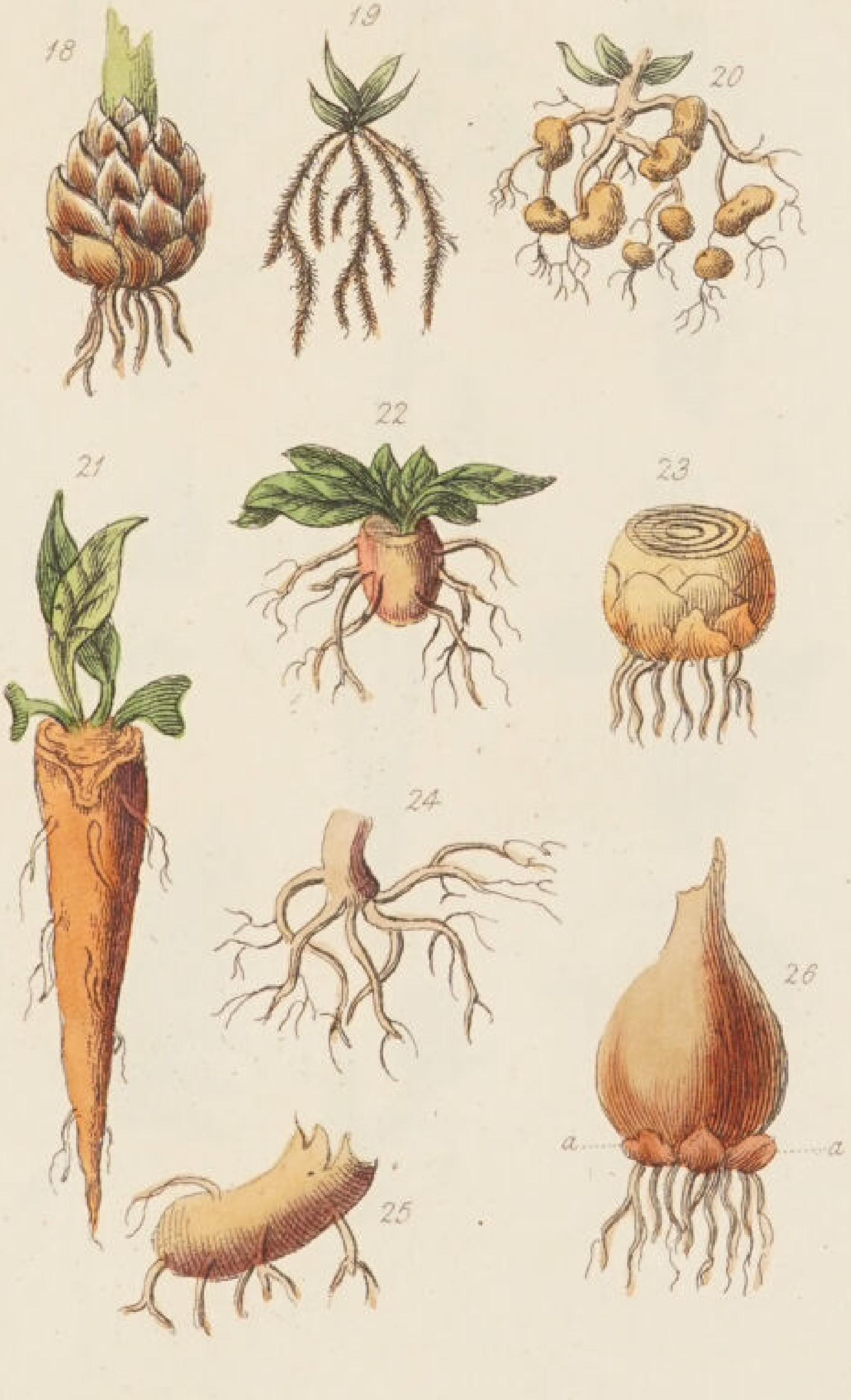

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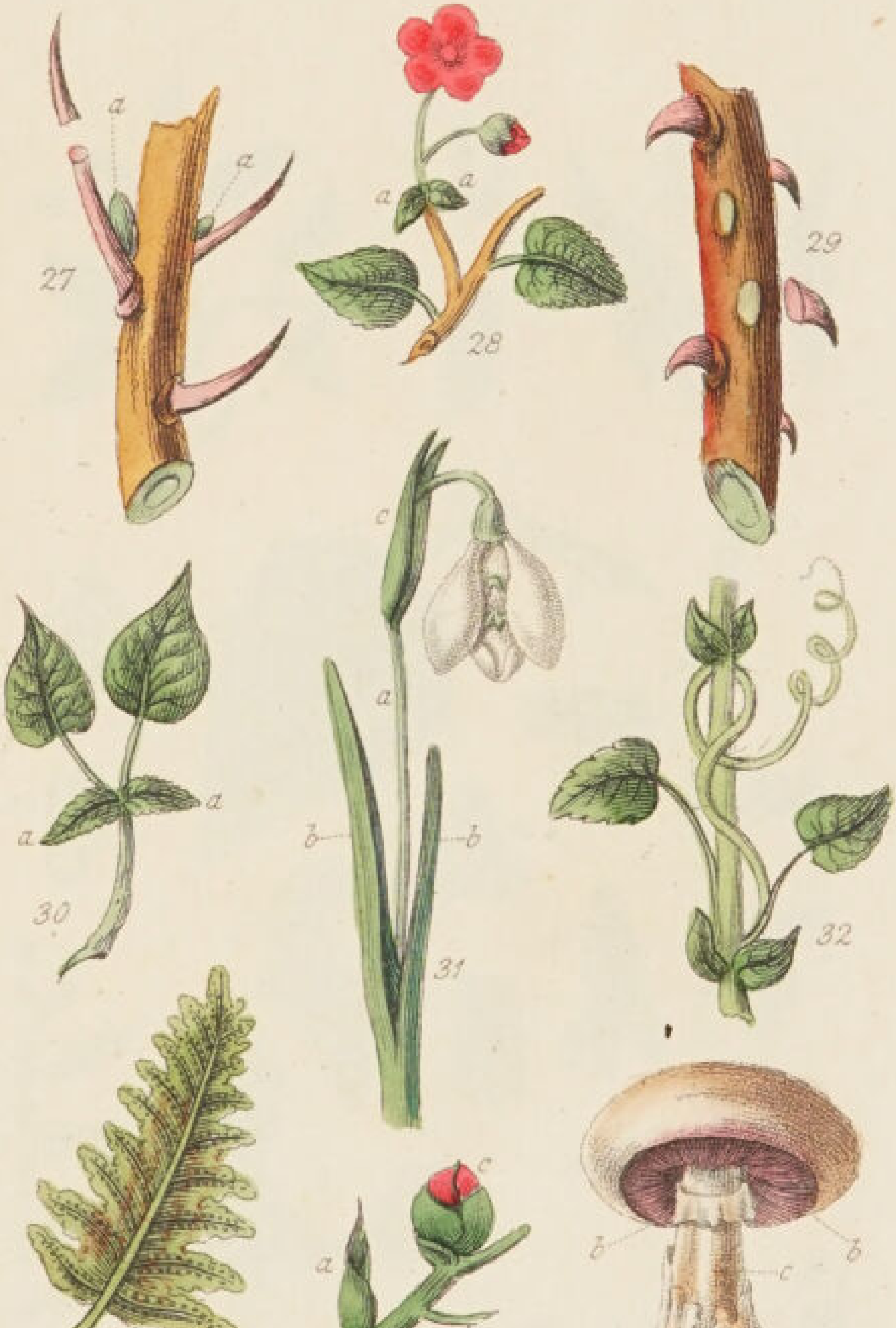

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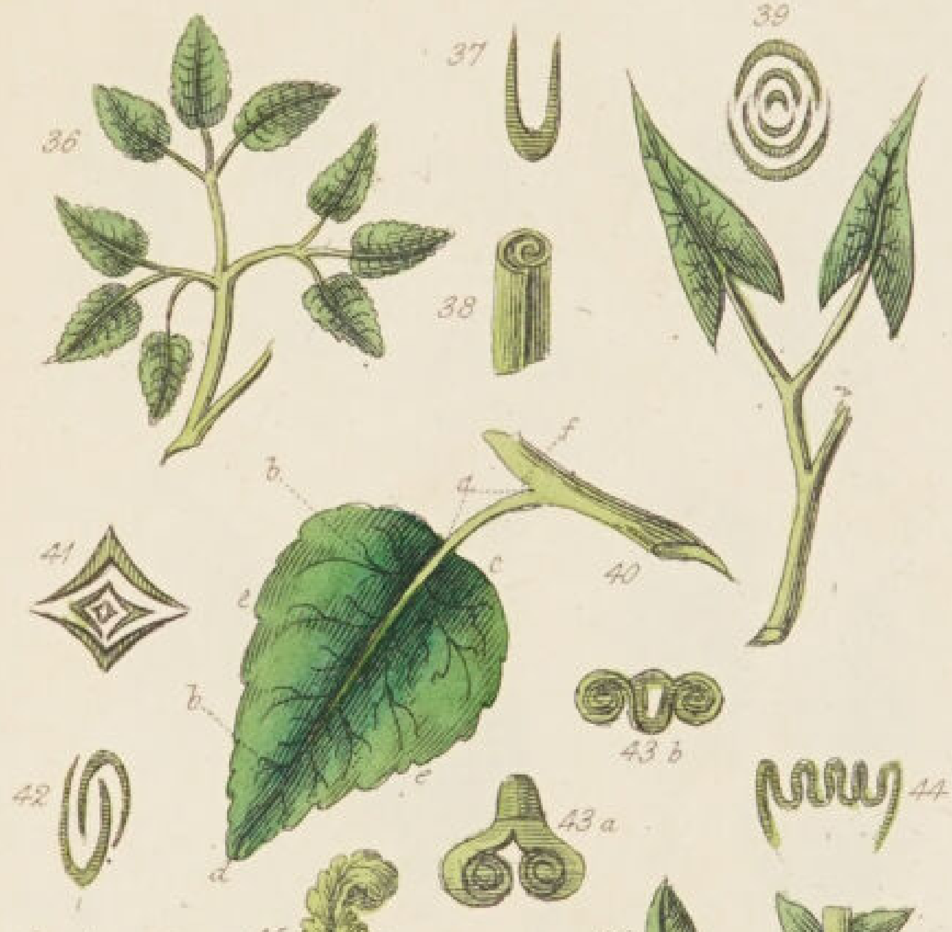

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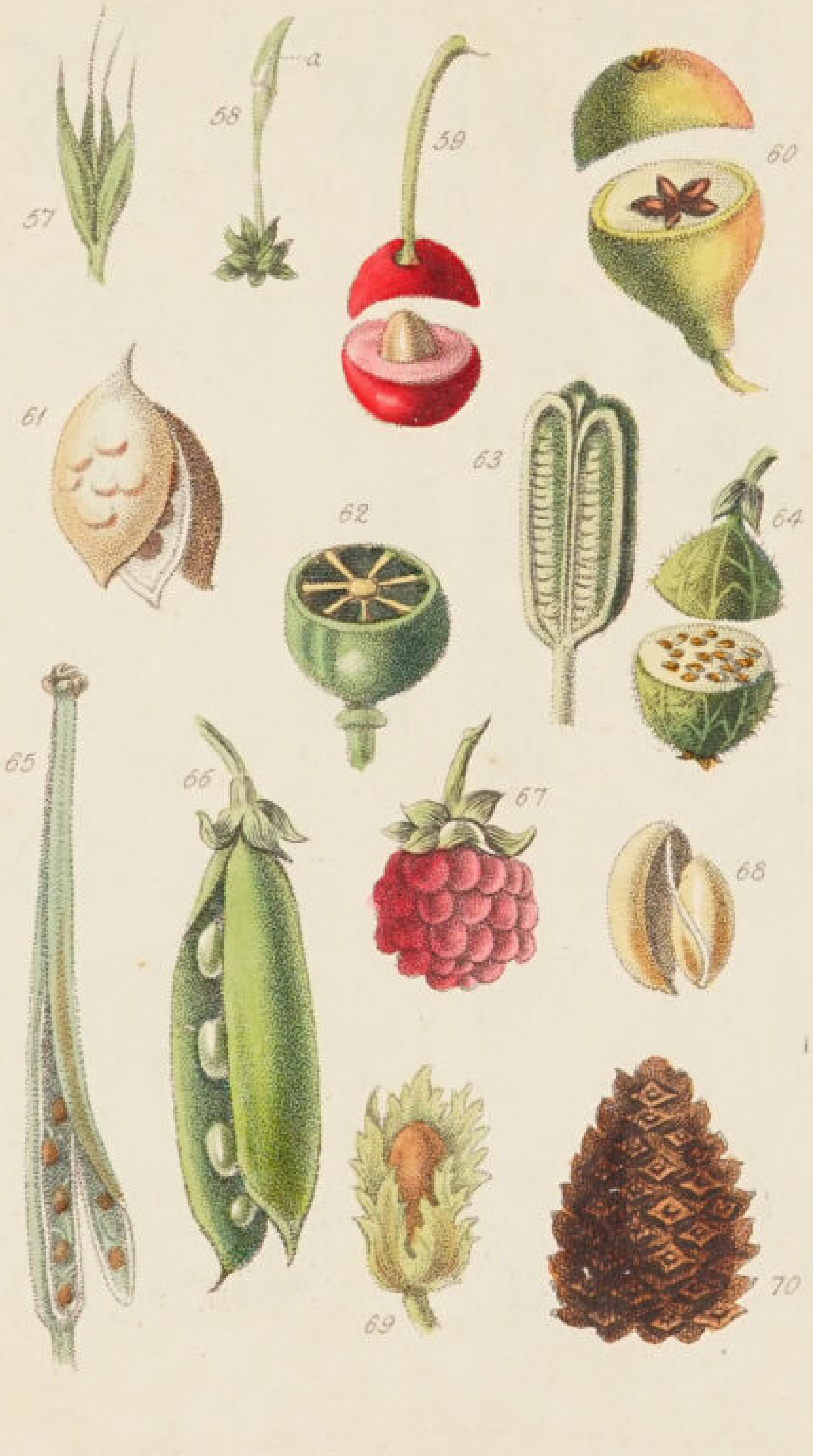

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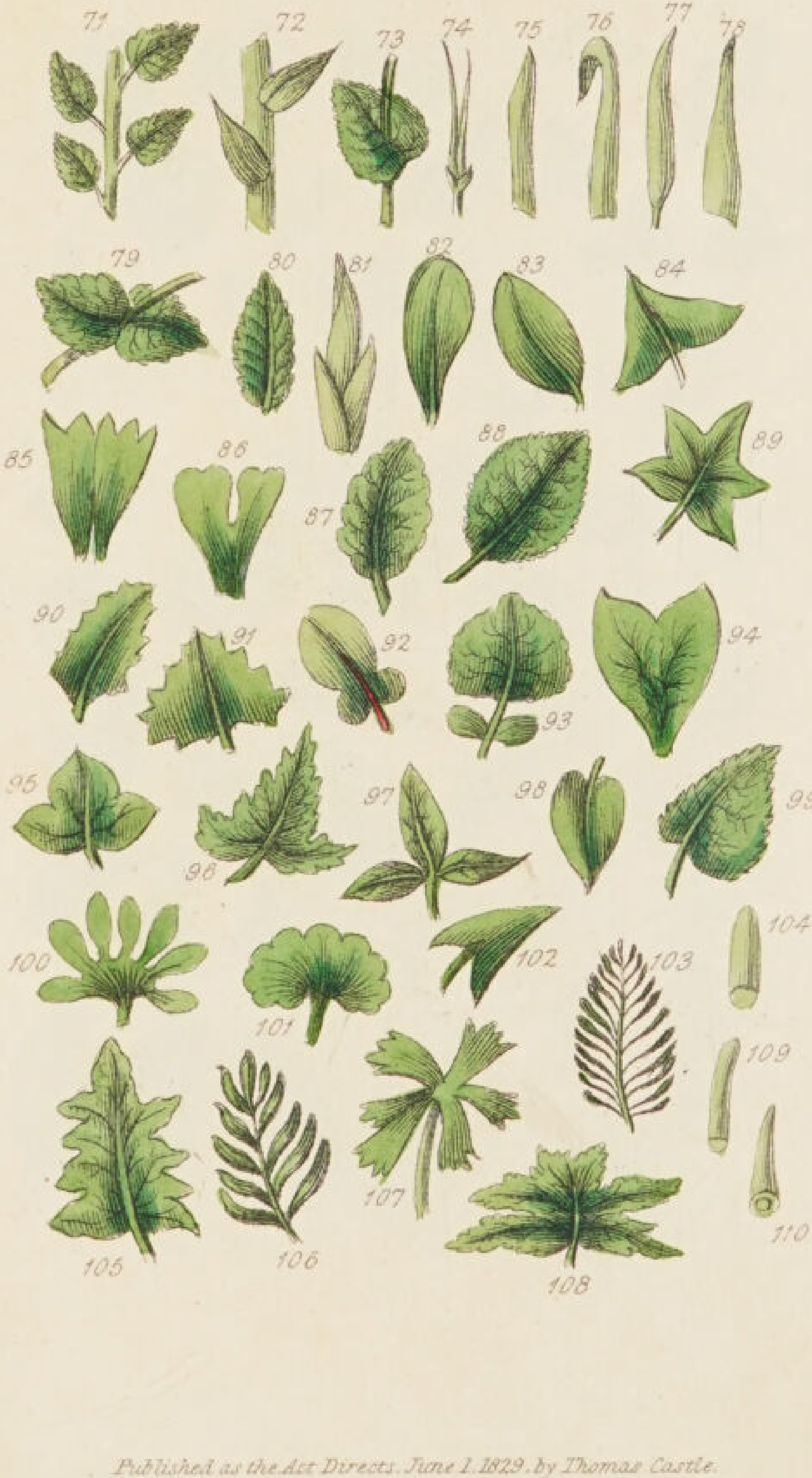

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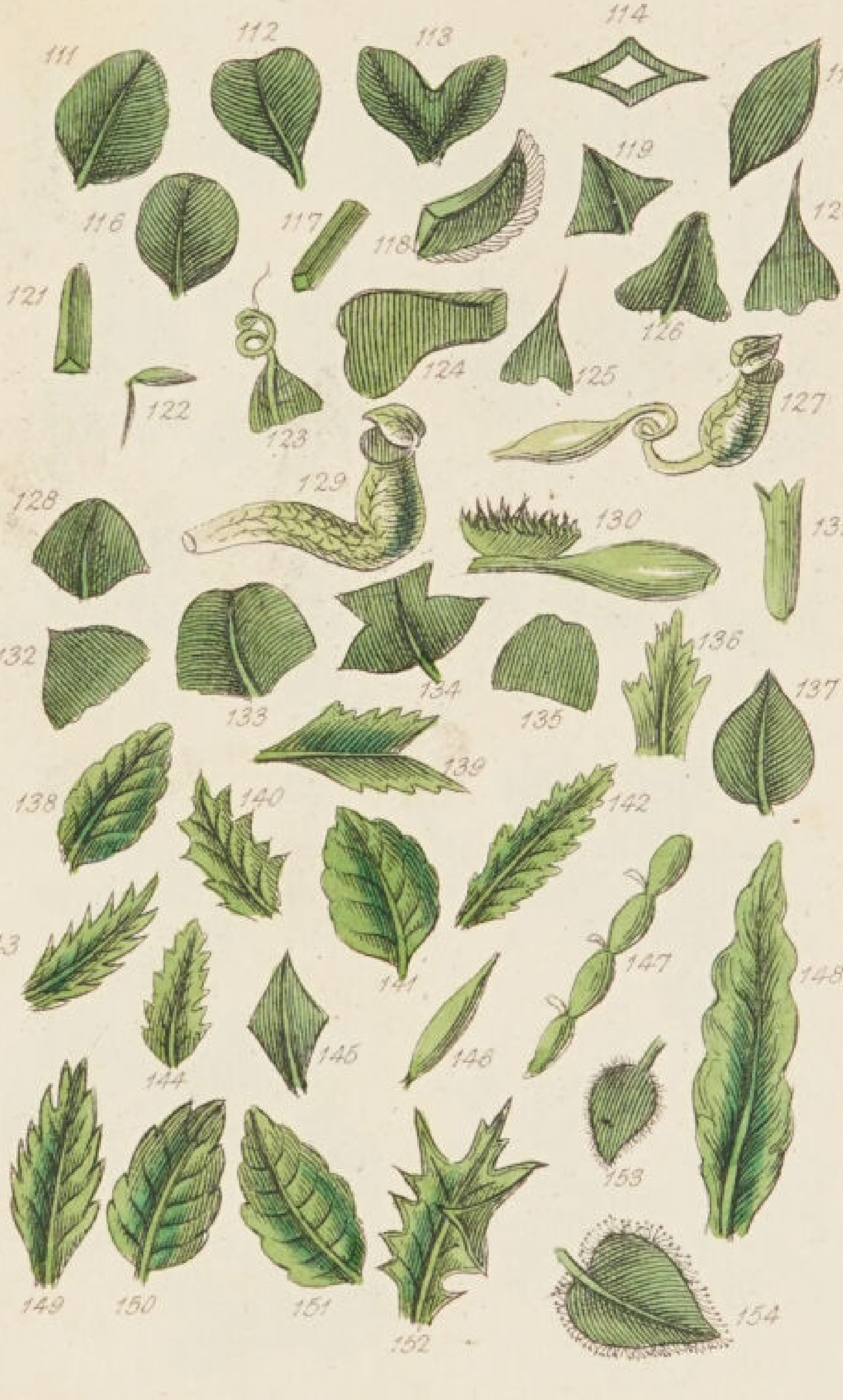

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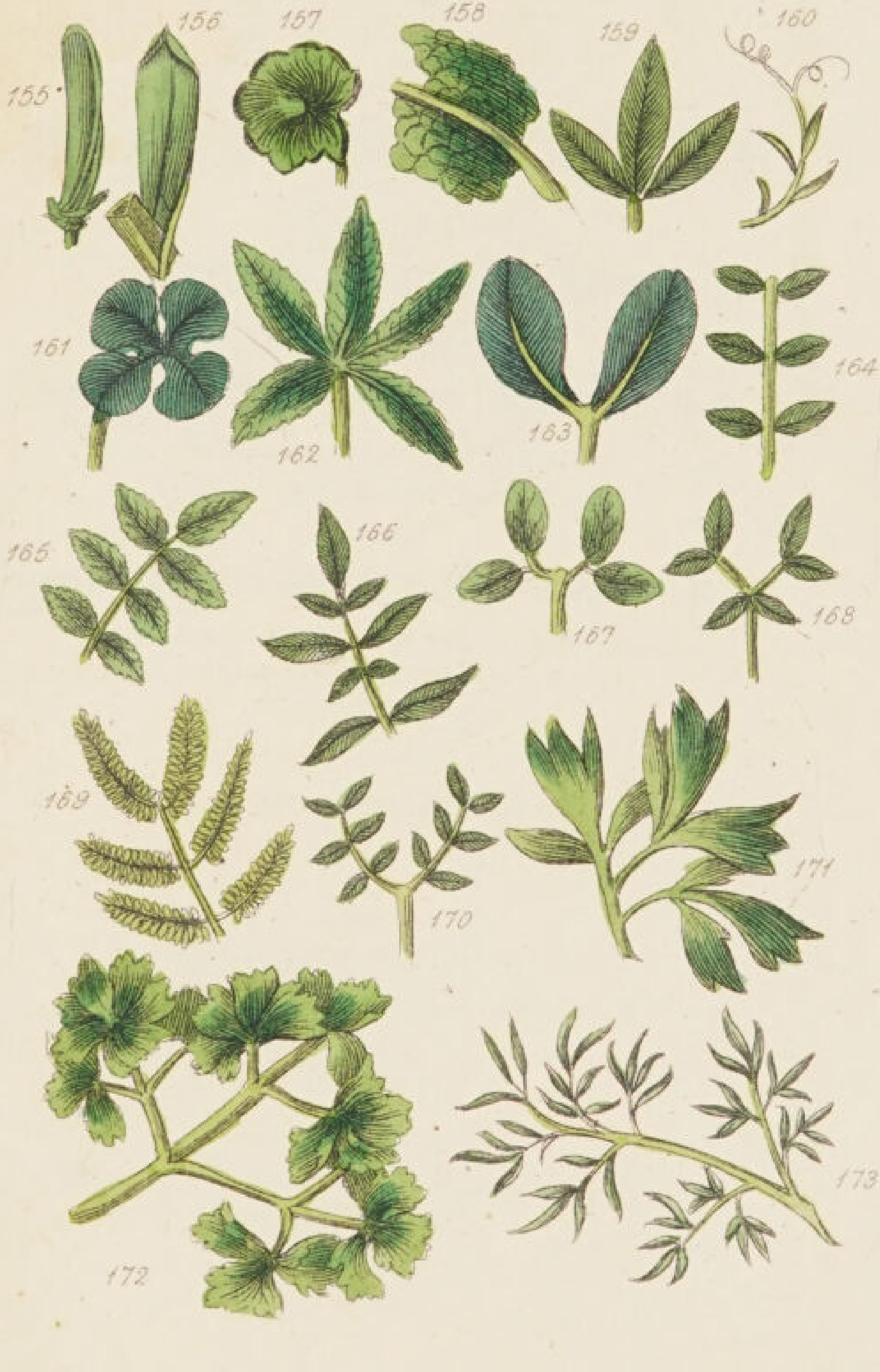

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AND

JOSEPH HENRY GREEN, ESQ F.R.S.

PROFESSOR OF ANATOMY TO THE ROYAL ACADEMY,
SURGEON TO, AND LECTURER ON SURGERY,
ST. THOMAS'S HOSPITAL.

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THOMAS CASTLE, F.L.S.
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