AN

INTRODUCTION

TO THE

STUDY OF BOTANY,

BY

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ETC., ETC.

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SEVENTH EDITION CORRECTED;

IN WHICH THE OBJECT OF THE "GRAMMAR OF BOTANY" OF SIR J. E. SMITH, IS COMBINED WITH THAT OF THE "INTRODUCTION;"

BY

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"Consider the lilies of the field how they grow."

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EDITOR'S PREFACE.

The value of Sir Jas. E. Smith's *Introduction to Physiological and Systematical Botany*, has been long felt and acknowledged by the British Public, and it is difficult to say whether the polished and agreeable style of the author, or the clearness and simplicity with which the subject is treated, demands the highest praise, or which has been of the greatest service in recommending the study of vegetables to various ranks and classes of people. The author himself, however, became sensible of its deficiency in containing no key to a knowledge of the Natural Orders; for which he endeavoured to compensate by the publication of the "*Grammar of Botany*," destined to explain the System and the Orders of the great Jussieu. But that volume went no farther; and I had often wished to see the object of the two works combined, with the addition of recent improvements; and even had it in contemplation to prepare an introductory work on such a plan, for the use of my own Class, when I was called upon by the Publishers of Sir Jas. E. Smith's works to edite a seventh edition of the "Introduction;" with, however, the most liberal permission to make what alteration or amendments the advanced state of the science should demand, or my own experience should suggest. I immediately proposed the union of the Grammar with the Introduction, and had thus the gratification of seeing my own wishes fulfilled, and what gave me even greater satisfaction, of preserving all that was most valuable of the author, in his own language, and in his own words.

Some further alteration was, indeed, necessary, and more space was required to admit, in one conveniently sized volume, the many additional Orders which have been introduced since the publication of the *Genera Plantarum* of Jussieu: and this has been accomplished by employing a smaller type, by omitting the numerous references to the *English Botany*, *Botanical Magazine* and *Exotic Botany ;* works of great cost and rarity, and which are consequently in the hands of very few botanical students. Thus has all the necessary space been obtained, and independently of the Chapter illustrative of the Natural Method, the whole (with the exception of some occasional notes and observations which are invariably distinguished from the body of the text,) stands as it came from the pen of the talented and lamented author in the 6th edition of this Introduction.

One great liberty indeed I have taken with the Title, and that is in omitting the words " Physiological and Systematical" (" Introduction to *Physiological* and *Systematical* Botany") ; and this I have done, lest the Reader should feel disappointment in the circumstance of so small a portion of the work being devoted to the former extensive and interesting subject. It indeed, contains the author's own views respecting it, down to so late a period as 1827 ; still as it embraces none or very few of the theories and discoveries of the French and German Physiologists, it must be allowed to be deficient in those respects; but is nevertheless in my opinion amply sufficient for a work whose end and aim, it must be confessed, are chiefly the communicating a knowledge of systematic Botany, and through that, of the uses and properties of Plants. To have discussed the subject fully and satisfactorily, and in a manner which its importance demands, would have required more time to be devoted to it than at present falls to my lot, while the admission of such a Treatise would have swelled the volume to an unreasonable size, and thus have deprived it of that extended degree of utility which its author always had in view: and it is now happily the less necessary, since we have in our own language a work which gives ample information on this head—I mean Professor Lindley's "Introduction to Botany:"—whilst in the very elaborate "Physiologie Végétale, ou Exposition des Forces et des Fonctions des Végétaux, pour servir de suite à l'Organographie Végétale et d' Introduction à la Botanique Géographique et Agricole" of De Candolle, the student may trace the progress of our knowledge of this science from the earliest period to the present day.

The extent and value of the "*terms*" employed in systematical Botany are of course differently estimated by different writers. So long as Botany was followed only with the view to the Linnæan or artificial arrangement of Plants, Sir Jas. E. Smith's Introduction may, in general, have been considered to give not only a sufficient but a copious terminology. Still, a more correct acquaintance with the Natural Families, and a deeper insight into vegetable organization have induced a necessity for a greater number of characteristic words. Such of these as are adopted in the systematic writings of our most esteemed authors, I have felt incumbent on me to introduce, but as briefly as possible; and, always bearing in mind the object of leaving Sir Jas. E. Smith's portion of this work in as original a state as possible, I have thought it best to print them with the alphabetical Indices, where, in the Index, No. I., the terms used substantively, and in the Index, No. II., those used adjectively, are either explained or referred to in the body of the work. My own inclinations, no less than the high respect I entertain for the author himself, have induced me to adhere as much as possible to the terminology of Sir Jas. E. Smith; assured, as I am, that by such a method the science is most likely to be effectually promoted.

I need hardly say, that in the choice of the characters for the Natural Orders, I invariably assign the preference to those which have been given by authors who have most studied them with a view to an universal arrangement. Thus, those of Professor De Candolle, as far as his inestimable "*Prodromus*" has extended, are here almost constantly adopted, and in the disposition of the succeeding Orders, I have in a great measure followed that given in the same writer's "*Théorie Elémentaire*." Many of these latter are happily detailed by the pen of a great master, in the "*Prodomus Floræ Novæ Hollandiæ*." Of these I have not failed to avail myself; nor of the more recent Orders, scattered through the whole system, which have appeared collectively in Professor Lindley's "*Introduction to the Natural System*," and which, together with the "general Introduction" already mentioned, ought to be in the hands of every Botanist both practical and theoretical. These, with Mr. Arnott's Table of Orders in the new edition of the Edinburgh Cyclopædia, together with the different Memoirs of the French and German Botanists, dispersed throughout various scientific works, have been my chief guides towards illustrating the portion of the work under consideration, making only such alterations as I deemed expedient to suit the characters to the present Introduction, and the terminology here recommended. Under the respective Orders, are given examples of the Genera, including nearly the whole of the British ones (except, indeed, in the Acotyledonous Plants, where their number is a bar to their being mentioned); and a brief notice of some of their more remarkable products and properties.

Messrs. Longmans having consented to the plates of the "Grammar of Botany" being published with the "Introduction," they will be found to furnish valuable additional illustrations to many of the most important Natural Orders, as well as to the terms which are verbally explained in the more elementary pages of the work:—and in order that they may be distinguished from the other plates of the volume, they are mentioned as supplementary ones (*Suppl.*), and the same mark is prefixed to the numbers on the plate itself.

W. J. HOOKER.

GLASGOW, *May* 1, 1833.

PREFACE

TO THE SIXTH EDITION.

After the many elementary works on Botany which have appeared in various languages, any new attempt of the same kind may, at first sight, seem unnecessary. But when we consider the rapid progress of the science within a few years, in the acquisition and determination of new plants, and especially the discoveries and improvements in vegetable physiology: when we reflect on the views with which those fundamental works of Linnæus, the basis of all following ones, were composed, and to whom they were addressed, we must be aware of their unfitness for purposes of general and popular utility, and that something else is wanting. If we examine the mass of introductory books on botany in this light, we shall find them in some cases too elaborate and intricate, in others too obscure and imperfect: they are also deficient in that very pleasing and instructive part of botany the anatomy and physiology of plants. There are indeed works, such as Rose's *Elements of Botany*, and Darwin's *Phytologia*, with which no such faults can be found. The former is a compendium of Linnæan learning, the latter a store of ingenious philosophy; but they were designed for philosophers, and are not calculated for every reader. Linnæus and his scholars have generally written in Latin. They addressed themselves to physicians, to anatomists, to philosophers, little thinking that their science would ever be the amusing pursuit of the young, the elegant and the refined, or they would have treated the subject differently. It appears to me, therefore, that an introductory publication is still desirable in this country, on an original plan, easy, comprehensive, and fit for general use; and such were the reasons which first prompted me to the undertaking.

When, however, I had proceeded a considerable way in its execution, I found that such a work might not only serve to teach the first outlines of the science, but that it might prove a vehicle for many observations, criticisms, and communications, scarcely to be brought together on any other plan: nor did it appear any objection to the general use of the book, that, besides its primary intention, it might be capable of leading into the depths of botanical philosophy, whether physiological, systematical, or critical, any student who should be desirous of proceeding so far. A volume of this size can indeed be but elementary on subjects so extensive; but if it be clear and intelligible as far as it goes, serving to indicate the scope of the science of botany, and how any of its branches may be cultivated further, my purpose is answered. The subject has naturally led me to a particular criticism of the Linnæan system of arrangement, which the public, it seems, has expected from me. Without wasting any words on those speculative and fanciful changes, which the most ignorant may easily make in an artificial system; and without entering into controversy, with the very few competent writers who have proposed any alterations; I have simply stated the result of my own practical observations, wishing by the light of experience to correct and to confirm what has been found useful, rather than rashly to overthrow what perhaps cannot on the whole be improved.

As the discriminating characters of the Linnæan system are founded in nature and fact, and depend upon parts essential to every species of plant when in perfection; and as the application of them to practise is, above all other systems, easy and intelligible; I conceive nothing more useful can be done than to perfect, upon its own principles, any parts of this system that experience may show to have been originally defective. This is all I presume to do. Speculative alterations in an artificial system are endless, and scarcely answer any more useful purpose than changing the order of letters in an alphabet. The philosophy of botanical arrangement or the study of the natural affinities of plants, is quite another matter. But it would be as idle, while we pursue this last-mentioned subject, so deep and so intricate that its most able cultivators are only learners, to lay aside the continual use of the Linnæan system, as it would be for philologists and logicians to slight the convenience, and indeed necessity, of the alphabet, and to substitute the Chinese character in its stead. If the following pages be found to elucidate and to confirm this comparison, I wish the student to keep it ever in view.

The illustration of the Linnæan system of classification, though essential to my purpose, is however but a small part of my aim. To explain and apply to practice those beautiful principles of method, arrangement and discriminations which render Botany not merely an amusement, a motive for taking air and exercise, or an assistance to many other arts and sciences; but a school for the mental powers, an alluring incitement for the young mind to try its growing strength, and a confirmation of the most enlightened understanding in some of its sublimest most important truths. That every path tending to ends so desirable may be accessible, I have not confined myself to systematical subjects, wide and various as they are, but I have introduced the anatomy and physiology of plants to the botanical student, wishing to combine all these several objects; so far at least that those who do not cultivate them all, may be sensible of the value of each in itself, and that no disgraceful rivalship or contempt, the offspring of ignorance, may be felt by the pursuers of any to the prejudice of the rest.

I have treated of physiological and anatomical subjects in the first place, because a true knowledge of the structure and parts of plants seems necessary to the right understanding of botanical arrangement; and I trust the most superficial reader will here find enough for that purpose, even though he should not be led to pursue these subjects further by himself. I have every where aimed at familiar illustrations and examples, referring, as much as possible, to plants of easy acquisition. In the explanation of botanical terms and characters, I have, besides furnishing a new set of plates with references to the body of the work, always cited a plant for my purpose by its scientific name, with a reference to some good and sufficient figure. For this end I have generally used either my own works, the *English* and *Exotic Botany*,* all the plates of which, as well as of the present volume, are the performance of the same excellent botanist as well as artist; or *Curtis's Magazine*,* some of which also were drawn by Mr. Sowerby, but the greater part by the no less ingenious Mr. Edwards. I have chosen these as the most comprehensive and popular books, quoting others only when these failed me, or when I had some particular end in view. If this treatise should be adopted for general use in schools or families, the teacher at least will probably be furnished with those works, and will accommodate their contents to the use of the pupils. I am aware of the want of a systematical English description of British plants, on the principles of this *Introduction;* but that deficiency I hope as soon as possible

* These references are omitted in the present edition, for reasons stated in the Editor's Preface.—Ed.

to supply.* In the mean while Dr. Withering's work may serve the desired purpose, attention being paid only to his original descriptions, or to those quoted from English writers. His index will atone for the changes I cannot approve in his system. Wherever my book may be found deficient in the explanation of his or any other terms, as I profess to retain only what are necessary, or in some shape useful, the *Language of Botany*, by Professor Martyn, will prove extremely serviceable.

Having thus explained the use and intention of the present work, perhaps a few remarks on the recommendations of the study of Botany, besides what have already been suggested, may not here be misplaced.

I shall not labour to prove how delightful and instructive it is to

"Look through Nature up to Nature's God."

Neither, surely, need I demonstrate, that if any judicious or improved use is to be made of the natural bodies around us, it must be expected from those who discriminate their kinds and study their properties. Of the benefits of natural science in the improvement of many arts, no one doubts. Our food, our physic, our luxuries are improved by it. By the inquiries of the curious, new acquisitions are made in remote countries, and our resources of various kinds are augmented. The skill of Linnæus by the most simple observation, founded however on scientific principles, taught his countrymen to destroy an insect, the *Cantharis navalis*, which had cost the

* The *English Flora*, by the author of the present work, of which three volumes have appeared, and a fourth is now in the press, is published with this intention.—The fourth appeared in 1828, shortly before the death of the author, and included the whole of the first 23 Classes, and the Ferns of the 24th Class: and the 1st part of the fifth volume, including the Mosses, Hepaticæ, Lichens, Characeæ and Algæ, has likewise been published by the Editor of this Edition of the Introduction.—Ed.

Swedish government many thousand pounds a year by its ravages on the timber of one dockyard only. After its metamorphoses, and the season when the fly laid its eggs, were known, all its ravages were stopped by immersing the timber in water during that period. The same great observer, by his botanical knowledge, detected the cause of a dreadful disease among the horned cattle of the north of Lapland, which had previously been thought equally unaccountable and irremediable, and of which he has given an exquisite account in his Lapland Tour, as well as under *Cicuta virosa, Engl. Bot. t.* 479, in his *Flora Lapponica.* One man in our days, by his scientific skill alone, has given the bread-fruit to the West-Indies, and his country justly honoured his character and pursuits. All this is acknowledged. We are no longer in the infancy of science, in which its utility, not having been proved, might be doubted, nor is it for this that I contend. I would recommend Botany for its own sake. I have often alluded to its benefits as a mental exercise, nor can any study exceed it in raising curiosity, gratifying a taste for beauty and ingenuity of contrivance, or sharpening the powers of discrimination. What then can be better adapted for young persons? The chief use of a great part of our education is no other than what I have just mentioned. The languages and the mathematics, however valuable in themselves when acquired, are even more so as they train the youthful mind to thought and observation. In Sweden Natural History is the study of the schools, by which men rise to preferment; and there are no people with more acute or better regulated minds than the Swedes.

To those whose minds and understandings are already formed, this study may be recommended, independently of all other considerations, as a rich source of innocent pleasure. Some people are ever inquiring "what is the use" of any particular plant, by which they mean "what food or physic, or what materials for the painter or dyer does it afford?" They look on a beautiful flowery meadow with admiration, only in proportion as it affords nauseous drugs or salves. Others consider a botanist with respect only as he may be able to teach them some profitable improvement in tanning, or dyeing, by which they may quickly grow rich, and be then perhaps no longer of any use to mankind or to themselves. They would permit their children to study Botany, only because it might possibly lead to professorships, or other lucrative preferment.

These views are not blameable, but they are not the sole end of human existence. Is it not desirable to call the soul from the feverish agitation of worldly pursuits, to the contemplation of Divine Wisdom in the beautiful economy of Nature? Is it not a privilege to walk with God in the garden of creation, and hold converse with his Providence? If such elevated feelings do not lead to the study of Nature, it cannot far be pursued without rewarding the student by exciting them.

Rousseau, a great judge of the human heart and observer of human manners, has remarked, that "when science is transplanted from the mountains and woods into cities and worldly society, it loses its genuine charms, and becomes a source of envy, jealousy and rivalship." This is still more true if it be cultivated as a mere source of emolument. But the man who loves botany for its own sake knows no such feelings, nor is he dependent for happiness on situations or scenes that favour their growth. He would find himself neither solitary nor desolate, had he no other companion than a "mountain daisy," that "modest crimson-tipped flower," so sweetly sung by one of Nature's own poets. The humblest weed or moss will ever afford him something to examine or to illustrate, and a great deal to admire. Introduce him to the magnificence of a tropical forest, the enamelled meadows of the Alps, or the wonders of New Holland, and his thoughts will not dwell much upon riches or literary honours, things that

"Play round the head, but come not near the heart."

One idea is indeed worthy to mix in the pure contemplation of Nature, the anticipation of the pleasure we may have to bestow on kindred minds with our own, in sharing with them our discoveries and our acquisitions. This is truly an object worthy of a good man, the pleasure of communicating virtuous disinterested pleasure to those who have the same tastes with ourselves; or of guiding young ingenuous minds to worthy pursuits, and facilitating the acquisition of what we have already obtained. If honours and respectful consideration reward such motives, they flow from a pure source. The giver and the receiver are alike invulnerable, as well as inaccessible, to "envy, jealousy or rivalship," and may pardon their attacks without an effort.

The natural history of animals, in many respects even more interesting than botany to man as an animated being, and more striking in some of the phenomena which it displays, is, in other points, less pleasing to a tender and delicate mind. In botany all is elegance and delight. No painful, disgusting, unhealthy experiments or inquiries are to be made. Its pleasures spring up under our feet, and, as we pursue them, reward us with health and serene satisfaction. None but the most foolish or depraved could derive any thing from it but what is beautiful, or pollute its lovely scenery with unamiable or unhallowed images. Those who do so, either from corrupt taste or malicious design, can be compared only to the fiend entering into the garden of Eden.

Let us turn from this odious picture to the contemplation of Nature, ever new, ever abundant in inexhaustible variety Whether we scrutinize the damp recesses of woods in the wintry months, when the numerous tribes of mosses are displaying their minute but highly interesting structure; whether we walk forth in the early spring, when the ruby tips of the hawthorn-bush give the first sign of its approaching vegetation, or a little after, when the violet welcomes us with its scent, and the primrose with its beauty; whether we contemplate in succession all the profuse flowery treasures of the summer, or the more hidden secrets of Nature at the season when fruits and seeds are forming; the most familiar objects, like old friends, will always afford us something to study and to admire in their characters, while new discoveries will awaken a train of new ideas. The yellow blossoms of the morning, that fold up their delicate leaves as the day advances; others that court and sustain the full blaze of noon; and the pale night-scented tribe, which expand, and diffuse their very sweet fragrance, towards evening, will all please in their turn. Though spring is the season of hope and novelty, to a naturalist more especially, yet the wise provisions and abundant resources of Nature, in the close of the year, will yield an observing mind no less pleasure, than the rich variety of her autumnal tints affords to the admirers of her external charms. The more we study the works of the Creator, the more wisdom, beauty and harmony become manifest, even to our limited apprehensions: and while we admire, it is impossible not to adore.

"Soft roll your incense, herbs, and fruits, and flowers,
In mingled clouds, to *Him*, whose sun exalts,
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CONTENTS.

INTRODUCTION

TO

PHYSIOLOGICAL AND SYSTEMATICAL

BOTANY.

CHAP. I.—*Distinctions between Animals, Vegetables, and Fossils.—On the Vital Principle essential to the two former.*

THOSE who with a philosophical eye have contemplated the productions of Nature, have all, by common consent, divided them into three great classes, called the Animal, the Vegetable, and the Mineral or Fossil Kingdoms. These terms are still in general use, and the most superficial observer must be struck with their propriety. The application of them seems at first sight perfectly easy, and in general it is so. Difficulties occur to those only who look very deeply into the subject.

Animals have an organized structure, which regularly unfolds itself, and is nourished and supported by air and food; they consequently possess life, and are subject to death; they are moreover endowed with sensation, and with spontaneous, as well as voluntary, motion.

Vegetables are organized, supported by air and food, endowed with life and subject to death as well as animals.

They have in some instances spontaneous, though we know not that they have voluntary, motion. They are sensible to the action of nourishment, air, and light, and either thrive or languish according to the wholesome or hurtful application of these stimulants. This is evident to all who have ever seen a plant growing in a climate, soil, or situation, not suitable to it. Those who have ever gathered a rose, know but too well how soon it withers; and the familiar application of its fate to that of human life and beauty is not more striking to the imagination than philosophically and literally true. The sensitive plant is a more astonishing example of the capability of vegetables to be acted upon as living bodies. Other instances of the same kind we shall hereafter have occasion to consider.

The spontaneous movements of plants are almost as readily to be observed as their living principle. The general direction of their branches, and especially of the upper surface of their leaves, though repeatedly disturbed, to the light; the unfolding and closing of their flowers at stated times, or according to favourable or unfavourable circumstances, with some still more curious particulars to be explained in the sequel of this work, are actions undoubtedly depending on their vital principle, and are performed with the greater facility in proportion as that principle is in its greatest vigour. Hence arises a question whether Vegetables are endowed with sensation. As they possess life, irritability, and motion, spontaneously directing their organs to what is natural and beneficial to them, and flourishing according to their success in satisfying their wants, may not the exercise of their vital functions be attended with some degree of sensation, however low, and some consequent share of happiness? Such a supposition accords with all the best ideas we can form of the Divine Creator; nor could the consequent uneasiness which plants must suffer, no doubt in a very low degree likewise, from the depredations of animals, bear any comparison with their enjoyment on the whole. However this may be, the want of sensation is most certainly not to be proved with regard to Vegetables, and therefore is of no use as a practical means of distinguishing them, in doubtful cases, from Animals.

Some philosophers * have made a locomotive power peculiarly characteristic of Animals, not being aware of the true nature of those half animated beings called Corals and Corallines, which are fixed, as immovably as any plants, to the bottom of the sea, while indeed many living vegetables swim around them, unattached to the soil, and nourished by the water in which they float. Some † have characterized Animals as nourished by their internal, and Vegetables by their external surface, the latter having no such thing as an internal stomach. This is ingenious, and tolerably correct; but the proofs of it must fail with respect to those minute and simply constructed animals the Polypes, and the lower tribes of Worms, whose feelers, put forth into the water, seem scarcely different from roots seeking their food in the earth, and some of which may be turned inside out, like a glove, without any disturbance of their ordinary functions. The most satisfactory remark I have for a long time met with on this difficult subject is that of M. Mirbel, in his *Traité d'Anatomie et de Physiologie Végétales*,‡ a work I shall often have occasion to quote. He observes, *vol.* i. *p.* 19, " that plants alone have a power of deriving nourishment, though not indeed exclusively, from inorganic matter, mere earths, salts, or airs, substances certainly incapable of serving as food for any animals, the latter only feeding on what is or has been, organized matter, either of a vegetable or animal nature. So that it should seem to be the office of vegetable life alone to transform dead matter into organized living bodies." This idea appears to me so just, that I have in vain sought for any exception to it.

Let us however descend from these philosophical speculations to purposes of practical utility. It is sufficient for the young student of Natural History to know, that in every case in which he can be in doubt whether he has found a plant or one of the lower orders of animals, the simple experiment of burning will decide the question. The smell of a burnt bone,

* Jungius, Boerhaave, Ludwig, and many others.

† Dr. Alston, formerly professor of Botany at Edinburgh.

‡ Published at Paris a few years since, in two vols. 8vo.

coralline, or other animal substance, is so peculiar that it can never be mistaken, nor does any known vegetable give out the same odour.

The Mineral Kingdom can never be confounded with the other two. Fossils are masses of mere dead unorganized matter, subject to the laws of chemistry alone; growing indeed, or increasing by the mechanical addition of extraneous substances, or by the laws of chemical attraction, but not fed by nourishment taken into an organized structure. Their curious crystallization bears some resemblance to organization, but performs none of its functions, nor is any thing like a vital principle to be found in this department of Nature.

If it be asked what is this vital principle, so essential to animals and vegetables, but of which fossils are destitute, we must own our complete ignorance. We know it, as we know its Omnipotent Author, by its effects.

Perhaps in the fossil kingdom *heat* may be *equivalent* to a vital principle; but heat is not the vital principle of organized bodies, though probably a consequence of that principle.

Living bodies of animals and plants produce heat; and this phenomenon has not, I think, been entirely explained on any chemical principles, though in fossils the production of heat is in most cases tolerably well accounted for. In animals it seems to have the closest possible connexion with the vital energy. But the effects of this vital energy are still more stupendous in the operations constantly going on in every organized body, from our own elaborate frame to the humblest moss or fungus. Those different fluids, so fine and transparent, separated from each other by membranes as fine, which compose the eye, all retain their proper situations (though each fluid individually is perpetually removed and renewed) for sixty, eighty, or a hundred years, or more, while *life* remains. So do the infinitely small vessels of an almost invisible insect, the fine and pellucid tubes of a plant, all hold their destined fluids, conveying or changing them according to fixed laws, but never permitting them to run into confusion, so long as the vital principle animates their various forms. But no sooner does *death* happen, than, without any alteration of structure, any apparent change in their *material* configuration, all is reversed. The eye loses its form and brightness; its membranes let go their contents, which mix in confusion, and thenceforth yield to the laws of chemistry alone. Just so it happens, sooner or later, to the other parts of the animal as well as vegetable frame. Chemical changes, putrefaction, and destruction, immediately follow the total privation of life, the importance of which becomes instantly evident when it is no more. I humbly conceive, therefore, that if the human understanding can in any case flatter itself with obtaining, in the natural world, a glimpse of the *immediate agency* of the Deity, it is in the contemplation of this *vital principle*, which seems independent of material organization, and an impulse of his own divine energy.

Nor am I ashamed to confess that I can no more explain the physiology of vegetables than of animals, without this hypothesis, as I allow it to be, of a living principle in both. Chemistry seems to me no more competent to develope our vital functions, than the humoral pathology of old could explain our diseases. To argue from dead to living matter is a solecism. The able Mr. Chevalier, so recently lost to his country, has shown this on the most suitable of all occasions,* the anniversary of the birth of the great man to whose name and memory the Hunterian Oration is annually dedicated, and of whose physiological systems the *vital principle* always formed the basis. Even my illustrious friend Sir Humphry Davy, while he disowns this hypothesis, admits all I mean to claim, in allowing that vegetables "may truly be said to be living systems, inasmuch as they possess the means of converting the elements of common matter into organized structures." The Rev. Mr. Keith, who discusses this subject at length in *Trans. of Linn. Soc. v.* 11. *pp.* 252—269, justly observes, that our great chemist by "these *means*" evidently admits of something more than merely "common matter." I will not dispute about terms, but shall refer to this principle of vitality, by which a plant differs from a stone, and agrees with an

* See the Hunterian Oration delivered before the Royal College of Surgeons in London, on the 14th of February, 1821, by Thomas Chevalier, F.R.S. F.S.A. and F.L.S. Surgeon Extraordinary to the King. London, 1821.

animal, to explain, as far as I can, in the following pages, the phenomena of vegetation. I fear our ignorance of vegetable, as well as of animal, chemistry, must, on many occasions, take shelter under this *nominis umbra.*

Chap. II.—*Definition of Natural History, and particularly Botany.—Of the general texture of Plants.*

Natural History properly signifies that study by which we learn to distinguish from one another the natural bodies, whether Animal, Vegetable, or Mineral, around us; to discover as much as possible their nature and properties, and especially their natural dependence on each other in the general scale of beings. In a more extensive sense, it may be said to teach their secondary properties, or the various uses to which they have been, or may be, converted, in the service of mankind or of other animals; inasmuch as an acquaintance with their natural qualities is our only sure guide to a knowledge of their artificial uses. But as this definition would include many arts and sciences, each of them sufficient to occupy any common mind, as Agriculture, Dietetics, Medicine, and many others, it is sufficient for a philosophical naturalist to be acquainted with the general principles upon which such arts and sciences are founded.

That part of Natural History which concerns plants is called Botany, from Βοτάνη, the Greek word for an herb or grass. It may be divided into three branches: 1st, The physiology of plants, or a knowledge of the structure and functions of their different parts; 2dly, The systematical arrangement and denomination of their several kinds; and 3dly, Their economical or medical properties. All these objects should be kept in view by an intelligent botanist. The two first are of essential service to each other, and the last is only to be pursued, with any certainty, by such as are versed in the other two. The present publication is intended to explain the fundamental principles of them all, with as much practical illustration as may be necessary for those who wish to become acquainted with this delightful science. Botany has one advantage over many other useful and necessary studies, that even its first beginnings are pleasing and profitable, though pursued to ever so small an extent; the objects with which it is conversant are in themselves charming, and they become doubly so to those who contemplate them with the additional sense, as it were, which science gives; the pursuit of these objects is an exercise no less healthful to the body, than the observation of their laws and characters is to the mind.

In studying the functions of the Vegetable frame, we must constantly remember that it is not merely a collection of tubes or vessels holding different fluids, but that it is endowed with life,* and consequently able not only to imbibe particular fluids, but to alter their nature according to certain laws, that is, to form peculiar secretions. This is the exclusive property of a living being. Animals secrete milk and fat from food which has no resemblance to those substances; so Vegetables secrete gum, sugar, and various resinous substances from the various materials of the soil in which they grow, or perhaps from mere water and air. The most different and discordant fluids, separated only by the finest film or membrane, are, as I have already observed, kept perfectly distinct while life remains; but no sooner does the vital principle depart, than secretion, as well as the due preservation of what has been secreted, are both at an end, and the principle of dissolution reigns absolute.

Before we can examine the physiology of vegetables, it is necessary to acquire some idea of their structure.

Much light has been thrown upon the general texture of Vegetables by the microscopic figures of Grew, Malpighi and others, repeated by Dr. Thornton in his Illustration of the Linnæan System; but more especially by the recent observations and highly magnified dissections of M. Mirbel. See his table of Vegetable Anatomy, in the work already mentioned. From preceding writers we had learned the general

* See Chapter I.

tubular or vascular structure of the vegetable body, and the existence of some peculiar spirally-coated vessels in many plants. On these slender foundations physiologists have, at their pleasure, constructed various theories, relative to the motion of the sap, respiration, and other functions, presumed to be analogous to those of animals. The anatomical observations of Mirbel go further than those of Grew, &c., and it is necessary to give a short account of his discoveries.

He finds, by the help of the highest magnifying powers, that the vegetable body is a continued mass of tubes and cells; the former extended indefinitely, the latter frequently and regularly interrupted by transverse partitions. These partitions being ranged alternately in the corresponding cells, and each cell increasing somewhat in diameter, after its first formation, except where restrained by the transverse partitions, seem to account for their hexagonal figure.* See Tab. I. *f. a.* The membranous sides of all these cells and tubes are very thin, more or less transparent, often porous, variously perforated or torn. Of the tubes, some are without any lateral perforations, *f. b*, at least for a considerable extent; others are pierced with holes ranged in a close spiral line, *f. c;* in others several of these holes run together, as it were, into interrupted spiral clefts, *f. d;* and in some those clefts are continued, so that the whole tube, more or less, is cut into a spiral line, *f. e;* which, in some young branches and tender leaves, will unroll to a great extent, when they are gently torn asunder. The cellular texture, especially, is extended to every part of the vegetable body, even into the thin skin called the cuticle, which covers every external part, and into the fine hairs or down which, in some instances, clothe the cuticle itself.

Before we offer any thing upon the supposed functions of these different organs, we shall take a general view of the Vegetable body, beginning at the external part and proceeding inwards.

* In microscopic figures they are generally drawn like circles intersecting each other.

Chap. III.—*Of the Cuticle or Epidermis.*

Every part of a living plant is covered with a skin or membrane, called the cuticle, which same denomination has been given by anatomists to the scarf skin that covers the animal body, protecting it from the injuries of the air, and allowing of due absorption and perspiration through its pores.

There is the most striking analogy, if not a perfect identity, between the animal and the vegetable cuticle. In the former, it varies in thickness from the exquisitely delicate film which covers the eye, to the hard skin of the hand or foot, or the far coarser covering of a Tortoise or Rhinoceros; in the latter, it is equally delicate on the parts of a flower, and scarcely less hard on the leaves of the Pearly Aloe, or coarse on the trunk of a Plane-tree. In the numerous layers of this membrane continually peeling off from the Birch, we see a resemblance to the scales which separate from the shell of a Tortoise. By maceration, boiling, or putrefaction, this part is separable from the plant as well as from the animal, being, if not absolutely incorruptible, much less prone to decomposition than the parts it covers. The vital principle, as far as we can judge, seems to be extinct in it.

The cuticle admits of the passage of fluids from within as well as from without, but in a due and definite proportion in every plant: consequently it must be porous; and the microscope shows, what reason would teach us to expect, that its pores are different in different kinds of plants. In very succulent plants, as Aloes, a leaf of which being cut off will lie for many weeks in the sun without drying entirely, and yet when partly dry, will become plump again in a few hours if plunged into water, the cuticle must be very curiously constructed, so as to admit of ready absorption, and very tardy perspiration. Such plants are accordingly designed to inhabit hot sandy countries, where they are long exposed to a burning sun, with very rare supplies of rain.

This part allows also of the passage of air, as is proved by experiments on the functions of leaves. Light probably acts through it, as the cuticle is a colourless membrane. We know the effects of light to be very important in the vegetable economy.

But though this fine membrane admits extraneous substances, so as to have their due effect upon the vegetable constitution, according to fixed laws, it no less powerfully excludes all that would be injurious to the plant, either in kind or proportion. Against heat or cold it proves, in general, but a feeble defence; but when clothed with hair or wool, it becomes a very powerful one. Against the undue action of the atmosphere it is so important a guard, that, when any tender growing part is deprived of it, the greatest mischiefs ensue. It forms in the Vegetable, as well as the Animal, a fine but essential barrier between life and destruction.

Some have imagined that the cuticle gave form to the vegetable body, because it sometimes being over-tight causes contractions on the stem of a tree, as in the Plum or Cherry, and because it is found to be cracked wherever an unnatural excrescence is produced on the bark. No doubt the cuticle is formed so as to accommodate itself only to the natural growth of the plant, not to any monstrosities, and those lumps cause it to burst; just as it happens to ripe fruits in very wet seasons. Their cuticle is constructed suitably to their usual size or plumpness, but not to any immoderate increase from too great absorption of wet. If the cuticle be removed from any part, no swelling follows, as it would if this membrane only kept the tree in shape.

The extension of the cuticle is astonishing, if we consider that it is formed, as Grew well observes, on the tenderest embryo, and only extended during the growth of the plant, and that it appears not to have any connexion with the vascular or living part of the vegetable body. But though so accommodating in those parts where it is wanted, on the old trunks of most trees it cracks in every direction, and in many is entirely obliterated, the old dead layers of their bark performing all the requisite offices of a cuticle.

M. Mirbel, indeed, though he admits the importance of this part in the several ways above-mentioned, contends, that it is not a distinct organ like the cuticle of animals, but merely formed of the cellular parts of the plant dilated and multiplied, and changed by their new situation. This is very true; but upon the same principle, the human cuticle can scarcely be called a distinct organ. Its texture is continually scaling off externally, and it is supplied with new layers from within. Just so does the cuticle of the Birch peel off in scales, separable, almost without end, into smaller ones.

Examples of different kinds of cuticle may be seen in the following plants.

On the Currant tree it is smooth, and scales off in large entire flakes, both from the young branches and old stem. The same may be observed in the Elder.

The fruit of the Peach, and the leaf of the Mullein, have a cuticle covered with dense and rather harsh wool, such as is found on many South American plants, and on more Cretan ones. The latter, we know, grow in open places under a burning sun.

The leaf of the White Willow is clothed with a fine silky or satiny cuticle.

The cuticle of the Betony, and of many other plants, is extended into rigid hairs or bristles, which in the Nettle are perforated, and contain a venomous fluid.

On the fruit of the Plum, and on many leaves, we find a bluish dry powder covering the cuticle, which is a resinous exudation, and it is difficult to wet the surface of these plants. Rain trickles over them in large drops.

In the Cork tree, the Common Maple, and even the Dutch Elm, the cuticle is covered with a fungous substance, most extraordinary in its nature, though familiar to us as cork.

In Grasses and some other plants, the ingenious Sir H. Davy has found a flinty substance in the cuticle. The *Equisetum hyemale*, in consequence of its unequal or toothed cuticle, which is of a flinty nature, serves to polish ivory and brass, being for such purposes imported from Holland, and called Dutch Rushes.

What seems to be the cuticle on the trunk of the Plane, the Fir, and a kind of Willow called *Salix triandra*, rather consists of scales of bark, which having performed their functions and become dead matter, are rejected by the increasing bark beneath them; and this accords with M. Mirbel's idea of the cuticle. The old layers of bark in the Chestnut, Oak, and many other trees, though not cast off, are of the same nature; and these under the microscope exhibit the same cellular texture as the real cuticle.

CHAP. IV.—*Of the Cellular Integument.*

IMMEDIATELY under the Cuticle we find a succulent cellular substance, for the most part of a green colour, at least in the leaves and branches, which is called by Du Hamel the *Enveloppe cellulaire*, and by Mirbel the *Tissu herbacé.* This is, in general, the seat of colour, and in that respect analogous to the *rete mucosum*, or pulpy substance situated under the human cuticle, which is pale in the European, and black in the Negro; but we must carry the analogy no further, for these two parts perform no functions in common. Du Hamel supposed this pulp to form the cuticle; but this is improbable, as his experiments show, when that membrane is removed, that the Cellular Integument exfoliates, at least in trees, or is thrown off in consequence of the injury it has sustained, and a new cuticle, covering a new layer of the same succulent matter, is formed under the old one. Annual stems or branches have not the same power, any more than leaves.

But little attention has been paid to this organ till lately, though it is very universal, even, as Mirbel observes, in Mosses and Ferns. The same writer remarks, that "leaves consist almost entirely of a plate of this substance, covered on each side by the cuticle. The stems and branches of both annual and perennial plants are invested with it; but in woody parts it is dried up and reproduced continually, such parts only having that reproductive power. The old layers remain, are pushed outward by the new ones, and form at length the rugged dry dead covering of the old trunks of trees."

When we come to consider the curious functions of leaves, we shall find this part to be of the very first importance. In it the principal changes operated upon the sap of plants by light and air, and the consequent elaboration of all their peculiar secretions, take place.

Chap. V.—*Of the Bark.*

Under the Cellular Integument we find the Bark, consisting of but one layer in plants or branches only one year old, and often not distinguishable from the wood. In the older branches and trunks of trees, it consists of as many layers as they are years old, the innermost being called the *liber;* and it is in this layer only that the essential vital functions are carried on for the time being, after which it is pushed outwards with the Cellular Integument, and becomes, like that, a lifeless crust. These older layers, however, are for some time reservoirs of the peculiar secreted juices of the plant, which perhaps they may help to perfect.

In some roots, the bark, though only of annual duration, is very thick: as in the Carrot, the red part of which is all bark. In the Parsnep, though not distinctly coloured, it is no less evident. In the Turnep it is much thinner, though equally distinct from the wood or body of the root.

The Bark contains a great number of woody fibres, running for the most part longitudinally, which give it tenacity, and in which it differs very essentially from the parts already described. These woody fibres, when separated by maceration, exhibit, in general, a kind of net-work, and in many instances, great regularity and beauty of structure. In a family of plants, to which the Mezereon belongs, the fibres of the inner bark have a beautiful white shining appearance like silk. In one of this tribe, a native of Jamaica, and called Lace Bark, that part may be separated by lateral extension into an elegant kind of lace.

In the old bark of the Fir tribe, on the contrary, nothing of this kind is discernible. The bark of the Cluster Pine, *Pinus Pinaster*, some inches in thickness, is separable into thin porous layers, each of them the production of one season, which do really seem to be, according to M. Mirbel's theory, hardened and dried Cellular Integument; but they are rather perhaps that vascular part of the Bark which once contained the secreted fluid, or turpentine, so abundant in this tree.

The bark of Oak trees twenty or thirty years old, if cut and long exposed to the weather, separates into many fine thin layers, of a similar, though less delicate, texture to the Lace Bark of Jamaica. All these layers, in a living state, are closely connected with each other by the cellular texture which pervades the vegetable body in general, as well as by transverse vessels necessary for the performance of several functions hereafter to be mentioned.

In the bark the peculiar virtues or qualities of particular plants chiefly reside, and more especially in several of its internal layers nearest to the wood. Here we find in appropriate vessels the resin of the Fir and Juniper, the astringent principle of the Oak and Willow, on which their tanning property depends, the fine and valuable bitter of the Peruvian Bark, and the exquisitely aromatic oil of the Cinnamon. The same secretions do indeed, more or less, pervade the wood and other parts of these plants, but usually in a less concentrated form.

When a portion of the bark of a tree is removed, the remainder has a power of extending itself laterally, though very gradually, till the wound is closed. This is accomplished by each new layer, added to the bark internally, spreading a little beyond the edge of the preceding layer. The operation of closing the wound goes on the more slowly, as the wood underneath, from exposure to the air, has become dead, and frequently rotten, proving an incumbrance, which, though the living principle cannot in this instance free itself from, it has no power of turning to any good account. If, however, this dead wood be carefully removed, and the wound protected from the injuries of the atmosphere, the new bark is found to spread much more rapidly: and as every new layer of bark forms, as will be proved in the next chapter, a new layer of wood, the whole cavity, whatever it may be, is in process of time filled up.

This operation of Nature was turned to great advantage by the late Mr. Forsyth of Kensington gardens, the history of whose experiments is before the public. Under his management many timber trees, become entirely hollow, were filled with new wood, and made to produce fresh and vigorous branches; and pear-trees, planted in the time of King William, and become so decayed and knotty as to bear no fruit worth gathering, were, by gradual paring away of the old wood and bark, and the application of a composition judiciously contrived to stick close and keep out air and wet, restored to such health and strength as to cover the garden walls with new branches bearing a profusion of fine fruit. These experiments have passed under my own actual observation, and I am happy to bear testimony to the merits of a real lover of useful science, and one of the most honest and disinterested men I ever knew.

Chap. VI.—*Of the Wood.*

When the bark is removed, we come to the substance of the wood, which makes the principal bulk of the trunk or branch of a tree or shrub. When cut across, it is found to consist of numerous concentric layers, very distinct in the Fir, and other European trees in general. Each of these circular layers is externally most hard and solid. They differ however among themselves in this respect, as well as in their breadth on the whole. It often happens that all the layers are broadest towards one side of the tree, so that their common centre is thrown very much out of the actual centre of the trunk.

The wood owes its strength and tenacity to innumerable woody fibres, and consists of various vessels running for the most part longitudinally; some having a spiral coat, others not. Of these vessels, some in their youngest state convey the sap from the root to the extremities of the branches and leaves; others contain the various peculiar or secreted juices; others perhaps contain air. The whole are joined together by the cellular substance already described.

Linnæus and most writers believe that one of the above-mentioned circular layers of wood is formed every year, the hard external part being caused by the cold of winter; consequently, that the exact age of a sound tree when felled may be known by counting these rings. It has even been asserted, that the date of peculiarly severe winters may be found in the harder more condensed rings, formed at those periods; and moreover, that the north side of a tree may always be known by the narrowness and density of the rings on that side. All this is controverted by Mirbel, chiefly on the authority of Du Hamel, who nevertheless scarcely says enough to invalidate the ancient opinion on the whole. It is very true that there may be occasional interruptions in the formation of the wood, from cold or fickle seasons, and that in some trees the thin intermediate layers, hardly discernible in general, which unite to form the principal or annual ones, may, from such fluctuation of seasons, become more distinct than is natural to them. Such intermediate layers are even found more numerous in some trees, of the same species and age, than in others. But as there is always a most material difference between summer and winter, so I believe will there always be a clear distinction between the annual rings of such trees as show them at all. Trees of hot countries indeed, as Mahogany, and evergreens in general, have them but indistinctly marked; yet even in these they are to be seen. With regard to their greater compactness on the north side of a tree, Du Hamel justly explodes this idea. In fact, there is most wood formed, and consequently these circles are broadest, on the side most favourable to vegetation, and where there are most branches and leaves. This in a solitary tree is generally towards the south; but it is easy to perceive the occasional variations which must arise from local exposure, soil, moisture, and other causes.

In some trees, a number of the outermost rings differ greatly in colour from the innermost, and are called by workmen the sap. In the Laburnum, the former are yellow, the latter brown. In the Oak, and many other trees, a similar difference, though less striking, is perceptible, and in most the external rings are much less firm, compact, and durable than the rest, retaining more vital principle, and more of the peculiar juices of the plant. Such rings are all comprehended by Du Hamel under the name of *Aubier*, alburnum; and he rightly observes that this difference often extends to a greater number of rings on one side of a tree than on another. It seems that the more vigour there is in a tree, or side of a tree, the sooner is its alburnum made perfect wood. By this term, however, is properly understood only the layer of new unhardened wood of the present year. When the word alburnum is used in the following pages, it applies to this part only.

Physiologists have long differed, and do still differ, about the origin of the wood. Malpighi and Grew thought it was formed by the bark, and the best observations have confirmed their opinion. Hales supposed the wood added a new layer to itself externally every year. Linnæus had a peculiar notion, that a new layer of wood was secreted annually, from the pith, and added internally to the former ones. Truth obliges me to confess that the latter theory is most devoid of any kind of proof or probability.

Du Hamel, by many experiments, proved the wood to be secreted or deposited from the innermost part of the bark or *liber*. He introduced plates of tinfoil under the barks of growing trees, carefully binding up their wounds, and, after some years, on cutting them across, he found the layers of new wood on the outside of the tin. His original specimens I have examined in the public museum at Paris.

Dr. Hope, formerly Professor of Botany at Edinburgh, instituted an experiment, if possible, more decisive, upon a branch of Willow three or four years old. The bark was carefully cut through longitudinally on one side, for the length of several inches, so that it might be slipped aside from the wood in the form of a hollow cylinder, the two ends remaining undisturbed. The edges of the bark were then united as carefully as possible, the wood covered from the air, and the whole bound up to secure it from external injury. After a few years, the branch was cut through transversely. The cylinder of bark was found lined with layers of new wood, whose number, added to those in the wood from which it had been stripped, made up the number of rings in the branch above and below the experiment. For an account of this experiment I am indebted to Dr. Thomas Hope, the present Chemical Professor at Edinburgh.

Du Hamel engrafted a portion of the bark of a Peach-tree upon a Plum. After some time he found a layer of new wood under the engrafted bark, white like that of the Peach, and evidently different from the red wood of the Plum. Moreover, in this, and other experiments made with the same intention, he found the layers of new wood always connected with the bark, and not united to the old wood. See his *Physique des Arbres*, *vol.* 2, *p.* 29, &c. It deserves also to be mentioned, that by performing this experiment of engrafting a portion of bark at different periods through the spring and summer, the same accurate observer found a great difference in the thickness of the layer of new wood produced under it, which was always less in proportion as the operation was performed later in the season.

That the bark or *liber* produces wood seems therefore proved beyond dispute, but some experiments persuaded Du Hamel that in certain circumstances the wood was capable of producing a new bark. This never happened in any case but when the whole trunk of a tree was stripped of its bark. A Cherry-tree treated in this manner exuded from the whole surface of its wood, in little points, a gelatinous matter which gradually extended over the whole, and became a new bark, under which a layer of new wood was speedily formed. Hence Mirbel concludes, *vol.* 1, *p.* 176, that the alburnum and the wood are really the origin of the new layers of wood, by producing first this gelatinous substance, or matter of organization, which he and Du Hamel call *cambium*, and which Mirbel supposes to produce the *liber* or young bark, and at the same time, by a peculiar arrangement of the vascular parts, the *alburnum* or new wood. His opinion is strengthened by the observation of a tribe of plants to be explained hereafter, Palms, Grasses, &c., in which there is no real bark, and in which he finds that the woody fibres do actually produce the *cambium*. Dr. Hope's experiment will scarcely invalidate this opinion, because it may be said the *cambium* had already in that case formed the *liber*.

This subject will be better understood when we come to speak of Mr. Knight's experiments on the course of the sap.

Chap. VII.—*Of the Medulla or Pith.*

The centre or heart of the vegetable body, within the wood, contains the *Medulla* or Pith. This, in parts most endowed with life, as roots, and young growing stems or branches, is a tolerably firm juicy substance, of an uniform texture, and commonly a pale green or yellowish colour. Such is its appearance in the young shoots of Elder in the spring; but in the very same branches, fully grown, the pith becomes dry, snow-white, highly cellular, and extremely light, capable of being compressed to almost nothing. So it appears likewise in the common Red or White Currant, and numerous other plants. In many annual stems, the pith, abundant and very juicy while they are growing, becomes little more than a web, lining the hollow of the complete stem, as in some Thistles. Many grasses and umbelliferous plants, as *Conium maculatum* or Hemlock, have always hollow stems, lined only with a thin smooth coating of pith, exquisitely delicate and brilliant in its appearance.

Concerning the nature and functions of this part various opinions have been held.

Du Hamel considered it as merely cellular substance connected with what is diffused through the whole plant, combining its various parts, but not performing any remarkable office in the vegetable economy.

Linnæus, on the contrary, thought it the seat of life and source of vegetation; that its vigour was the main cause of the propulsion of the branches, and that the seeds were more especially formed from it. This latter hypothesis is not better founded than his idea, already mentioned, of the pith adding new layers internally to the wood. In fact, the pith is soon obliterated in the trunks of many trees, which nevertheless keep increasing, for a long series of years by layers of wood added every year from the bark, even after the heart of the tree is become hollow from decay.

Some considerations have led me to hold a medium opinion between these two extremes. There is, in certain respects, an analogy between the *medulla* of plants and the nervous system of animals. It is no less assiduously protected than the spinal marrow or principal nerve. It is branched off and diffused through the plant, as nerves are through the animal. Hence it is not absurd to presume that it may, in like manner, give life and vigour to the whole, though by no means, any more than nerves, the organ or source of nourishment. It is certainly most vigorous and abundant in young and growing branches, and must be supposed to be subservient, in some way or other, to their increase. Mr. Lindsay of Jamaica, in a paper read long ago to the Royal Society, but not published, thought he demonstrated the *medulla* in the leaf-stalk of the *Mimosa pudica*, or Sensitive Plant, to be the seat of irritability, nor can I see any thing to invalidate this opinion.

Mr. Knight, in the Philosophical Transactions for 1801, *p.* 348, supposes the *medulla* may be a reservoir of moisture, to supply the leaves whenever an excess of perspiration renders such assistance necessary, and he has actually traced a direct communication by vessels between it and the leaf. "Plants," says that ingenious writer, "seem to require some such reservoir; for their young leaves are excessively tender, and they perspire much, and cannot, like animals, fly to the shade and the brook."

This idea of Mr. Knight's may derive considerable support from the consideration of bulbous-rooted grasses. The common Cats-tail Grass, *Phleum pratense*, when growing in pastures that are uniformly moist, has a fibrous root; but in dry situations, or such as are only occasionally wet, it acquires a bulbous one, whose inner substance is moist and fleshy, like the pith of young branches of trees. This is evidently a provision of Nature to guard the plant against too sudden a privation of moisture from the soil.

But on the other hand, all the moisture in the *medulla* of a whole branch is, in some cases, too little to supply one hour's perspiration of a single leaf. Neither can I find that the moisture of the *medulla* varies, let the leaves be ever so flaccid. I cannot but incline therefore to the opinion that the *medulla* is rather a reservoir of vital energy, even in these bulbous grasses.

Mr. Knight has shown that the part in question may be removed without any great injury to a branch, or at least without immediate injury; but I have had no opportunity of making any experiments on this particular subject.

Chap. VIII.—*Of the Sap-Vessels, and Course of the Sap; with Mr. Knight's Theory of Vegetation.*

Much contrariety of opinion has existed among physiologists concerning the vascular system of plants, and the nature of the propulsion of the sap through their stems and branches. Indeed it is a subject upon which, till lately, very erroneous ideas have prevailed.

That the whole vegetable body is an assemblage of tubes and vessels is evident to the most careless observer; and those who are conversant with the microscope, and books relating to it, have frequent opportunities of observing how curiously these vessels are arranged, and how different species of plants, especially trees, differ from each other in the structure and disposition of them. Such observations, however, if pursued no further, lead but a little way towards a knowledge of the wonderful physiology of vegetables.

In the 2d chapter, mention is made of the general cellular and vascular texture of plants; we must now be a little more particular in our inquiries.

That plants contain various substances, as sugar, gum, acids, odoriferous fluids and others, to which their various flavours and qualities are owing, is familiar to every one; and a little reflection will satisfy us that such substances must each be lodged in proper cells and vessels to be kept distinct from each other. They are extracted, or secreted, from the common sap of the plant, and called its peculiar or secreted fluids. Various experiments and observations, to be hereafter enlarged upon, prove also that air exists in the vegetable body, and must likewise be contained in appropriate vessels. Besides these, we know that plants are nourished and invigorated by water, which they readily absorb, and which is quickly conveyed through their stalks and leaves, no doubt by tubes or vessels on purpose. Finally, it is observable that all plants, as far as any experiment has been made, contain a common fluid, which at certain seasons of the year is to be obtained in great quantity, as from vine branches by wounding them in the spring before the leaves appear, and this is properly called the sap. It is really the blood of the plant, by which its whole body is nourished, and from which the peculiar secretions are made.

The great difficulty has been to ascertain the vessels in which the sap runs. Two of the most distinguished inquirers into the subject, Malpighi and Grew, believed the woody fibres, which make so large a part of the vegetable body, and give it consistence and strength, to be the sap-vessels, analogous to the blood-vessels of animals, and their opinion was adopted by Du Hamel. In support of this theory, it was justly observed that these fibres are very numerous and strong, running longitudinally, often situated with great uniformity (an argument for their great importance), and found in all parts of a plant, although in some they are so delicate as to be scarcely discernible. But Philosophers sought in vain for any perforation, any thing like a tubular structure in the woody fibres to countenance this hypothesis, they being divisible almost without end, like the muscular fibre. This difficulty was overlooked, because of the necessity of believing the existence of sap-vessels somewhere; for it is evident that the nutrimental fluids of a plant must be carried with force towards certain parts and in certain directions, and that this can be accomplished by regular vessels only, not, as Tournefort supposed, by capillary attraction through a simple spongy or cottony substance.

I received the first hint of what I now believe to be the true sap-vessels from the 2d section of Dr. Darwin's *Phytologia*, where it is suggested that what have been taken for air-vessels are really absorbents destined to nourish the plant, or, in other words, sap-vessels. The same idea has been adopted, confirmed by experiments, and carried to much greater perfection, by Mr. Knight, whose papers in the Philosophical Transactions for 1801, 1804 and 1805, throw the most brilliant light upon it, and, I think, establish no less than an entirely new theory of vegetation, by which the real use and functions of the principal organs of plants are now, for the first time, satisfactorily explained.

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 parts, and when examined minutely, these vessels often appear to be constructed with a spiral coat. This may be seen in the young twigs and leaf-stalks of Elder, Syringa, and many other shrubs, as well as in numerous herbaceous plants, as the Piony, and more especially many of the Lily tribe. If a branch or stalk of any of these plants be partly 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. In other cases, though the spiral structure exists, its convolutions are scarcely separable at all, or so indeterminate as to be only marked by an interrupted line of perforations or slits, as shown by M. Mirbel. Indeed the very same branches which exhibit these spiral vessels when young, show no signs of them at a more advanced period of growth, when their parts are become more woody, firm, and rigid. No such spiral-coated vessels have been detected in the bark at any period of its growth.

Malpighi asserts that these vessels are always found to contain air only, no other fluid; while Grew reports that he sometimes met with a quantity of moisture in them. Both judged them to be air-vessels, or, as it were, the lungs of plants, communicating, as these philosophers presumed, with certain vessels of the leaves and flowers, of an oval or globular form, but destitute of a spiral coat. These latter do really contain air, but it rather appears from experiment that they have no direct communication with the former. Thus the tubes in question have always been called air-vessels, till Darwin suggested their real nature and use.* He is perhaps too decisive when he asserts that none of them are air-vessels *because* they exist in the root, which is not exposed to the atmosphere. We know that air acts upon the plant under ground, because seeds will not vegetate in earth under the exhausted receiver of an air-pump. *Phil. Trans. No.* 23. I do not, however, mean to contend that any of these spiral vessels are air-vessels, nor do I see reason to believe that plants have any system of longitudinal air-vessels at all, though they must be presumed to abound in such as are transverse or horizontal.

Dr. Darwin and Mr. Knight have, by the most simple and satisfactory experiment, proved these spiral vessels to be the channel through which the sap is conveyed. The former placed leafy twigs of a common Fig-tree about an inch deep in a decoction of madder, and others in one of log-wood. After some hours, on cutting the branches across, the coloured liquors were found to have ascended into each branch by these vessels, which exhibited a circle of red dots round the pith, surrounded by an external circle of other vessels containing the white milky juice, or secreted fluid, so remarkable in the Fig-tree. Mr. Knight, in a similar manner, inserted the lower ends of some cuttings of the Apple-tree and Horse

* Du Hamel, indeed, once suspected that they contained "highly rarefied sap," but did not pursue the idea.

chestnut into an infusion of the skins of a very black grape in water, an excellent liquor for the purpose. The result was similar. But Mr. Knight pursued his observations much further than Dr. Darwin had done; for he traced the coloured liquid even into the leaves, "but it had neither coloured the bark nor the sap between it and the wood; and the *medulla* was not affected, or at most was very slightly tinged at its edges." *Phil. Trans. for* 1801, *p.* 335.

The result of all Mr. Knight's experiments and remarks seems to be, that the fluids destined to nourish a plant, being absorbed by the root and become sap, are carried up into the leaves by these vessels, called by him *central* vessels, from their situation near the pith. A particular set of them, appropriated to each leaf, branches off, a few inches below the leaf to which they belong, from the main channels that pass along the alburnum, and extend from the fibres of the root to the extremity of each annual shoot of the plant. As they approach the leaf to which they are destined, the central vessels become more numerous, or subdivided. "To these vessels," says Mr. Knight, "the spiral tubes are every where appendages," *p.* 336. By this expression, and by a passage in the following page,* 337, this writer might seem to consider the spiral line, which forms the coats of these vessels, as itself a pervious tube, or else that he was speaking of other tubes with a spiral coat, companions of the sap-vessels; but the plate which accompanies his dissertation, and the perspicuous mode in which he treats the subject throughout, prevent our mistaking him on the last point. In order to conceive how the sap can be so powerfully conveyed as it is through the vessels in which it flows, from the root of a tall tree to its highest branches, we must take into consideration the action of heat. We all know that this is necessary to the growth and health of plants; and that it requires to be nicely adjusted in degree, in order to suit the constitutions of different tribes of plants destined for

* "The whole of the fluid, which passes from the wood to the leaf, seems to me evidently to be conveyed through a single kind of vessel; for the spiral tubes will neither carry coloured infusions, nor in the smallest degree retard the withering of the leaf, when the central vessels are divided." *Knight.*

different parts of the globe. It cannot but act as a stimulus to the living principle, and is one of the most powerful agents of Nature upon the vegetable as well as animal constitution. Besides this, however, various mechanical causes may be supposed to have their effect; as the frequently spiral or screw-like form of the vessels, in some of which, when separated from the plant, Malpighi tells us he once saw a very beautiful undulating motion that appeared spontaneous. This indeed has not been seen by any other person, nor can it be supposed that parts so delicate can, in general, be removed from their natural situation, without the destruction of that fine irritability on which such a motion must depend. We may also take into consideration the agitation of the vegetable body by winds, which is known by experience to be so wholesome to it,* and must serve powerfully to propel the fluids of lofty trees; the passage, and evolution perhaps, of air in other parts or vessels, surrounding and compressing these; and lastly the action, so ingeniously supposed by Mr. Knight, of those thin shining plates called the *silver grain*, visible in oak wood, which pressing upon the sap-vessels, and being apparently susceptible of quick changes from variations in heat or other causes, may have a powerful effect. "Their restless temper," says Mr. Knight, "after the tree has ceased to live, inclines me to believe that they are not made to be idle whilst it continues alive." *Phil. Trans. for* 1801, *p.* 344. These plates are presumed by the author just quoted to be peculiarly useful in assisting the ascent of the sap through the alburnum of the trunk or chief branches, where indeed the spiral coats of the vessels are either wanting, or less elastic than in the leaf-stalks, and summits of the more tender shoots.

However its conveyance may be accomplished, it is certain that the sap does reach the parts above-mentioned, and there can surely be now as little doubt of the vessels in which it runs. That these vessels have been thought to contain air only, is well accounted for by Dr. Darwin, on the principle of their not collapsing when emptied of their sap; which is

* See Mr. Knight's experiments in confirmation of this in the *Phil. Trans. for* 1803, *p.* 280.

owing to their rigidity, and the elastic nature of their coats. When a portion of a stem or branch is cut off, the sap soon exhales from it, or rather is pushed out by the action of the vessels themselves: hence they are found empty; and for the same reason, the arteries of animals were formerly thought to contain air only. When the sap-vessels have parted with their natural contents, air, and even quicksilver, will readily pass through them, as is shown by various experiments. Arguments in support of any theory must be very cautiously deduced from such experiments, or from any other observations not made on vegetables in their most natural state and condition; and, above all, that great agent the vital principle must always be kept in view, in preference to mere mechanical considerations.

These to which I give the common name of sap-vessels, comprehending the common tubes of the alburnum, and the central vessels, of Mr. Knight, may be considered as analogous to the arteries of animals; or rather they are the stomach, lacteals, and arteries all in one, for I conceive it to be a great error in Dr. Darwin to call by this name the vessels which contain the peculiar secretions of the plant.* These sap-vessels, no doubt, absorb the nutritious fluids afforded by the soil, in which possibly, as they pass through the root, some change analogous to digestion may take place; for there is evidently a great difference, in many cases, between the fluids of the root, at least the secreted ones, and those of the rest of the plant; and this leads us to presume that some considerable alteration may be wrought in the sap in its course through that important organ. The stem, which it next enters, is by no means an essential part, for we see many plants whose leaves and flowers grow directly from the root.

Part of the sap is conveyed into the flowers and fruit, where various fine and essential secretions are made from it, of which we shall speak hereafter. By far the greater portion of the sap is carried into the leaves, of the great importance and utility of which to the plant itself, Mr.

* *Phytologia, sect.* 2.

Knight's theory is the only one that gives us any adequate or satisfactory notion. In those organs the sap is exposed to the action of light, air, and moisture, three powerful agents, by which it is enabled to form various secretions, at the same time that much superfluous matter passes off by perspiration.

These secretions not only give peculiar flavours and qualities to the leaf itself, but are returned by another set of vessels, as Mr. Knight has demonstrated, into the new layer of bark, which they nourish and bring to perfection, and which they enable in its turn to secrete matter for a new layer of alburnum the ensuing year. It is presumed that one set of the returning vessels of trees may probably be more particularly destined to this latter office, and another to the secretion of peculiar fluids in the bark. See *Phil. Trans. for* 1801, *p.* 337. In the bark, principally, if I mistake not, the peculiar secretions of the plant are perfected, as gum, resin, &c., each undoubtedly in an appropriate set of vessels. From what has just been said of the office of leaves, we readily perceive why all the part of a branch above a leaf or leaf-bud dies when cut, as each portion receives nourishment, and the means of increase, from the leaf above it.

By the above view of the vegetable economy, first given in the present work, it appears that the vascular system of plants is strictly annual. This, of course, is admitted in herbaceous plants, the existence of whose stems, and often of the whole individual, is limited to one season; but it is no less true with regard to trees. The layer of alburnum on the one hand is added to the wood, and the *liber*, or inner layer of the bark, is on the other, annexed to the layers formed in preceding seasons, and neither has any share in the process of vegetation for the year ensuing. Still, as they continue for a long time to be living bodies, and help to perfect, if not to form, secretions, they must receive some portion of nourishment from those more active parts which have taken up their late functions.

There is a tribe of plants called *Monocotyledones*, having only one lobe to the embryo,* whose growth requires par-

* Or rather no true cotyledon at all.

ticular mention. To these belongs the natural order of Palms, which being the most lofty, and, in some instances, the most long-lived of plants, have justly acquired the name of trees. Yet, paradoxical as it may seem, they are rather perennial herbaceous plants, having nothing in common with the growth of trees in general. Their nature has been learnedly explained by M. Desfontaines, a celebrated French botanist, and by M. Mirbel in his *Traité d' Anatomie et de Physiologie Végétales, vol.* 1. *p.* 209, and Linnæus has long ago made remarks to the same purpose. The Palms are formed of successive circular crowns of leaves, which spring directly from the root. These leaves and their foot-stalks are furnished with bundles of large sap-vessels, and returning vessels, like the leaves of our trees. When one circle of them has performed its office, another is formed within it, which being confined below, necessarily rises a little above the former. Thus successive circles grow one above the other, by which the vertical increase of the plant is almost without end. Each circle of leaves is independent of its predecessor, and has its own clusters of vessels, so that there can be no aggregation of woody circles; and yet in some of this tribe, the spurious kind of stem, formed in the manner just described, when cut across, shows something of a circular arrangement of fibres, arising from the original disposition of the leaves. The common orange lily, *Lilium bulbiferum, Curtis,** and white lily, *L. candidum, t.* 278, which belong to the same natural family, called *Monocotyledones*, serve to elucidate this subject. Their stems, though of only annual duration, are formed nearly on the same principle as that of a Palm, and are really congeries of leaves rising one above another, and united by their bases into an apparent stem. In these the spiral coats of the sap-vessels are very easily discernible.

To conclude this subject of the propulsion of the sap, it is necessary to say a few words on the power which the vessels of plants are reported to possess of conveying their appropriate fluids equally well in either direction; or, in other

* The Fiery, or Smaller, Orange Lily is perhaps the true *L. bulbiferum.*

words, that it is indifferent whether a cutting of any kind be planted with its upper or lower end in the ground. On this subject also Mr. Knight has afforded us new information, by observing that, in cuttings so treated, the returning vessels retain so much of their original nature as to deposite new wood *above* the leaf-buds; that is, in the part of the cutting which, if planted in its natural position, would have been below them. It appears, however, that the sap-vessels must absorb and transmit their sap in a direction contrary to what is natural; and it is highly probable, that, after some revolving seasons, new returning vessels would be formed in that part of the stem which is now below the buds. I presume there can be no doubt that successive new branches would deposite their wood in the usual position. It is, nevertheless, by no means common for such inverted cuttings to succeed at all. An experiment to a similar purpose is recorded by Dr. Hales, *Vegetable Staticks, p.* 132, *t.* 11, of engrafting together three trees standing in a row, and then cutting off the communication between the central one and the earth, so that it became suspended in the air, and was nourished merely through its lateral branches. The same experiment was successfully practised by the late Dr. Hope at Edinburgh upon three Willows, and in the years 1781, 82, and 83, I repeatedly witnessed their health and vigour. It was observed that the central tree was several days later in coming into leaf than its supporters, but I know not that any other difference was to be perceived between them. The tree which wanted the support of the ground was, some years after, blown down, so that we have now no opportunity of examining the course of its vessels, or the mode in which successive layers of wood were deposited in its branches; but the experiment is easily repeated.

In the weeping variety of the common Ash now so frequent in gardens, the branches are completely inverted as to position, yet the returning fluids appear to run exactly in their natural direction, depositing new wood, as they are situated *above* the buds or leaves; and if the end of any branch be cut, all beyond (or *below*) the next bud dies; so that in this case, gravitation, to which Mr. Knight attributes considerable power over the returning fluids, *Phil. Trans. for* 1804, does not counteract the ordinary course of nature.

CHAP. IX.—*Of the Sap, and Insensible Perspiration.*

THE sap of trees, as has been mentioned in the last chapter, may be obtained by wounding a stem or branch in spring, just before the buds open, or in the end of autumn, though less copiously, after a slight frost; yet not during the frost. In the palm-trees of hot countries, it is said to flow from a wound at any time of the year. It has always been observed to flow from the young wood or alburnum of our trees, not from the bark; which agrees with Mr. Knight's theory.

A common branch of the Vine cut through, will yield about a pint of this fluid in the course of twenty-four hours. The Birch, *Betula alba*, affords plenty of sap; some other trees yield but a small quantity. It flows equally upward and downward from a wound, at least proportionably to the bulk of the stem or branch in either direction to supply it. Some authors have asserted, that in the heat of the day it flows most from the lower part of a wound, and in the cool of the evening from the upper; hence they concluded it was ascending during the first period, and descending in the latter. If the fact be true, some other solution must be sought; nor would it be difficult to invent a theory upon this subject, but we rather prefer the investigation of truth on more solid foundations.

This great motion called the *flowing* of the sap, which is to be detected principally in the spring, and slightly in the autumn, is therefore totally distinct from that constant propulsion of it going on in every growing plant, about which so much has been said in the preceding chapter, and which is proved by taking an entire herb, of any kind, that has been gathered and suffered to begin to fade, and immersing its root in water. By absorption through the sap-vessels it presently revives, for those vessels require a constant supply from the root.

This *flowing* of the sap has been thought to demonstrate a circulation, because, there being no leaves to carry it off by perspiration, it is evident that, if it were at these periods running up the sap-vessels with such velocity, it must run down again by other channels. As soon as the leaves expand, its motion is no longer to be detected. The effusion of sap from plants, when cut or wounded, is, during the great part of the year, comparatively very small. Their secreted fluids run much more abundantly.

I conceive therefore that this *flowing* is nothing more than a facility in the sap to run, owing to the peculiar irritability of the vegetable body at the times above-mentioned; and that it runs only when a wound is made, being naturally at rest till the leaves open, and admit of its proper and regular conveyance. Accordingly, ligatures made at this period, which show so plainly the course of the blood in an animal body, have never been found to throw any light upon the vegetable circulation. This great facility in the sap to run is the first step towards the revival of vegetation from the torpor of winter; and its exciting cause is heat, most unquestionably by the action of the latter on the vital principle, and scarcely by any mechanical operation, or expansive power upon the fluids. The effect of heat is in proportion to the degree of cold to which the plant has been accustomed. In forced plants the irritability, or, to use the words of a late ingenious author,* who has applied this principle very happily to the elucidation of the animal economy, *excitability*, is exhausted, as Mr. Knight well remarks, and they require a stronger stimulus to grow with vigour. See the latter part of chap. 10. Hence vegetation goes on better in the increasing heat of spring than in the decreasing heat of autumn. And here I cannot but offer, by way of illustration, a remark on the theory advanced by La Cepède, the able continuator of Buffon, relative to serpents. That ingenious writer mentions, very truly, that these reptiles awake from their torpid state in the spring, while a

* Dr. John Brown, formerly of Edinburgh. See the 14th Section of Dr. Darwin's *Phytologia* on this subject.

much less degree of heat exists in the atmosphere than is perceptible in the autumn, when, seemingly from the increasing cold, they become benumbed; and he explains it by supposing a greater degree of electricity in the air at the former season. Dr. Brown's hypothesis, of their irritability being as it were accumulated during winter, offers a much better solution, either with respect to the animal or vegetable constitution. For the same reason it is necessary to apply warmth very slowly and carefully to persons frozen, or even chilled only, by a more than usual degree of cold, which renders them more susceptible of heat; and a temperate diet and very moderate stimulants are most safe and useful to the unexhausted constitutions of children. The same principle accounts for the occasional *flowing* of the sap in autumn after a slight frost. Such a premature cold increases the sensibility of the plant to any warmth that may follow, and produces, in a degree, the same state of its constitution as exists after the longer and severer cold of winter. Let me be allowed a further illustration from the animal kingdom. Every body conversant with labouring cattle must have observed how much sooner they are exhausted by the warm days of autumn, when the nights are cold, than in much hotter weather in summer; and this is surely from the same cause as the autumnal flowing of the vegetable sap.

The sap, or lymph, of most plants, when collected in the spring as above-mentioned, appears to the sight and taste little else than water, but it soon undergoes fermentation and putrefaction. Even that of the Vine is scarcely acid, though it can hardly be obtained without some of the secreted juices, which in that plant are extremely acid and astringent. The sap of the Sugar Maple, *Acer saccharinum*, has no taste, though according to Du Hamel every 200lb. of it will afford 10lb. of sugar. Probably, as he remarks, it is not collected without an admixture of secreted fluids.

As soon as the leaves expand, insensible perspiration takes place very copiously, chiefly from those organs, but also in some degree from the bark of the young stem or branches. The liquor perspired becomes sensible to us by being collected from a branch introduced into any sufficiently capacious glass vessel, and proves, for the most part, a clear watery liquor, like the sap, and subject to similar chemical changes. It is observed to be uniform in all plants, or nearly so, as well as the sap, except where odorous secretions transude along with it. Still there must be a very essential difference between the original sap of any plant and its perspiration, the latter no longer retaining the rudiments of those fine secretions which are elaborated from the former; but that difference eludes our senses as well as our chemistry. The perspiration of some plants is prodigiously great. The large Annual Sunflower, *Helianthus annuus*, according to Dr. Hales, perspires about 17 times as fast as the ordinary insensible perspiration of the human skin. But of all plants upon record the Cornelian Cherry, *Cornus mascula*, is most excessive in this respect. The quantity of fluid which evaporates from its leaves in the course of twenty-four hours, is said to be nearly equal to twice the weight of the whole shrub. *Du Hamel Phys. des Arbres, v.* 1. *p.* 145.

CHAP. X.—*Of the secreted fluids of Plants.—Grafting.—Heat of the vegetable body.*

THE sap in its passage through the leaves and bark becomes quite a new fluid, possessing the peculiar flavour and qualities of the plant, and not only yielding woody matter for the increase of the vegetable body, but furnishing various secreted substances, more or less numerous and different among themselves. These accordingly are chiefly found in the bark; and the vessels containing them often prove upon dissection very large and conspicuous, as the turpentine-cells of the Fir tribe. In herbaceous plants, whose stems are only of annual duration, the perennial roots frequently contain these fluids in the most perfect state, nor are they, in such, confined to the bark, but deposited throughout the substance or wood of the root, as in Rhubarb, *Rheum palmatum*, and Gentian, *Gentiana lutea* and *purpurea*. In the wood of the

Fir, indeed, copious depositions of turpentine are made, and in that of every tree more or less of a gummy, resinous, or saccharine matter is found. Such must be formed by branches of those returning vessels that deposite the new alburnum. These juices appear to be matured, or brought to greater perfection, in layers of wood or bark that have no longer any principal share in the circulation of the sap.

The most distinct secretions of vegetables require to be enumerated under several different heads.

Gum or mucilage, a viscid substance of little flavour or smell, soluble in water, is very general. When superabundant, it exudes from many trees in the form of large drops or lumps, as in Plum, Cherry, and Peach trees, and different species of *Mimosa* or Sensitive plants, one of which yields the Gum Arabic, others the Gum Senegal, &c.

Jelly, akin to the former, but soluble by heat, and remaining fluid in a very low temperature, above that of the surrounding atmosphere. It is chiefly procured from ripe pulpy fruits by evaporation.

Resin is a substance soluble in spirits, and much more various in different plants than either of the preceding, as the Turpentine of the Fir and Juniper, the Red Gum of New South Wales, produced by one or more species of *Eucalyptus*, and the fragrant Yellow Gum of the same country, which exudes spontaneously from the *Xanthorrhœa Hastile.* Most vegetable exudations partake of a nature between Resin and mucilage, being partly soluble in water, partly in spirits, and are therefore called Gum-resins. The milky juice of the Fig, Spurge, &c., which Dr. Darwin has shown, and which every body may see, to be quite distinct from the sap, is, like animal milk, an *emulsion,* or combination of a watery fluid with oil or resin. Accordingly, when suffered to evaporate in the air, such fluids become resins or gum-resins, as the Gum *Euphorbium.* In the Celandine, *Chelidonium majus,* and some plants allied to it, the emulsion is orange-coloured.

The more refined and volatile secretions of a resinous nature are called Essential Oils, and are often highly aromatic and odoriferous. One of the most exquisite of these is afforded by the Cinnamon bark. They exist in the highest perfection in the perfumed effluvia of flowers, some of which, capable of combination with spirituous fluids, are obtainable by distillation, as that of the Lavander and Rose; while the essential oil of the Jasmine is best procured by immersing the flowers in expressed oil, which imbibes and retains their fragrance. Such Expressed or Gross Oils, as they are called to distinguish them from essential oils obtained by distillation, are chiefly found in the seeds of plants. In the pulp of the Olive indeed they occur in the form of an emulsion, mixed with watery and bitter fluids, from which the oil easily separates by its superior lightness. These expressed oils are not soluble in spirits or water, though by certain intermediate substances they may be rendered capable of uniting with both.

The bitter secretion of many plants does not seem exactly to accord with any of the foregoing. Some facts would seem to prove it of a resinous nature, but it is often perfectly soluble in water. Remarkable instances of this secretion occur in the *Cinchona officinalis* or Peruvian bark, and, more or less, in every species of Gentian.

Acid secretions are well known to be very general in plants. Formerly one uniform vegetable or acetous acid was supposed common to all plants; but the refinements of modern chemistry have detected in some a peculiar kind, as the Oxalic acid, obtained from *Oxalis* or Wood Sorrel, and several others. The astringent principle should seem to be a sort of acid, of which there are many different forms or kinds, and among them the tanning principle of the Oak, Willow, &c.

On the other hand, two kinds of Alkali are furnished by vegetables, of which the most general is the Vegetable Alkali, properly so called, known by the name of Salt of Tartar, or Salt of Wormwood, or more correctly by the Arabic term *Kali*. The Fossil Alkali, or *Soda*, is most remarkable in certain succulent plants that grow near the sea, belonging to the genera *Chenopodium*, *Salsola*, &c. When these plants are cultivated in a common soil, they secret *Soda* as copiously, provided their health be good, as in their natural maritime places of growth.

Sugar, more or less pure, is very generally found in plants. It is not only the seasoning of most eatable fruits, but abounds in various roots, as the Carrot, Beet, and Parsnep, and in many plants of the grass or cane kind, besides the famous Sugar Cane, *Saccharum officinarum*. There is great reason to suppose Sugar not so properly an original secretion, as the result of a chemical change in secretions already formed, either of an acid or mucilaginous nature, or possibly a mixture of both. In ripening fruits this change is most striking, and takes place very speedily, seeming to be greatly promoted by heat and light. By the action of frost, as Dr. Darwin observes, a different change is wrought in the mucilage of the vegetable body, and it becomes starch.

A fine red liquor is afforded by some plants, as the Bloody Dock, or *Rumex sanguineus*, the Red Cabbage and Red Beet, which appears only to mark a variety in all these plants, and not to constitute a specific difference. It is however perpetuated by seed.

It is curious to observe, not only the various secretions of different plants, or families of plants, by which they differ from each other in taste, smell, qualities and medical virtues, but also their great number, and striking difference, frequently in the same plant. Of this the Peach-tree offers a familiar example. The gum of this tree is mild and mucilaginous. The bark, leaves and flowers abound with a bitter secretion, of a purgative and rather dangerous quality, than which nothing can be more distinct from the gum. The fruit is replete, not only with acid, mucilage and sugar, but with its own peculiar aromatic and highly volatile secretion, elaborated within itself, on which its fine flavour depends. How far are we still from understanding the whole anatomy of the vegetable body, which can create and keep separate such distinct and discordant substances!

Nothing is more astonishing than the secretion of flinty earth by plants, which, though never suspected till within a few years, appears to me well ascertained. A substance is found in the hollow stem of the Bamboo, (*Arundo Bambos* of

Linnæus, *Nastos* of Theophrastus,) called Tabaxir or Tabasheer, which is supposed in the East Indies (probably because it is rare and difficult of acquisition, like the imaginary stone in the head of a toad) to be endowed with extraordinary virtues. Some of it, brought to England, underwent a chemical examination, and proved, as nearly as possible, pure flint. See Dr. Russell's and Mr. Macie's papers on the subject, in the *Phil. Trans. for* 1790 *and* 1791. It is even found occasionally in the Bamboo cultivated in our hothouses. But we need not search exotic plants for flinty earth. I have already, in speaking of the Cuticle, chapter 3d, alluded to the discoveries of the late President of the Royal Society, Sir Humphrey Davy, on this subject. That able chemist has detected pure flint in the cuticle of various plants of the family of Grasses, in the Cane (a kind of Palm) and in the Rough Horsetail, *Equisetum hyemale.* In the latter it is very copious, and so disposed as to make a natural file, which renders this plant useful in various manufactures, for even brass cannot resist its action. Common Wheat straw, when burnt, is found to contain a portion of flinty earth in the form of a most exquisite powder, and this accounts for the utility of burnt straw in giving the last polish to marble. How great is the contrast between this production, if it be a secretion, of the tender vegetable frame, and those exhalations which constitute the perfume of flowers! One is among the most permanent substances in Nature, an ingredient in the primeval mountains of the globe; the other the invisible untangible breath of a moment!

The odour of plants is unquestionably of a resinous nature, a volatile essential oil; and several phenomena connected with it well deserve our attentive consideration. Its general nature is evinced by its ready union with spirits or oil, not with water; yet the moisture of the atmosphere seems, in many instances, powerfully to favour its diffusion. This I apprehend to arise more from the favourable action of such moisture upon the health and vigour of the plant itself, thus occasionally promoting its odorous secretions, than from the fitness of the atmosphere, so circumstanced, to convey them. Both causes however may operate. A number of flowers which have no scent in the course of the day, smell powerfully in an evening, whether the air be moist or dry, or whether they happen to be exposed to it or not. This is the property of some which Linnæus has elegantly called *flores tristes*, melancholy flowers, belonging to various tribes as discordant as possible, agreeing only in their nocturnal fragrance, which is peculiar, very similar and exquisitely delicious, and in the pale yellowish, greenish, or brownish tint of their flowers. Among these are *Mesembryanthemum noctiflorum*, *Pelargonium triste*, and several species akin to it; *Mathiola tristis; Cheiranthus tristis; Daphne Pontica; Crassula odoratissima;* and many others.* A few more, greatly resembling these in the green hue of their blossoms, exhale, in the evening chiefly, a most powerful lemon-like fragrance, as *Cymbidium ensifolium*, and *Chloranthus inconspicuus*, great favourites of the Chinese, who seem peculiarly fond of this scent. There are other instances of odorous and aromatic secretions, similar among themselves, produced by very different plants, as Camphor. The sweet smell of new hay is found not only in *Anthoxanthum odoratum*,

* These flowers afford the poet a new image, which is introduced into the following imitation of Martial, and offered here solely for its novelty:

Go mingle Arabia's gums
With the spices all India yields.
Go crop each young flower as it blooms.
Go ransack the gardens and fields.

Let Pæstum's all-flowery groves
Their roses profusely bestow.
Go catch the light zephyr that roves
Where the wild thyme and marjoram grow.

Let every pale night-scented flower,
Sad emblem of passion forlorn,
Resign its appropriate hour,
To enhance the rich breath of the morn.

All that art or that nature can find,
Not half so delightful would prove,
Nor their sweets all together combined,
Half so sweet as the breath of my love.

and some other grasses, but in Woodruff or *Asperula odorata*, Melilot or *Melilotus officinalis*, and all the varieties, by some deemed species, of *Orchis militaris*, plants widely different from each other in botanical characters, as well as in colour and every particular except smell. Their odour has one peculiarity, that it is not at all perceptible while the plants are growing, nor till they begin to dry. It proceeds from their whole herbage, and should seem to escape from the orifices of its containing cells, only when the surrounding vessels, by growing less turgid, withdraw their pressure from such orifices. When this scent of new hay is vehement, it becomes the flavour of bitter almonds. The taste of syrup of capillaire, given by an infusion of Orange flowers, is found in the herbage of *Gaultheria procumbens*, and *Spiræa Ulmaria*, two very different plants.

Some of the above examples show an evident analogy between the smell and colours of flowers, nor are they all that might be pointed out. A variety of the *Chrysanthemum Indicum*, with orange-coloured flowers, was procured from China by the late Lady Amelia Hume. These faintly agree in scent, as they do in colour, with the Wall-flower, *Cheiranthus Cheiri;* whereas the common purple variety of the same *Chrysanthemum* has a totally different and much stronger odour.

The various effects of the perfumes of flowers upon different persons, and of different kinds of flowers upon the same individual, though a subject belonging rather to animal physiology, are not improper to be noticed here. Many people experience headach, sickness, and fainting, from any sweet flowers in a close room. The writer of this is peculiarly affected by Honeysuckles, which, however grateful in the open air, affect him in the house with violent pain in the temples, soon followed by sickness, and a partial loss of recollection, which would probably end in a fainting fit, if the cause were not removed. Yet the equally delicious, and very similar, evening fragrance of the Butterfly Orchis, *Orchis bifolia*, gives him no annoyance whatever, but can be indulged in to any extent in the closest apartment. The scent of *Iris Persica*, he, like many other people, cannot perceive, though some find it extremely pleasant.* But its flowers, nevertheless, affect him, in a room, with a most uneasy sensation, partaking of nausea and suffocation. The White Lily, Mezereon, Lilac, and Peruvian Heliotrope, with many other scents, delightful in the open air, are poison in the house; and he has seen a strong healthy man greatly distressed by one carnation which had fallen down, and remained concealed by a piece of furniture, in a spacious airy drawing-room. It may be asserted as a general rule, that plants of the same genus, or natural order, produce by the odour of their flowers, a similar effect upon the same person. But this effect often varies in degree, according to any person's state of health. The blossoms of the Portugal Laurel, when abundant, exhale in my opinion, a nauseous fœtor; which, in some of the same tribe, as Hawthorn, is not too strong to be agreeable, partaking of an almond flavour. In a very different flower, *Polemonium cæruleum*, a similar odour, though generally not very remarkable, has proved, during illness, quite intolerable in a room.

Many curious facts might be added to these, and the subject may be followed up by persons of leisure who have a turn for observation. We should always in the course of our experiments be cautious as to general conclusions; for we shall find as "there is no disputing about tastes," so the opinions and perceptions of different people about smells are still more discordant. Roses are universally acceptable, and scarcely noxious to any body; but perhaps the odours of the various kinds of *Stapelia*, imitating carrion, rotten cheese, and foul water, may be better suited to the tastes of the Hottentots, in whose country those singular plants abound. A botanist of my acquaintance can perceive no scent in any flower whatever.

There is, of course, still more analogy between the smell of plants in general and their impression on the palate, insomuch that we are frequently unable to discriminate between the

* In the same manner, the flowers of the White Indian Azalea, *A. ledifolia*, yield a very agreeable fragrance to some persons, which is imperceptible to others. *Ed.*

two. The taste is commonly more permanent than the smell, but now and then less so. The root of the *Arum maculatum*, for instance, has, when fresh, a most acrid flavour and irritating quality, totally lost by drying, when the root becomes simply farinaceous, tasteless and inert; so that well might learned physicians contrive the "Compound Powder of Arum," to excuse the continuance of its use in medicine, unless they had always prescribed the recent plant.—Many curious remarks are to be found in Grew relative to the tastes of plants, and their different modes of affecting our organs. *Anatomy of Plants*, *pp.* 279—292.

To all the foregoing secretions of vegetables may be added those on which their various colours depend. We can but imperfectly account for the green so universal in their herbage, but we may gratefully acknowledge the beneficence of the Creator in clothing the earth with a colour the most pleasing and the least fatiguing to our eyes. We may be dazzled with the brilliancy of a flower-garden, but we repose at leisure on the verdure of a grove or meadow. Of all greens, the most delicate and beautiful perhaps is displayed by several umbelliferous plants under hedges in the spring.

Some of Nature's richest tints and most elegant combinations of colour are reserved for the petals of flowers, the most transient of created beings; and even during the short existence of the parts they decorate, the colours themselves are often undergoing remarkable variations. In the beautiful Scorpion-grass, *Myosotis palustris*, and several of its natural order, the flower-buds are of the most delicate rose-colour, which turns to a bright blue as they open. Many yellow flowers under the influence of light become white. Numbers of red, purple, or blue ones are liable, from some unknown cause in the plant to which they belong, to vary to white. Such varieties are sometimes perpetuated by seed, and are almost invariably permanent, if the plants be propagated by roots, cuttings, or grafting. Plants of an acid or astringent nature often become very red in their foliage by the action of light, as in *Rumex*, *Polygonum*, *Epilobium*, and *Berberis;* and it is remarkable that American plants in general, as well as such European ones as are particularly related to them, are distinguished for assuming various rich tints in their foliage, of red, yellow, white, or even blue, at the decline of the year; witness the Guelder-rose, the Cornel, the Vine, the Sumach, the *Azalea Pontica*, and others. Fruits for the most part incline to a red colour, apparently from the acid they contain. I have been assured by a first-rate chemist that the colouring principle of the Raspberry is a fine blue, turned red by the acid in the fruit. The juices of some Fungi, as *Boletus bovinus* and *Agaricus deliciosus*, change almost instantaneously on exposure to the air, from yellow to dark blue or green.

These are a few hints only on a subject which opens a wide field of inquiry, and which, in professedly chemical works, is carried to a greater length than I have thought necessary in a physiological one. See *Thomson's Chemistry*, *v.* 4. and *Willdenow's Principles of Botany*, *p.* 229. We must ever keep in mind, as we explore it, that our anatomical instruments are not more inadequate to dissect the organs of a scarcely distinguishable insect, than our experiments are to investigate the fine chemistry of Nature, over which the living principle presides.

Before we take leave of the secreted fluids of vegetables, a few more remarks upon their direct utility to the plants themselves may not be superfluous. Malpighi first suggested that these secretions might nourish the plant, and our latest inquiries confirm the suggestion. Du Hamel compares them to the blood of animals, and so does Darwin. But the analogy seems more plain between the sap, being nearly uniform in all plants, and the animal blood; as in that particular they accord, while the secreted fluids are so very various. Mr. Knight's theory confirms this analogy, at the same time that it establishes the opinion of Malpighi. The sap returning from the leaf, where it has been acted upon by the air and light, forming new wood, is clearly the cause of the increase of the vegetable body. But it is not so clear how the resinous, gummy, or other secretions, laid aside, as it were, in vessels, out of the great line of circulation, can directly minister to the growth of the tree. I conceive they may be in this respect analogous to animal fat, a reservoir of nourishment whenever its ordinary supplies are interrupted, as in the winter, or in seasons of great drought or of unusual cold. In such circumstances the mucilaginous or saccharine secretions especially, perhaps the most general of all, may be absorbed into the vegetable constitution; just as fat is into the animal one, during the existence of any disease that interrupts the ordinary supplies of food, or interferes with its due appropriation. It is well known that such animals as sleep through the winter, grow fat in the autumn and awake very lean in the spring. Perhaps the more recent layers of wood in a Plum or Cherry-tree, if they could be accurately examined, might be found to contain a greater proportion of mucilage at the end of autumn than in the early spring. If these substances do not nourish the plant, they seem to be of no use to it, whatever secondary purposes they may answer in the schemes of Providence. The direct end, with respect to the plant, of the finer secreted fluids of its fruit can very well be perceived, as tempting the appetite of animals, and occasioning, through their means, the dispersion of the seeds; and the perfume of flowers may attract insects, and so promote the fertilization of the seed, as will be explained hereafter.

After what has been said we need not waste much time in considering the hypothesis, advanced by some philosophers, that the sap-vessels are veins, and the returning vessels arteries. This is so far correct, that, as the chyle prepared by the digestive organs, poured into the veins and mixed with the blood, is, through the medium of the heart, sent into the lungs to be acted upon by the air; so the nutrimental juices of plants, taken up from the earth, which has been called their stomach, are carried by the sap-vessels into the leaves, for similar purposes already mentioned. The improved sap, like the vivid arterial blood, then proceeds to nourish and invigorate the whole frame. I very much doubt, however, if those who suggested the above hypothesis, could have given so satisfactory an explanation of it.

That the secretions of plants are wonderfully constant, appears from the operation of grafting. This consists in uniting the branches of two or more separate trees, as Dr. Hope's Willows, (see *p.* 30,) and a whole row of lime-trees in the garden of New College, Oxford, whose branches thus make a network. This is called grafting by approach. A more common practice, called budding, or inoculating, is to insert a bud of one tree, accompanied by a portion of its bark, into the bark of another, and the tree which is thus ingrafted upon is called the stock. By this mode different kinds of fruits, as apples, pears, plums, &c., each of which is only a variety accidentally raised from seed, but no further perpetuated in the same manner, are multiplied, buds of the kind wanted to be propagated being ingrafted on so many stocks of a wild nature. The mechanical part of this practice is detailed in Du Hamel, Miller, and most gardening books. It is of primary importance that the *liber*, or young bark, of the bud, and that of the stock, should be accurately united by their edges. The air and wet must of course be excluded.

It is requisite for the success of this operation that the plants should be nearly akin. Thus the *Chionanthus Virginica*, Fringe-tree, succeeds well on the Common Ash, *Fraxinus excelsior*, by which means it is propagated in our gardens. Varieties of the same species succeed best of all; but Apples and Pears, two different species of the same genus, may be grafted on one stock. The story of a Black Rose being produced by grafting a common rose, (it is not worth inquiring which,) on a black currant stock, is, as far as I can learn, without any foundation, and is indeed at the first sight absurd. I have known the experiment tried to no purpose. The rose vulgarly reported to be so produced is merely a dark Double Velvet Rose, a variety of *Rosa centifolia*. Another report of the same kind has been raised concerning the Maltese Oranges, whose red juice has been attributed to their being budded on a Pomegranate stock, of which I have never been able to obtain the smallest confirmation.

Heat can scarcely be denominated a secretion, and yet is undoubtedly a production, of the vegetable as well as animal body, though in a much lower degree in the former than the latter. The heat of plants is evinced by the more speedy melting of snow when in contact with their leaves or stems, compared with what is lodged upon dead substances, provided the preceding frost has been sufficiently permanent to cool those substances thoroughly. Mr. Hunter appears to have detected this heat by a thermometer applied in frosty weather to the internal parts of vegetables newly opened. It is evident that a certain appropriate portion of heat is a necessary stimulus to the constitution of every plant, without which its living principle is destroyed. Most tropical plants are as effectually killed by a freezing degree of cold, as by a boiling heat, and have nearly the same appearance; which is exemplified every autumn in the Garden Nasturtium, *Tropæolum majus*. The vegetables of cold climates, on the contrary, support a much greater degree of cold without injury, at least while in a torpid state; for when their buds begin to expand they become vastly more sensible, as is but too frequently experienced in the fickle spring of our climate. Nor is this owing, as vulgarly supposed, merely to the greater power of the cold to penetrate through their opening buds. It must penetrate equally through them in the course of long and severe winter frosts, which are never known to injure them. The extremely pernicious effects therefore of cold on opening buds can only be attributed to the increased susceptibility of the vital principle, after it has been revived by the warmth of spring.

The vegetation of most plants may be accelerated by artificial heat, which is called *forcing* them, and others may, by the same means, be kept in tolerable health, under a colder sky than is natural to them. But many alpine plants, naturally buried for months under a deep snow, are not only extremely impatient of sharp frosts, but will not bear the least portion of artificial heat. The pretty *Primula marginata*, if brought into a room with a fire when beginning to blossom, scarcely opens another bud; while the American Cowslip, *Dodecatheon Meadia*, one of the most hardy of plants, with respect to cold, bears forcing admirably well.

Mr. Knight very satisfactorily shows, *Phil. Trans. for* 1801, *p.* 343, that plants acquire habits with regard to heat which prove their vitality, and that a forced Peach-tree will, in the following season, expand its buds prematurely in the open air, so as to expose them to inevitable destruction, (See *p.* 32). A thousand parallel instances may be observed, by the sagacious gardener, of plants retaining the habits of their native climates, which very often proves one of the greatest impediments to their successful cultivation.

The most remarkable account that has fallen in my way concerning the production of heat in plants, is that given by Lamarck in his *Flore Françoise, v. 3. p.* 538, of the Common *Arum maculatum* (the white-veined variety), the flower of which, at a certain period of its growth, he asserts to be, for a few hours, "so hot as to seem burning." The learned M. Senebier of Geneva, examining into this fact, discovered that the heat began when the sheath was about to open, and the cylindrical body within just peeping forth; and that it was perceptible from about three or four o'clock in the afternoon till eleven or twelve at night. Its greatest degree was seven of Reaumur's scale above the heat of the air, which at the time of his observation was about fourteen or fifteen of that thermometer. Such is the account with which I have been favoured by Dr. Bostock from a letter of M. Senebier,* dated Nov. 28, 1796, to M. De la Rive. I have not hitherto been successful in observing the phenomenon in question, which however is well worthy of attention, and may probably not be confined to this species of *Arum.*

CHAP. XI.—*The Process of Vegetation.—Use of the Cotyledons.*

WHEN a seed is committed to the ground it swells by the moisture which its vessels soon absorb, and which, in conjunction with some degree of heat, stimulates its vital principle. Atmospherical air is also necessary to incipient vegetation, for seeds in general will not grow under water, except

* It is now published in his *Physiologie Végétale, v. 3. p.* 314, where nevertheless this ingenious philosopher has declared his opinion to be rather against the existence of a spontaneous heat in vegetables, and he explains even the above striking phenomenon upon chemical principles which seem to be very inadequate.

those of aquatic plants, nor under an exhausted receiver; and modern chemists have determined oxygen gas, which is always an ingredient in our atmosphere, to be absorbed by seeds in vegetation. An experiment is recorded in the *Philosophical Transactions, No.* 23, of sowing Lettuce-seed in two separate pots, one of which was placed in the common air, the other in the vacuum of an air-pump. In the former the young plants rose to the height of two inches, or more, in a week's time; in the other none appeared till after the pot had been removed for a similar period into the air again. Seeds buried in the ground to a greater depth than is natural to them do not vegetate, but they often retain their power of vegetation for an unlimited period. Earth taken from a considerable depth will, when exposed to the air, be soon covered with young plants, especially of Thistles, or of the Cress or Mustard kind, though no seeds have been allowed to have access to it. If the ground in old established botanic gardens be dug much deeper than ordinary, it frequently happens that species which have been long lost are recovered, from their seeds being latent in the soil, as I have been assured by Mr. Fairbairn of Chelsea garden, and others.

The integuments of the seed, having fulfilled their destined office of protection, burst and decay. The young root is the first part of the infant plant that comes forth, and by an unerring law of Nature, it is sent downwards, to seek out nourishment, as well as to fix the plant to the ground. In sea-weeds, *Fuci*, *Ulvæ* and *Confervæ*, it seems chiefly to answer the latter purpose. In the Dodder, *Cuscuta*, a parasitical plant, the original root lasts only till the stems have established themselves on some vegetable, on whose juices they feed by means of other roots or fibres, and then it withers away.

The descent of the root, and the ascent of the leaf-bud in a contrary direction, are ingeniously explained by Dr. Darwin, *Phytologia, sect.* 9. 3, on the principle of the former being stimulated by moisture, and the latter by air, whence each elongates itself where it is most excited. This is, perhaps, more satisfactory than any mechanical hypothesis. In whatever position seeds happen to lie in the earth, the root makes more or less of a curve in order to shoot downwards. Mr. Hunter sowed a number of seeds in a basket of earth placed on an axis, by which their position was a little altered every day. After the basket had thus made two or three circumvolutions, the young roots were found to have formed as many turns in attempting to attain their natural perpendicular direction. Mr. Knight has ascertained, *Phil. Trans. for* 1806, that a strong centrifugal force, applied to vegetating seeds, will considerably divert the root from this direction outwards, while the stem seems to have a centripetal inclination.

The young root, if it grew in a soil which afforded no inequality of resistance, would probably, in every case, be perfectly straight, like the radical fibres of bulbous roots in water; but as scarcely any soil is so perfectly homogeneous, the root acquires an uneven or zigzag figure. It is elongated chiefly at its extremity,* and has always, at that part especially, more or less of a conical or tapering figure.

When the young root has made some progress, the two lobes, commonly of a hemispherical figure, which compose the chief bulk of the seed, swell and expand, and are usually raised out of the ground by the ascending stem. These are called the *Cotyledons*, *f.* 4. Between them is seated the *Embryo*, or germ of the plant, called by Linnæus *Corculum*, or little heart, in allusion to the heart of the walnut. Mr. Knight denominates it the germen, but that term is appropriated to a very different part, the rudiment of the fruit. The expanding *Embryo*, resembling a little feather, has been for that reason named by Linnæus *Plumula ;* it soon becomes a tuft of young leaves, with which the young stem, if there be any, ascends. Till the leaves unfold, and sometimes after, the cotyledons, assuming their green colour, perform their functions; then the latter generally wither. This may be seen in the Radish, Lupine, Garden Bean, and various umbelliferous plants, in all which the expanded cotyledons are

* As may be seen by marking the fibres of Hyacinth roots in water, or the roots of Peas made to vegetate in wet cotton wool.

remarkably different from the true leaves. Such is the general course of vegetation in plants furnished with two cotyledons, or *Dicotyledones;* but I have already mentioned a very distinct tribe called *Monocotyledones;* see *p.* 28. These are the Grass and Corn tribe, Palms, the beautiful *Orchis* family, and many others. In these the body of the seed does not ascend out of the ground, and they are rather to be considered as having no cotyledon at all. See Mr. Salisbury's paper in the Transactions of the Linnæan Society, *v.* 7, on the germination of the Orchis tribe. We reserve more particular remarks on this subject till we examine the structure of seeds.

Some plants are reckoned by Linnæus to have many cotyledons, as the Fir and Cypress. But the germination of these differs in no respect from that of the generality of *Dicotyledones.* Mr. Lambert, in his splendid history of the genus *Pinus,* has illustrated this peculiarity of structure in the Swiss *P. Cembra;* see our *tab.* 1, *fig.* 2. In the *Dombeya,* or Norfolk Island Pine, the cotyledons are very distinctly four: see *fig.* 3.

The preservation of the vital principle in seeds is one of those wonders of Nature which pass unregarded, from being every day under our notice. Some lose their vegetative power by being kept out of the ground ever so little a while after they are ripe, and in order to succeed must sow themselves, in their own way, and at their own time. Others may be sent round the world through every vicissitude of climate, or buried for ages deep in the ground, till favourable circumstances cause them to vegetate. Great degrees of heat, short of boiling, do not impair the vegetative power of seeds, nor do we know any degree of cold that has such an effect. Those who convey seeds from distant countries, should be instructed to keep them dry; for, if they receive any damp sufficient to cause an attempt at vegetation, they necessarily perish, because the process cannot, as they are situated, go on. If, therefore, they are not exposed to so great an artificial heat as might change the nature of their oily juices, they can scarcely, as several cultivators have assured me, be kept in too warm a place. By the preservation of many seeds so long under ground, it seems that long-continued moisture is not in itself fatal to their living powers; neither does it cause their premature germination, unless accompanied by some action of the air.

It is usual with gardeners to keep Melon and Cucumber seeds for a few years, in order that the future plants may grow less luxuriantly, and be more abundant in blossoms and fruit. Dr. Darwin accounts for this from the damage which the cotyledons may receive from keeping, by which their power of nourishing the infant plant, at its first germination, is lessened, and it becomes stunted and dwarfish through its whole duration.

Dr. Thomson in his System of Chemistry, *vol.* 4. p. 374, has published a very satisfactory explanation of one part of the functions of the cotyledons. Several Philosophers have discovered that very soon after the seed begins to imbibe moisture, it gives out a quantity of carbonic acid gas, even though no oxygen gas be present. In this case the process stops here, and no germination takes place. But if oxygen gas be present, it is gradually absorbed in the same proportion. At the same time the farina of the cotyledons becomes sweet, being converted into sugar. "Hence it is evident," says this intelligent writer, "that the farina is changed into sugar, by diminishing its carbon, and of course by augmenting the proportion of its hydrogen and oxygen*. This is precisely the process of malting, during which it is well known that there is a considerable heat evolved. We may conclude from this, that during the germination of seeds in the earth, there is also an evolution of a considerable portion of heat. This indeed might have been expected, as it usually happens when oxygen gas is absorbed. So far seems to be the work of chemistry alone; at least we have no right to conclude that any other agent interferes; since *hay*, when it happens to imbibe moisture, exhibits nearly the same processes."

I conceive the evolution of this heat may powerfully further the progress of vegetation by stimulating the vital

* This is also the opinion of M. de Saussure, *Recherches Chimiques sur la Végétation*, p. 16.

principle of the embryo, till its leaves unfold and assume their functions. It is necessary to observe, that the above process equally takes place, whether the farinaceous particles be lodged in the bulk of the cotyledons themselves, or compose a separate body called by authors the *albumen*, as in grasses and corn.

CHAP. XII.—*Of the Root, and its different kinds.*

WE begin the description of the completely formed vegetable by its root, being the basis of all the rest, as well as the first part produced from the seed. Its use in general is two-fold; to fix the plant in a commodious situation, and to derive nourishment for its support. This part is therefore commonly plunged deeply into the ground, having, as we have already shown, a natural tendency to grow downwards. In some cases, however, when plants grow on the stems or branches of others, as the Dodder or *Cuscuta*, several Ferns, and a portion of the Orchis tribe, the root is closely attached to the bark, from which it draws nourishment by the under side only, the upper being bare.

The root consists of two parts, *Caudex* the body of the root, and *Radicula* the fibre. The latter only is essential, being the part which imbibes nourishment.

Roots are either of annual, biennial or perennial duration. The first belong to plants which live only one year, or rather one summer, as Barley; the second to such as are produced one season, and, living through the ensuing winter, produce flowers and fruit the following summer, as Foxglove, and several species of *Verbascum;* and the third to those which live and blossom through many successive seasons to an indefinite period, as trees, and many herbaceous plants. The term biennial is applied to any plant that is produced one year and flowers another, provided it flowers but once, whether that event takes place the second year, as usual, or whether from unfavourable circumstances, it may happen to be deferred to any future time. This is often the case with the *Lavatera arborea*, Tree Mallow, and some other plants, especially when growing out of their natural soil or station. Linnæus justly observes that, however hardy with respect to cold such plants may prove before they blossom, they perish at the first approach of the succeeding winter, nor can any artificial heat preserve them. This is, no doubt, to be attributed to the exhaustion of their vital energy by flowering. Several plants of hot climates, naturally perennial and even shrubby, become annual in our gardens, as the *Tropæolum*, or Garden Nasturtium.

In the Turnep, and sometimes the Carrot, Parsnep, &c., the *Caudex* or body of the root is above ground and bare, becoming as it were a stem. Linnæus indeed calls the stems of trees " roots above ground;" but this seems paradoxical and scarcely correct. Perhaps it would be more accurate to say the *caudex* is a subterraneous stem; but we rather presume it has functions distinct from the stem, analogous, as has been hinted, *p.* 27, to digestion, at least in those plants whose stems are annual though their roots are perennial.

The fibres of the root, particularly those extremities of them which imbibe nourishment from the earth, are in every case strictly annual. During the winter, or torpid season of the year, the powers of roots lie dormant, which season therefore is proper for their transplantation. After they have begun to throw out new fibres, it is more or less dangerous, or even fatal, to remove them. Very young annual plants, as they form new fibres with great facility, survive transplantation tolerably well, provided they receive abundant supplies of water by the leaves till the root has recovered itself.

Botanists distinguish several different kinds of roots, which are necessary to be known, not only for botanical purposes, but as being of great importance in agriculture and gardening. The generality of roots may be arranged under the following heads.

1. *Radix fibrosa*, *fig.* 5. A Fibrous Root. The most simple in its nature of all, consisting only of fibres, either branched or undivided, which convey nourishment directly to the

basis of the stem or leaves. Many grasses, as *Poa annua*, and the greater part of annual herbs, have this kind of root. The radical fibres of grasses that grow in loose sand are remarkably downy, possibly for the purpose of fixing them more securely to so slippery a support, or to multiply the surface or points of absorption in so meagre a source of nutriment. The fibres of some parasitical plants already alluded to, as the Air-plants, *Epidendrum*, &c., are peculiarly thick and fleshy, not only for the purpose of imbibing the more nourishment, but also to bind them so strongly to the branches of trees, as to defy the force of winds upon their large and rigid leaves.

2. *Radix repens*, *f.* 6. A Creeping Root, as in Mint, *Mentha.* A kind of subterraneous stem, creeping and branching off horizontally, and throwing out fibres as it goes. This kind of root is extremely tenacious of life, for any portion of it will grow. Hence weeds furnished with it are among the most troublesome, as the different sorts of Couch-grass, *Triticum repens*, *Holcus mollis*, &c.; while, on the other hand, many sea-side grasses, having such a root, prove of the most important service in binding down loose blowing sand, and so resisting the encroachments of the ocean. These are principally *Carex arenaria*, *Arundo arenaria*, and *Elymus arenarius.*

3. *Radix fusiformis*, *f.* 7. A Spindle-shaped or Tapering Root. Of this the Carrot, Parsnep and Radish are familiar examples. Such a root is formed on the principle of a wedge, for penetrating perpendicularly into the ground. It is common in biennial plants, but not peculiar to them. The *caudex*, which is the spindle-shaped part, abounds with the proper secreted juices of the plant, and throws out numerous fibres or radicles, which are in fact the real roots, for they alone imbibe nourishment.

4. *Radix præmorsa*, *f.* 8. An Abrupt Root, is naturally inclined to the last-mentioned form, but from some decay or interruption in its descending point, it becomes abrupt

or as it were bitten off. *Scabiosa succisa*, Devil's Bit Scabious, *Hedypnois*, or rather *Apargia*, *hirta*, and some other Hawkweeds, have this kind of root, the old opinion concerning which cannot be better described than in Gerarde's Herbal, under the plant first named, *p.* 726.

"The great part of the root seemeth to be bitten away: old fantasticke charmers report, that the divel did bite it for envie, because it is an herbe that hath so many good vertues, and is so beneficial to mankinde."——The malice of the devil has unhappily been so successful, that no virtues can now be found in the remainder of the root or herb.

5. *Radix tuberosa*, *f.* 9. A Tuberous or Knobbed Root, is of many different kinds. The most genuine consists of fleshy knobs, various in form, connected by common stalks or fibres, as in the Potatoe, *Solanum tuberosum*, and Jerusalem Artichoke,* *Helianthus tuberosus.* These knobs are reservoirs of nourishment, moisture, and vital energy. Several of the Vetch or Pea kind are furnished with them on a smaller scale; as *Vicia lathyroides* and several species of *Trifolium*, either annuals, as *glomeratum*, or perennials, as *fragiferum*. The knobs in these instances are only of annual duration; in the *Pæonia*, Piony, and *Spiræa Filipendula*, Dropwort, they are perennial.—In the *Orchideæ* of Europe they are mostly biennial. The root in many of the latter consists either of a pair of globular or oval bodies, *f.* 10, as in *Orchis hircina*, *Ophrys aranifera*, and *apifera*, or are palmate, that is, shaped somewhat like the human hand, *f.* 11, as in *Orchis maculata*. Of these globular or palmate knobs or bulbs one produces the herb and flowers of the present year, withering away towards autumn, and the other is reserved for the following season, while in the meantime a third is produced to succeed the latter. The knobs of *Neottia spiralis*, are formed three

* A corruption, as I presume, of the Italian name *Girasole Articiocco*, Sunflower Artichoke, as the plant was first brought from Peru to Italy, and thence propagated throughout Europe.

or four years before they flower, and their flowering appears to be occasionally deferred to a more distant period. The root of *Habenaria albida*, consists of three pair of tapering knobs or bulbs, *f.* 12, which flower in succession. On the contrary, *Herminium monorchis* forms its new bulb so late, that it is not perfected till the autumn immediately preceding its flowering, and the plant seems to have but one bulb. *Listera Nidus avis* has clusters of cylindrical knobs, which are formed, and also wither away, in parcels, each parcel being equivalent to one of the above-mentioned bulbs.

Such of the *Orchis* tribe as have biennial bulbs are supposed to be very difficult of cultivation; but according to the experience of my excellent friend the late Mr. Crowe, in whose garden I have seen them many successive years, they are best removed when in full flower, the earth being cleared completely away from the roots, which are then to be replanted in their natural soil, previously dried and sifted. Afterwards they must be well watered. The bulb for the following year has not, at the flowering period, begun to throw out its fibres; for after that happens, it will not bear removal. By this treatment, several rare plants of this family were successfully sent from Sicily to England, by my friend Mr. W. Swainson. *Habenaria albida* having, as mentioned above, so many pair of roots, the growth of some of which is always going on, has hitherto not been found to survive transplantation at all.

Iris tuberosa, *Sm.* has a root very analogous to those just described, but *I. Florentina* and *I. Germanica* have more properly creeping roots, though so thick and fleshy in their substance, and so slow in their progress, that they (this is called by many writers *rhizoma*, or rootstalk) are generally denominated tuberous.

6. *Radix bulbosa.* A Bulbous Root, properly so called, is either solid, *f.* 13, as in *Crocus*, *Ixia*, *Gladiolus*, &c.; tunicate, *f.* 14, *tunicata*, composed of concentric layers enveloping one another as in *Allium*, the Onion tribe; or scaly, *f.* 15, consisting of fleshy scales connected only at their

base, as in *Lilium*, the White or Orange Lily. The two latter kinds have the closest analogy with leaf-buds. They are reservoirs of the vital powers of the plant, during the season when those powers are torpid or latent, and in order to perform the functions of roots, they first produce fibres, which are the actual roots. The strict affinity between bulbs and buds appears from the scaly buds formed on the stem of the Orange Lily, *Lilium bulbiferum*, which fall to the ground, and, throwing out fibres from their base, become bulbous roots.* The same thing happens in *Dentaria bulbifera*, and *Saxifraga cernua*.

These two last-mentioned plants however have scaly roots, like the Toothwort, *Lathræa Squamaria*, which seem bulbs lengthened out. Whether they would, in the torpid season of the year, bear removal, like bulbs, we have no information. If disturbed at other times they are immediately killed. Many plants with solid bulbs are provided by Nature to inhabit sandy countries, over the face of which, in the dry season succeeding their flowering, they are scattered by the winds to a great distance, as happens to our own *Poa bulbosa*, as well as to numerous beautiful productions of the Cape of Good Hope.

7. *Radix articulata*, or *granulata*, *f.* 16. A Jointed or Granulated Root, agrees very much with those described in the last section. The *Oxalis Acetosella*, Wood Sorrel, and *Saxifraga granulata*, White Saxifrage, are instances of it. The former has most affinity with scaly bulbs, the latter with solid ones.

It is evident that fleshy roots, whether of a tuberous or bulbous nature, must at all times powerfully resist drought. I have already mentioned, *p.* 21, the acquisition of a bulb in *Phleum pratense*, whenever that grass is situated in a fluctuating soil, by which its vital powers are supported while the fibrous roots are deprived of their usual supplies. In this state it becomes the *Phleum nodosum* of authors; but on being

* I have had scaly buds form even on the flower-stalk of *Lachenalia tricolor* whilst lying for many weeks between papers to dry, which, on being put into the ground, have become perfect plants, though of slow growth.

removed to a thoroughly wet soil, it resumes the entirely fibrous root and luxuriant growth of *P. pratense.* I have also found *Alopecurus geniculatus,* (an aquatic grass, whose root is naturally fibrous and creeping,) growing with an ovate juicy bulb on the top of a dry wall. This variety has been taken for the true *A. bulbosus,* which has always bulbs, even in its native marshes. We see the wisdom of this provision of Nature in the grasses above-mentioned, nor may the cause be totally inexplicable. When a tree happens to grow from seed on a wall, it has been observed, on arriving at a certain size, to stop for a while, and send down a root to the ground. As soon as this root was established in the soil, the tree continued increasing to a large magnitude.* Here the vital powers of the tree, not being adequate, from scanty nourishment, to the usual annual degree of increase in the branches, were accumulated in the root, which therefore was excited to an extraordinary exertion, in its own natural direction, downward. There is no occasion then to suppose, as some have done, that the tree had any information of the store of food at the foundation of the wall, and voluntarily sent down its root to obtain it; nor is it wonderful that the Author of life should provide for it as effectually as it could for itself, had it really been a reflecting being. So in the case of the grasses in question, I presume the herb being in the first instance starved, by a failure of the nutrimental fluids hitherto conveyed by the water of the soil, its growth would be checked, and when checked, the same growth could not, as we know by observation on vegetation in general, be instantaneously renewed. A sudden fresh supply of food would therefore cause an accumulation of vital energy in the root, which would consequently assume a degree of vigour and a luxuriant mode of growth not natural to it, and become bulbous. Thus it acquires a resource against such checks in future, and the herb is preserved alive, though in a very far less luxuriant state than when regularly and uniformly supplied with its

* A particular fact of this kind, concerning an Ash, was communicated to me by the late Rev. Dr. Walker of Edinburgh. See also *Trans. of Linn. Soc. v.* 2. *p.* 268.

requisite nourishment. These are not solitary instances. It is well worthy the attention of an intelligent cultivator to seek them out, and turn them to his advantage.

Chap. XIII.—*Different Kinds of Stems and Stalks of Plants.*

Linnæus enumerates seven kinds of Trunks, Stems, or Stalks of Vegetables. These are necessary to be known, for botanical distinctions, though some are more important than others, both in that respect and in a physiological point of view.

1. Caulis. A stem, properly so called, which bears, or elevates from the root, the leaves as well as flowers. The trunks and branches of all trees and shrubs come under this denomination, as well as of a great proportion of herbaceous plants, especially annuals.

   The stem is either simple, as in the White Lily, or branched, as in most instances. When it is regularly and repeatedly divided, and a flower springs from each division, it is called *caulis dichotomus, f.* 17, a forked stem, as in *Chlora perfoliata*, as well as the common Mouse-ear Chick-weeds, *Cerastium vulgatum* and *viscosum*.

   Though generally leafy, a Stem may be partially naked, or even entirely so, in plants destitute of leaves altogether, as the Creeping Cereus, *Cactus flagelliformis*, various exotic species of *Euphorbia* or Spurge, and the whole genus of *Stapelia*. In *Orobanche*, it is scaly, *f.* 18, *squamosus*.

   With respect to mode of growth, the stem is

   Erectus, upright, as in Yellow Loosestrife, *Lysimachia vulgaris*.

   Procumbens, procumbent, Wood Loosestrife, *L. nemorum*.

Repens, creeping, Creeping Loosestrife, *L. Nummularia*, and Creeping Crowfoot, *Ranunculus repens*.

Adscendens, ascending obliquely without support, as *Panicum*, now *Digitaria, sanguinalis*.

Prostratus, prostrate, or *Depressus*, depressed, when it lies remarkably flat, spreading horizontally over the ground, as in *Coldenia procumbens;* also *Coronopus Ruellii*, (*Brit. Flora*,) or *Senebiera Coronopus*, Swine's-cress.

Reclinatus, reclining, curved towards the ground, as in *Ficus*, the Fig, *Rubus*, the Bramble, &c.

Radicans, *f.* 19, clinging to any other body for support, by means of fibres which do not imbibe nourishment, as Ivy, *Hedera Helix*. Linnæus, (*Philosophia Botanica*, *p.* 39,) has expressed this by the term *repens*, but has corrected it in his own copy. Still he does not distinguish between these plants, and those whose stems throw out real roots, which last only are justly called *creeping*, whether they grow on the ground, like those above-mentioned, or on other plants, like *Cuscuta*, Dodder. See *p.* 48.

Scandens, climbing; either with spiral tendrils for its support, as the Vine, *Vitis*, the various species of Passion-flower, *Passiflora cærulea*, &c., and *Bryonia dioica*, Red-berried Bryony; or by adhesive fibres, as in the preceding paragraph.

Volubilis, twining round other plants by its own spiral form, either from left to right, *f.* 20, supposing the observer in the centre (or, in other words, according to the apparent motion of the sun), as the Black Bryony, *Tamus communis*, the Honeysuckles, *Lonicera Caprifolium* and *Periclymenum*, and the *Polygonum Convolvulus;* or from right to left, *f.* 21, contrary to the sun, as the Great Bindweed, *Convolvulus sepium*, the French Bean, *Phaseolus vulgaris*, &c. Figures of plants being sometimes reversed by the engraver, in that case give a wrong representation of the circumstance in question, witness *Lonicera Periclymenum* in Curtis's *Flora Londinensis*, *fasc.* 1. *t.* 15, and many instances might be pointed out of its not being attended to at all.

Flagelliformis, long and pliant, like the Common Jasmine, *Jasminum officinale*, or Blue Box-thorn, *Lycium Barbarum*.

Sarmentosus, trailing. A creeping stem, barren of flowers, thrown out from the root for the purpose of increase, is called *sarmentum* or *flagellum*, a runner, *f.* 22, as in the Strawberry, *Fragaria vesca*. When leafy it is generally denominated *stolo*, a sucker or scyon, as in Bugle, *Ajuga reptans*, and *Viola odorata*, the Sweet Violet. When the *stolo* has taken root, it sometimes flowers the first year; but generally not till the following season.

Rectus, straight, as in *Lilium*, the different species of garden Lily.

Strictus, expresses only a more absolute degree of straightness.

Laxus or *Diffusus*, loosely spreading, has a contrary meaning, as in the Sea Rocket, and *Sedum acre*, Biting Stone-crop.

Flexuosus, zigzag, forming angles alternately from right to left, and from left to right, as in *Smilax aspera*, and many of that genus, also *Statice reticulata*, Matted Sea Lavander. In a less degree it is not unfrequent, as in *Atriplex pedunculata*.

Alterne ramosus, alternately branched, as *Polygonum minus*, *Dianthus deltoides*, &c

Distichus, two-ranked, when the branches spread in two horizontal directions, as in the Silver Fir, *Pinus picea*.

Brachiatus, brachiate, or four-ranked, when they spread in four directions, crossing each other alternately in pairs; a very common mode of growth in shrubs that have opposite leaves, like the Common Lilac, *Syringa vulgaris*.

Ramosissimus, much-branched, is applied to a stem repeatedly subdivided into a great many branches without order, as that of an Apple or Pear-tree, or Gooseberry-bush.

Prolifer, proliferous, shooting out new branches from the summits of the former ones,* as in the Scotch Fir,

* *Linn. Phil. Bot. sect.* 82. 28.

Pinus sylvestris, and *Lycopodium annotinum*. This is obsolete and seldom used.

Determinate ramosus, *f.* 23, 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 those flowers. This term occurs frequently in the later publications of Linnæus, particularly the second *Mantissa*, but I know not that he has any where explained its meaning. It is exemplified in *Azalea nudiflora*, *Erica Tetralix*, many Cape Heaths, and other shrubs of the same Natural Order.

Articulatus, jointed, as in Samphire, *Salicornia herbacea*, and more remarkably in the Indian Figs, *Cactus Tuna*, &c.

In shape the Stem is

Teres, *f.* 32, round, as in *Trollius Europæus*, and *Hydrangea hortensis*, &c.

Anceps, two-edged, as in *Sisyrinchium striatum*, *S. gramineum*, and some of the genus *Lathyrus*.

Trigonus or *Triangularis*, triangular or three-edged, as *Cactus triangularis*.

Triqueter, three-sided, is applied to a stem with 3 flat sides.

Tetragonus or Quadrangularis, square, as *Lamium album*, White Dead-nettle, and a multitude of other plants (especially of the Natural Order *Labiatæ*).

Pentagonus or *Quinquangularis*, five-sided, as *Asparagus horridus*.

When the number of angles is either variable, or more than five, it is usual merely to describe the stem as *angulosus*, angular, except where the precise number makes a specific difference, as in the genus *Cactus*.

Alatus, *f.* 36, winged, when the angles are extended into flat leafy borders, like *Passiflora alata*, *Lathyrus latifolius*, and many others of the Pea kind, besides several Thistles, as *Carduus acanthoides*, *Cnicus palustris*, and *Centaurea solstitialis*.

The surface of the Stem is

Glaber, smooth,* (glabrous) opposed to all kinds of hairiness or pubescence, as in Petty Spurge, *Euphorbia Peplus*, and numerous plants besides.

Lævis, smooth and even, opposed to all roughness and inequality whatever, as in the last example, and also *Euonymus Europæus*.

Nitidus, polished, smooth and shining, as *Chærophyllum* (or *Anthriscus*) *sylvestre*.

Viscidus, viscid, covered with a clammy juice, as *Lychnis Viscaria*.

Verrucosus, warty, like *Euonymus verrucosus*.

Papillosus, papillose, covered with soft tubercles, as the Ice plant, *Mesembryanthemum crystallinum*.

Scaber, rough to the touch from any little rigid inequalities, opposed to *lævis*, as *Anthriscus vulgaris*, *Centaurea nigra*, and *Stellaria holostea*.

Hispidus, bristly, (or hispid,) as Borage, *Borago officinalis*.

Hirtus or *Pilosus*, hairy, as *Salvia pratensis*, and *Cerastium alpinum*.

Tomentosus, downy, as *Geranium rotundifolium*, very soft to the touch.

Villosus, shaggy, as *Cineraria integrifolia*, (*campestris Brit. Fl.*)

Lanatus, woolly, as *Verbascum pulverulentum*, *V. Thapsus*, and *Santolina* (*Diotis*, *Brit. Fl.*) *maritima*.

Incanus, hoary, as Wormwood, *Artemisia Absinthium*, and *Atriplex portulacoides*, in the former case from close silky hairs, in the latter from a kind of scaly mealiness.

Glaucus, glaucous, clothed with fine seagreen mealiness which easily rubs off, as *Chlora perfoliata*, and *Lithospermum maritimum*.

* In common language, the word *smooth* is so universally employed to express an *even* surface, that it can scarcely be considered synonymous with the Latin *glaber*, hence I have been disposed to adopt the word *glabrous*. Professor Lindley gives to *glaber* and *lævis* the same meaning, *smooth*, in the common acceptation of the term; and employs *nudus* in opposition to all hairiness or downiness. But a *caulis nudus* is, as Sir J. E. Smith well observes elsewhere, a stem destitute of leaves; *folium nudum*, a leaf destitute of all clothing or hairiness.—*Ed.*

Striatus, striated, marked with fine parallel lines, as *Œnanthe fistulosa.*

Sulcatus, furrowed with deeper lines, as *Smyrnium Olusatrum.*

Maculatus, spotted, as Hemlock, *Conium maculatum.*

The spines and prickles of the stem will be explained hereafter.

Internally the stem is either *solidus*, solid, as that of *Inula* (*Limbarda, Brit. Fl.*) *crithmoides*, and numerous others; or *cavus*, hollow, as in *Cineraria palustris*, as well as Hemlock, and many umbelliferous plants besides.

Plants destitute of a stem are termed *acaules*, stemless, as *Cypripedium humile*, and *Cnicus acaulis*. Such plants, when they belong to a genus or family generally furnished with stems, as in these instances and *Carlina acaulis*, are liable, from occasional luxuriance, to acquire some degree of stem, but seldom otherwise. *Pinguicula* is a genus invariably stemless, while *Primula* is much less truly so. The term *acaulis* however must never be too rigidly understood, for logical precision is rarely applicable to natural productions.

Caulis fasciculatus, a clustered stem, is a disease or accident, in which several branches or stems are united longitudinally into a flat broad figure, crowded with leaves or flowers at the extremity. It occurs in the Ash, several species of *Daphne*, *Ranunculus*, *Antirrhinum*, &c. In *Pisum comosum* of Rivinus, called the Top-knot Pea, it is a permanent variety propagated by seed.

2. Culmus. A straw or Culm,* is the peculiar Stem of the Grasses, Rushes, and plants nearly allied to them. It bears both leaves and flowers, and its nature is more easily understood than defined. Many botanists have thought this term superfluous.

The Culm is occasionally

Enodis, without joints, as in our common Rushes, *Juncus conglomeratus*, and *effusus*.

* The term *Culm* is now generally confined to the stems of *Grasses* (which have indeed a very peculiar structure), exclusive of the *Rushes*.—*Ed.*

Articulatus, jointed, as in all true grasses.

Geniculatus, bent like the knee, as *Alopecurus geniculatus*.

It is either solid or hollow, round or triangular, rough or smooth, sometimes hairy or downy, scarcely woolly. I know of no instance of such a scaly culm as Linnæus has figured in his *Philosophia Botanica*, *t.* 4. *f.* 111, nor can I conceive what he had in view.

3. SCAPUS, (a Scape or) Stalk, springs from the Root, and bears the flowers and fruit, but not the leaves. *Primula vulgaris*, the Primrose, and *P. veris*, the Cowslip, are examples of it. In the former the scape or stalk is simple and single-flowered; in the latter subdivided, and many-flowered. It is either naked, as in *Narcissus*, or scaly, as in *Tussilago Farfara*. In others of this last genus, the scales become leafy, and render the *Scapus* a proper *Caulis*.

The stalk is spiral in *Cyclamen*, and *Valisneria spiralis*, a wonderful plant whose history will be detailed hereafter.

Linnæus believed* that a plant could not be increased by its *Scapus*, which in general is correct; but we have already recorded an exception, *p.* 57, in *Lachenalia tricolor*. The same great author has observed† that "a *Scapus* is only a species of *Pedunculus*." The term might therefore be spared, were it not found very commodious in constructing neat specific definitions of plants. If abolished, *Pedunculus radicalis*, a radical flower-stalk, should be substituted in its room.

4. PEDUNCULUS, the flower-stalk, springs from the stem, and bears the flowers and fruit, not the leaves. *Pedicellus*, a partial flower-stalk, is the ultimate subdivision of a general one, as in the Cowslip, and *Saxifraga umbrosam*.

The Flower-stalk is

Caulinus, cauline, when it grows immediately out of the main stem, especially of a tree, as in *Averrhoa Bilimbi*, the Indian substitute for our green gooseberries.

* *MSS. in Phil. Bot.* 40. † *Ibid.*

Rameus, growing out of a main branch, as in *Averrhoa Carambola*, and *Eugenia Malaccensis.*

Axillaris, axillary, growing either from the bosom of a leaf, that is, between it and the stem, as in *Anchusa sempervirens*, and *Campanula Trachelium*, or between a branch and the stem, as *Ruppia maritima.*

Oppositifolius, opposite to a leaf, as *Geranium Pyrenaicum*, *G. molle*, and *Sium angustifolium.*

Internodis, proceeding from the intermediate part of a branch between two leaves, as in *Ehretia internodis*, *Solanum Carolinense*, and *Indicum*, but this mode of insertion is rare.

Gemmaceus, growing out of a leaf-bud, as the Barberry, *Berberis vulgaris.*

Terminalis, terminal, when it terminates a stem or branch, as *Tulipa sylvestris*, and *Centaurea Scabiosa.*

Lateralis, lateral, when situated on the side of a stem or branch, as in some of the *Contortæ*, or *Asclepiadeæ.*

Solitarius, solitary, either single on a plant, as in *Rubus Chamæmorus*, or only one in the same place, as in *Antirrhinum* (*Linaria Brit. Fl.*) *spurium*, and many common plants.

Aggregati Pedunculi, clustered flower-stalks, when several grow together, as in *Verbascum nigrum.*

Sparsi, scattered, dispersed irregularly over the plant or branches, as *Linum perenne*, and *Ranunculus sceleratus.*

Uniflori, *biflori*, *triflori*, &c., bearing one, two, three, or more flowers, of which examples are needless.

Multiflori, many-flowered, as *Daphne Laureola.*

When there is no Flower-stalk, the flowers are said to be *Sessiles*, sessile, as in *Centaurea Calcitrapa*, and the Dodders.

The subject of inflorescence, or particular modes of flowering, will be explained in a future chapter.

5. Petiolus. The Petiole, Footstalk, or Leaf-stalk. This term is applied exclusively to the stalk of a leaf, which is either simple, as in *Ranunculus parviflorus*, *Sium angustifolium*, and all simple leaves; or compound, as

Coriandrum sativum, and *Fumaria claviculata*. In the latter, the footstalks end in tendrils, and are called *Petioli cirriferi*.

This part is commonly channelled on the upper-side. Sometimes it is greatly dilated and concave at the base, as in *Angelica sylvestris*.

The Footstalk bears the Flower-stalk in *Turnera ulmifolia*, *Villarsia Indica*, and perhaps *Epimedium alpinum*.

6. Frons. A Frond. In this the stem, leaf and fructification are united, or, in other words, the flowers and fruit are produced from the leaf itself, as in the Fern tribe, *Suppl. f.* 101. It is also applied to the *Lichen* tribe, and others, in which the whole plant is either a crustaceous or a leafy substance, from which the fructification immediately proceeds. Linnæus considered Palm-trees as fronds, so far correctly as that they have not the proper stem of a tree, see *p.* 29 ; but they are rather perhaps herbs whose stalks bear the fructification. It must however be observed that the deposition of wood in ferns, takes place exactly as in palms.

The term frond is now hardly used but in the class *Cryptogamia*, except in the genus *Lemna*.

7. Stipes, Stipe*, is the stem of a frond, which in ferns is commonly scaly. The term is likewise applied to the stalk of a Fungus, as the Common Mushroom, *Agaricus campestris*.

Chap. XIV.—*Of Buds.*

Gemma, a Bud, contains the rudiments of a plant, or of part of a plant, for a while in a latent state, till the time of the year and other circumstances favour their evolution. In the bud therefore the vital principle is dormant, and its

* Martyn, *Language of Botany*.

excitability is accumulated. The closest analogy exists between buds and bulbs; and indeed the *Dentaria bulbifera*, *Lilium bulbiferum*, with other similar plants, as mentioned *p.* 57, almost prove their identity.

Buds of trees or shrubs, destined for cold countries, are formed in the course of the summer in the bosoms of their leaves, and are generally solitary; but in the Blue-berried Honeysuckle, *Lonicera cærulea*, they grow one under another for three successive seasons, *f.* 24. The buds of the Plane-tree, *Platanus*, are concealed in the footstalk, which must be removed before they can be seen, and which they force off by their increase; so that no plant can have more truly and necessarily deciduous leaves than the Plane. Shrubs in general have no buds, neither have the trees of hot climates. Linnæus once thought the presence of buds might distinguish a tree from a shrub, but he was soon convinced of there being no real limits between them.

The situation of buds is necessarily like that of the leaves, alternate, opposite, &c. Trees with opposite leaves have three buds, those with alternate ones a solitary bud, at the top of each branch. *Du Hamel.*

Buds are various in their forms, but very uniform in the same species, or even genus. They consist of scales closely enveloping each other, and enfolding the embryo plant or branch. Externally they have often an additional guard of gum, resin, or woolliness, against wet and cold. The Horse Chestnut, *Æsculus Hippocastanum*, now so common with us, though, as I have learned from Mr. Hawkins,* a native of Mount Pindus in Arcadia, is a fine example of large and well-formed buds, *f.* 25; and some of the American Walnuts are still more remarkable.

It has been already remarked, *p.* 29, that buds resist cold only till they begin to grow: hence according to the nature and earliness of their buds, plants differ in their powers of bearing a severe or variable climate.

Grew is elaborate on the forms of buds, and the arrange-

* See a note on this subject, which Mr. R. P. Knight has honoured with a place in the second edition of his poem on Landscape.

ment of the spots apparent within them when cut transversely, which indicate the number and situation of their vessels. It was the character of this excellent man to observe every thing, without reference to any theory, and his book is a storehouse of facts relating to vegetation. Loefling, a favourite pupil of Linnæus, wrote, under the eye of his great teacher, an essay on this subject, published in the *Amœnitates Academicæ*, *v.* 2, in which the various forms of buds, and the different disposition of the leaves within them, are illustrated by numerous examples. The Abbé de Ramatuelle had taken up this subject with great zeal at Paris about thirty years ago, but the result of his inquiries has not reached me.

Dr. Darwin, *Phytologia*, *sect.* 9, has many acute observations on the physiology of buds, but he appears to draw the analogy too closely between them and the embryo of a seed, or the chick in the egg. By buds indeed, as we well know, plants are propagated, and in that sense each bud is a separate being, or a young plant in itself; but such propagation is only the extension of an individual, and not a reproduction of the species, as by seed. Accordingly, all plants increased by buds, cuttings, layers, or roots, retain precisely the peculiar qualities of the individual to which they owe their origin. If those qualities differ from what are common to the species, sufficiently to constitute what is called a variety, that variety is perpetuated through all the progeny thus obtained. This fact is exemplified in a thousand instances, none more notorious than the different kinds of Apples, all which are varieties of the common crab, *Pyrus Malus ;* and I cannot but assent to Mr. Knight's opinion, that each individual thus propagated has only a determinate existence, in some cases longer, in others shorter; from which cause many valuable varieties of apples and pears, known in former times, are now worn out, and others are dwindling away before our eyes. New varieties of Cape Geraniums, raised from seed in our greenhouses, are of still shorter duration, and can be preserved by cuttings for a few successive seasons only; yet several of these stand in our botanic works, with all the importance of real species. Gardeners know how many of the most hardy perennial herbs require to be frequently renewed from seed to exist in full vigour; and though others appear, to our confined experience, unlimited in that respect, we have many reasons to believe they are not so. Propagation by seeds is therefore the only true reproduction of plants, by which each species remains distinct, and all variations are effaced; for though new varieties may arise among a great number of seedling plants, it does not appear that such varieties owe their peculiarities to any that may have existed in the parent plants. How propagation by seed is accomplished will be explained in a future chapter, as well as the causes of some varieties produced by that means.

Mr. Knight in the *Philosophical Transactions for* 1805, has shown that buds originate from the alburnum, as might indeed be expected. The trunks and branches of trees, and the knobs of genuine tuberous roots, like the potatoe, are studded with them; in which respect, as Professor Willdenow judiciously observes, *Principles of Botany, p.* 15, such roots essentially differ from bulbous ones, which last are themselves simple buds, and produce their shoots, as well as their offsets, either from the centre or from the base.

The contents of buds are different, even in different species of the same genus, as Willows. The buds of some produce leaves only, others flowers; while in other species the same bud bears both leaves and flowers. Different causes depending on the soil or situation, seem in one case to generate leaf-buds, in another flower-buds. Thus the *Solandra grandiflora,* a Jamaica shrub, was for a number of years cultivated in the English stoves, and propagated extensively by cuttings, each plant growing many feet in length every season, from abundance of moisture and nourishment, without showing any signs of fructification. At length a pot of the *Solandra* was accidentally left without water in the dry stove at Kew; and in consequence of this unintentional neglect, the luxuriant growth of its branches was greatly checked, and a flower came forth at the extremity of each. By a similar mode of treatment the same effect has since frequently been produced. Several plants, especially with bulbous roots, which blossom abundantly in their native soils, have hitherto defied all the art of our gardeners to produce this desirable effect; yet future experience may possibly place it within our reach by some very simple means. In general, whatever checks the luxuriant production of leaf-buds, favours the formation of flowers and seeds. That variety, or perhaps species, of the Orange Lily, *Lilium bulbiferum*, which is most prolific in buds, seldom forms seeds, or even those organs of the flower necessary to their perfection. So likewise the seeds of Mints, a tribe of plants which increase excessively by roots, have hardly been detected by any botanist; and it is asserted by Doody in Ray's *Synopsis*, that when the elegant little *Ornithopus perpusillus* does not produce pods, it propagates itself by the grains or tubercles of its root, though in general the root is annual.

Chap. XV.—*Of Leaves, their Situations, Insertions, Surfaces, and Various Forms.*

Folium, the Leaf, is a very general, but not universal, organ of vegetables, of an expanded form, presenting a much greater surface to the atmosphere than all the other parts of the plant together. Its colour is almost universally green, its internal substance pulpy and vascular, sometimes very succulent, and its upper and under surfaces commonly differ in hue, as well as in the kind or degree of roughness.

Leaves are eminently ornamental to plants from their pleasing colour, and the infinite variety as well as elegance of their forms. Their many economical uses to mankind, and the importance they hold in the scale of nature as furnishing food to the brute creation, are subjects foreign to our present purpose, and need not here be insisted upon. Their essential importance to the plant which bears them, and the curious functions by which they contribute to its health and increase, will presently be detailed at length. We shall first explain their different situations, insertions, forms, and surfaces, which are of the greatest possible use in systematical botany.

The leaves are wanting in many plants, called for that erason *plantæ aphyllæ*, as *Salicornia*, and *Stapelia*. In such cases the surface of the stem must perform all their necessary functions.

1. With respect to Situation and Position,

Folia radicalia, radical leaves, are such as spring from the root, like those of the Cowslip, and *Anemone Pulsatilla*.

Caulina, stem-leaves, grow on the stem, as in *Paris quadrifolia*, *Polemonium cæruleum*, &c.

Ramea, branch-leaves, sometimes differ from those of the main stem, and then require to be distinguished from them, as in *Melampyrum arvense*.

Alterna, *f.* 21, alternate leaves, stand solitarily on the stem or branches, spreading in different directions, as those of Borage, and innumerable other plants.

Sparsa, *f.* 19, scattered irregularly, as in *Genista tinctoria*, *Lilium Chalcedonicum*, and *bulbiferum*.

Opposita, opposite to each other, as *Saxifraga oppositifolia*, *Ballota nigra*, &c.

Conferta, clustered, or crowded together, as those of *Trientalis Europæa*.

Bina, only two upon a plant or stem, as in the Snowdrop, *Galanthus nivalis*, *Scilla bifolia*, and *Convallaria majalis*.

Terna, three together, as *Verbena triphylla*. The plants of Chili and Peru seem particularly disposed to this arrangement of their leaves.

Quaterna, *quina*, &c., when 4, 5, or more, are so situated, as in various species of Heath, *Erica*. *Verticillata*, whorled, is used to express several leaves growing in a circle round the stem, without a reference to their precise number, as in *Asperula cynanchica*, and *odorata*, which, with the genus *Galium*, and some others, are for this reason called *Stellatæ*, star-leaved plants. Whorled leaves are also found in *Hippuris vulgaris*, and many besides.

Fasciculata, *f.* 26, tufted, as in the Larch, *Pinus Larix*, the Cedar, and some others of that genus.

Imbricata, *f.* 27, imbricated, like tiles upon a house, as in the common Ling, *Calluna vulgaris*, and *Euphorbia paralia*.

Decussata, *f.* 28, decussated, in pairs alternately crossing each other, as *Veronica decussata*.

Disticha, *f.* 29, two-ranked, spreading in two directions, and yet not regularly opposite at their insertion, as *Taxus baccata*.

Secunda, *f.* 30, unilateral, or leaning all towards one side, as *Convallaria multiflora*.

Adpressa, close-pressed to the stem, as *Xeranthemum sesamoides*.

Verticalia, perpendicular, both sides at right angles with the horizon, as *Lactuca Scariola*.

Erecta, upright, forming a very acute angle with the stem, as *Juncus acutiflorus*.

Patentia, spreading, forming a moderately acute angle with the stem or branch, as *Atriplex portulacoides*.

Horizontalia, horizontal, or *patentissima*, spreading in the greatest possible degree, as *Gentiana campestris*.

Reclinata, inclining downward, as *Leonurus Cardaica*.

Recurva, or *reflexa*, curved backwards, as *Erica retorta*.

Incurva, or *inflexa*, curved inward, as *Erica empetrifolia*.

Obliqua, twisted, so that one part of each leaf is vertical, the other horizontal, as *Fritillaria obliqua*, and some of the large *Proteæ*.

Resupinata, reversed, when the upper surface is turned downward, as *Pharus latifolius*, and *Alstrœmeria pelegrina*.

Depressa, radical leaves pressed close to the ground, as *Plantago media*, and *P. Coronopus*. The same term applied to stem-leaves, expresses their shape only as being vertically flattened, in opposition to *compressa*.

Natantia, floating on the surface of the water, as *Nymphæa alba*, *Potamogeton natans*, and many water-plants.

Demersa, *immersa*, or *submersa*, plunged under water, as *Potamogeton perfoliatum*, *Hottonia palustris*, *Lobelia Dortmanna*, and the lower leaves of *Ranunculus aquatilis*, while its upper ones are *folia natantia*.

Emersa, raised above the water, as the upper leaves, accompanying the flowers, of *Myriophyllum verticillatum*, while its lower ones are *demersa*.

2. By Insertion is meant the mode in which one part of a plant is connected with another.

Folia petiolata, leaves on footstalks, are such as are furnished with that organ, whether long or short, simple or compound, as *Verbascum nigrum*, *Thalictrum minus*, *T. alpinum*, *&c.*

Peltata, *f.* 31, peltate, when the footstalk is inserted into the middle of the leaf, like the arm of a man holding a shield, as in the common Nasturtium, *Tropæolum majus*, *Hydrocotyle vulgaris*, and the noble *Cyamus Nelumbo*.

Sessilia, sessile, are such as spring immediately from the stem, branch or root, without any footstalk, like *Anchusa sempervirens*, and *Pinguicula vulgaris*.

Amplexicaulia, *f.* 32, clasping the stem with their base, as the upper leaves of *Glaucium luteum*, *Gentiana campestris*, and *Humea elegans*.

Connata, *f.* 17, connate, united at their base, as *Chlora perfoliata*, whose leaves are *connato-perfoliata*.

Perfoliata, *f.* 33, perfoliate, when the stem runs through the leaf, as *Bupleurum rotundifolium*, and the *Uvulariæ*.

Vaginantia, *f.* 34, sheathing the stem, or each other, as in most Grasses; as *Phleum alpinum*, and *Arundo (Ammophila) arenaria*. The same character is found in many of the Orchis tribe, as *Habenaria albida*.

Equitantia, *f.* 35, equitant, disposed in two opposite rows, and clasping each other by their compressed base, as in *Narthecium ossifragum*, and the genus *Iris*.

Decurrentia, *f.* 36, decurrent, running down the stem or branch in a leafy border or wing, as *Onopordum Acanthium*, *Carduus tenuiflorus*, and many other Thistles, also the Great Mullein, *Verbascum Thapsus*, and Comfrey, *Symphytum officinale*.

Florifera, *f.* 37, flower-bearing, when flowers grow out of the disk or margin of any leaf, as in *Ruscus aculeatus*, *Xylophylla latifolia*, and *X. falcata*. This is equivalent to a frond in the class *Cryptogamia;* see *p.* 67.

3. With regard to Form, Leaves are either *simplicia*, simple, like those of Grasses, Orchises, Lilies, and many other plants, *Ballota nigra*, and *Berberis vulgaris;* or *composita*, compound, as in most Umbelliferous plants, Parsley, Hemlock, &c.; also Roses.

In compound leaves the footstalk is either simple, as in the instances last quoted, and *Sium angustifolium;* or compound, like those of *Selinum palustre*, and *Thalictrum majus*. In simple leaves the footstalk, if present, must of course be simple, while in compound ones it must always be present, though not always subdivided.

Simple leaves are either *integra*, undivided, as those of Grasses and Orchises; or *lobata*, lobed, like the Vine, the Thistle, most kinds of Crane's-bill, as *Geranium pratense*, &c.

Leaves are frequently undivided and lobed on the same plant, as the Hop.

4. The following are the most remarkable forms of Simple Leaves, considering their outline only.

Orbiculatum, *f.* 38, a circular or orbicular leaf, whose length and breadth are equal, and the circumference an even circular line. Precise examples of this are scarcely to be found. Some species of *Piper* approach it, and the leaf of *Desmodium styracifolium* is perfectly orbicular, except a notch at the base.

Subrotundum, *f.* 39, roundish, as *Pyrola*, and many other plants.

Ovatum, *f.* 40, ovate, of the shape of an egg cut lengthwise, the base being rounded, and broader than the extremity, a very common form of leaves, as *Urtica pilulifera*, and *Vinca major*. The length may vary.

Obovatum, *f.* 41, obovate, of the same figure, with the broader end uppermost, as those of the Primrose, and the Daisy. Linnæus at first used the words *obverse ovatum*.

Ellipticum, *f.* 42, or *ovale*, elliptical or oval, of a similar form to the foregoing, but of equal breadth at each end, as in the Lily of the Valley.

Oblongum, oblong, three or four times longer than broad. This term is used with great latitude, and serves chiefly in a specific character to contrast a leaf which has a variable, or not very decided, form, with others that are precisely round, ovate, linear, &c.

Spatulatum, *f.* 43, spatulate, of a roundish figure tapering into an oblong base, as in *Silene Otites*.

Cuneiforme, *f.* 44, wedge-shaped, broad and abrupt at the summit, and tapering down to the base, as in *Saxifraga cuneifolia*.

Lanceolatum, *f.* 45, lanceolate, of a narrow oblong form, tapering towards each end, very common, as *Tulipa sylvestris*, *Lithospermum purpuro-cæruleum*, *Plantago lanceolata*, many Willows, &c.

Lineare, *f.* 46, linear, narrow with parallel sides, as those of most Grasses; also *Gentiana Pneumonanthe*, and *Narcissus Pseudo-narcissus*.

Acerosum, *f.* 47, needle-shaped, linear and evergreen, generally acute and rigid, as in the Fir, *Pinus*, Juniper, *Juniperus communis*, and Yew, *Taxus baccata*. Linnæus observes, *Phil. Bot.* 219, that this kind of leaf has, for the most part, a joint at its union with the branch.

Triangulare, *f.* 48, triangular, having three prominent angles, without any reference to their measurement or direction, as in the genus *Chenopodium*, *Cochlearia Danica*, and some leaves of the Ivy.

Quadrangulare, *f.* 49, with four angles, as the Tulip-tree, *Liriodendrum tulipifera*.

Quinquangulare, *f.* 19, with five angles, as some Ivy leaves, &c.

Deltoideum, *f.* 50, trowel-shaped or deltoid, having three angles, of which the terminal one is much farther from the base than the lateral ones, as *Chenopodium Bonus-Henricus*, and some leaves of *Cochlearia Danica*. A wrong figure is quoted for this in *Philosophia Botanica*, which has caused much confusion.

Rhombeum, f. 51, rhomboid, or diamond-shaped, approaching to a square, as *Chenopodium olidum*, and *Trapa natans.*

Reniforme, f. 52, kidney-shaped, a short, broad, roundish leaf, whose base is hollowed out, as *Asarum Europæum*, and *Sibthorpia Europæa.*

Cordatum, f. 53, heart-shaped, according to the vulgar idea of a heart; that is, broadly ovate hollowed out at the base, as *Tamus communis.*

Lunulatum, f. 54, crescent-shaped, like a half-moon, whether the points are directed towards the stalk, or from it, as *Passiflora lunata.*

Sagittatum, f. 55, arrow-shaped, triangular, hollowed out very much at the base, as *Sagittaria sagittifolia*, and *Rumex Acetosa.*

Sometimes the posterior angles are cut off, as in *Convolvulus sepium.*

Hastatum, f. 56, halberd-shaped, triangular, hollowed out at the base and sides, but with spreading lobes, as *Rumex Acetosella*, *Antirrhinum* (*Linaria Brit. Fl.*,) *Elatine*, and the upper leaves of *Solanum Dulcamara.*

Panduriforme, f. 57, fiddle-shaped, oblong, broad at the two extremities, and contracted in the middle, as the Fiddle Dock, *Rumex pulcher.*

Runcinatum, f. 58, runcinate, or lion-toothed, cut into several transverse, acute segments, pointing backwards, as the Dandelion, *Leontodon Taraxacum.*

Lyratum, f. 59, lyrate, or lyre-shaped, cut into several transverse segments, gradually larger towards the extremity of the leaf, which is rounded, as *Erysimum Barbarea*, now *Barbarea vulgaris.*

Fissum, f. 60, cloven, when the margins of the fissures and segments are straight, as in the Gingko-tree, *Salisburia adiantifolia.*

Bifidum, trifidum, multifidum, &c., express the number of the segments.

Lobatum, f. 61, lobed, when the margins of the segments are rounded, as in *Anemone Hepatica.*

Bilobum, trilobum, &c., according to the number of the lobes.

Sinuatum, *f.* 62, sinuated, cut into rounded or wide openings, as *Statice sinuata.*

Partitum, *f.* 63, deeply divided, nearly to the base, as *Helleborus viridis.*

Bipartitum, *tripartitum*, *multipartitum*, according to the number of the divisions.

Laciniatum, *f.* 64, laciniated, cut into numerous irregular portions, as *Ranunculus parviflorus*, and *Geranium columbinum.*

Incisum, and *Dissectum*, cut, are nearly synonymous with the last.

It is remarked by Linnæus that aquatic plants have their lower, and mountainous ones their upper, leaves most divided, by which they better resist the action of the stream in one case, and of wind in the other. Probably these actions are in some measure the causes of such configurations.

Palmatum, *f.* 65, palmate, cut into several oblong, nearly equal segments, about half way, or rather more, towards the base, leaving an entire space like the palm of the hand, as *Passiflora cœrulea.*

Pinnatifidum, *f.* 66, pinnatifid, cut transversely into several oblong parallel segments, as in *Cakile maritima; Senebiera (Coronopus, Brit. Fl.,) didyma*, *Hutchinsia petræa* and *Myriophyllum verticillatum.*

Bipinnatifidum, *f.* 67, doubly pinnatifid, as *Papaver Argemone.*

Pectinatum, *f.* 68, pectinate, is a pinnatifid leaf, whose segments are remarkably narrow and parallel, like the teeth of a comb, as the lower leaves of *Myriophyllum verticillatum*, and those of *Hottonia palustris.*

Inequale, *f.* 69, unequal, sometimes called oblique, when the two halves of the leaf are unequal in dimensions, and their bases not parallel, as in *Eucalyptus resinifera*, and most species of that genus, as well as of *Begonia.*

5. The Terminations of Leaves are various.

Folium truncatum, *f.* 49, an abrupt leaf, has the extremity cut off, as it were, by a transverse line, as *Liriodendrum tulipifera.*

Præmorsum, f. 70, jagged-pointed, very blunt, with various irregular notches, as in Dr. Swartz's genus *Aërides,* comprehended under the *Epidendrum* of Linnæus.

Retusum, f. 71, retuse, ending in a broad shallow notch, as *Oxyria reniformis.*

Emarginatum, f. 72, emarginate, or nicked, having a small acute notch at the summit, as the Bladder Senna, *Colutea arborescens* and Box, *Buxus sempervirens.*

Obtusum, f. 39, blunt, terminating in a segment of a circle, as the Primrose and Snowdrop.

Acutum, f. 51, sharp, ending in an acute angle, which is common to a great variety of plants, as Ladies' Slipper, and *Campanula Trachelium.*

Acuminatum, f. 73, pointed, having a taper or awl-shaped point, as *Arundo Phragmites,* and *Scirpus maritimus.*

Obtusum cum acumine, f. 74, blunt with a small point, as *Statice Limonium.*

Mucronatum or *Cuspidatum, f.* 75, sharp-pointed, tipped with a rigid spine, as in the Thistles and *Ruscus aculeatus,* &c.

Cirrosum, f. 76, cirrose, tipped with a tendril, as in *Gloriosa superba.*

6. The different Margins of Leaves are characterized as follows:

Folium integerrimum, f. 39, an entire leaf, as in the Orchis and Lily tribe, as well as *Polygala vulgaris, Daphne Laureola,* &c.

This term is opposed to all kinds of teeth, notches, or incisions. It regards solely the margin of a leaf; whereas *integrum, p.* 75, respects its whole shape, and has nothing to do with the margin. English writers who translate the one *entire,* and the other *very entire,* are therefore incorrect.

Spinosum, f. 77, spinous, beset with thorns, as *Cnicus lanceolatus,* and *Eryngium campestre.* The veins are spinous in *Solanum Pyracantha,* &c.

Inerme, f. 71, unarmed, is opposed to spinous.

Ciliatum, *f.* 78, fringed, bordered with soft parallel hairs, as *Galium cruciatum.*

Cartilagineum, cartilaginous, hard and horny, as *London Pride*, *Saxifraga umbrosa.*

Dentatum, *f.* 79, toothed, beset with projecting, horizontal, rather distant teeth of its own substance, as *Atriplex laciniata*, *Hypochæris maculata*, and the lower leaves of *Centaurea Cyanus*; also *Nymphæa Lotus.*

Serratum, *f.* 80, serrated, when the teeth are sharp, and resemble those of a saw, pointing towards the extremity of the leaf. Examples of this are frequent, as *Urtica*, *Rosa*, *Comarum palustre*, &c. Some leaves are doubly serrated, *duplicato-serrata*, having a series of smaller serratures intermixed with the larger, as *Mespilus grandiflora*, and *Campanula Trachelium*, as well as several Roses.

Serrulatum, *f.* 63, minutely serrated, is used when the teeth are very fine, as in *Polygonum amphibium.*

Crenatum, *f.* 81, notched, or crenate, when the teeth are rounded, and not directed towards either end of the leaf, as in Ground-Ivy, *Glechoma hederacea*, *Chrysosplenium*, and *Sibthorpia Europæa.* In *Saxifraga Geum*, the leaves are sharply crenate. In the two British species of *Salvia*, the radical leaves are doubly crenate.

Erosum, *f.* 83, jagged, irregularly cut or notched, especially when otherwise divided besides, as in *Senecio squalidus.*

Repandum, *f.* 84, wavy, bordered with numerous minute angles, and small segments of circles alternately, as *Villarsia nymphæoides*, and *Inula dysenterica.*

Glandulosum, glandular, as *Hypericum montanum*, and the Bay-leaved Willow, *Salix pentandra.*

Revolutum, revolute, when the margin is turned or rolled backwards, as *Andromeda polifolia*, and *Tetratheca glandulosa.*

Linnæus seems originally to have applied this term to the rolling of the whole leaf backwards, as in *Solidago Virgaurea*, meaning to use the expression *margine revolutum* when the margin was intended; but this latter case being extremely frequent and the other very rare, he fell into the practice of using *revolutum*, simply for the margin.

Involutum, involute, the reverse of the preceding, as in *Pinguicula*.

Conduplicatum, folded, when the margins are brought together in a parallel direction, as in *Roscoea purpurea*.

7. Terms expressive of different kinds of Surface, applying equally to the leaf and to the stem, have been already explained, p. 63. To these may be added the following, chiefly appropriated to leaves.

Punctatum, dotted; either superficially, as in *Rhododendron punctatum*, and *Melaleuca linarifolia*; or through the substance, as in *Hypericum perforatum*, and the Natural Order to which the Orange and Lemon belong.

Rugosum, rugged, when the veins are tighter than the surface between them, causing the latter to swell into little inequalities, as in various species of Sage, *Salvia; Teucrium Scorodonia*, &c.

Bullatum, blistery, is only a greater degree of the last, as in the Garden Cabbage, *Brassica oleracea*.

Plicatum, *f.* 85, plaited, when the disk of the leaf, especially towards the margin, is acutely folded up and down, as in Mallows, and *Alchemilla vulgaris*, where, however, the character is but obscurely expressed.

Undulatum, *f.* 86, undulated, when the disk near the margin is waved obtusely up and down, like *Reseda lutea*, and *Ixia crispa* (more properly *undulata**).

Crispum, *f.* 87, curled, when the border of the leaf becomes more expanded than the disk, so as to grow elegantly curled and twisted, which Linnæus considers as a disease. *Malva crispa* is an example of it, and may probably be a variety of *M. verticillata*, *Jacq.*

Concavum, hollow, depressed in the middle, owing to a tightness in the border, as *Cyamus Nelumbo*.

Venosum, *f.* 88, veiny, when the vessels by which the leaf

* *Salisb. Hort.* 37.

is nourished are branched, subdivided, and more or less prominent, forming a network over either or both of its surfaces, as *Pyrus torminalis*, and *Verbascum Lychnitis*.

Nervosum, *f.* 89, or *Costatum*, ribbed, when they extend in simple lines from the base to the point, as in *Cypripedium Calceolus*, the *Convallariæ*, and the greater number of monocotyledonous plants. The larger clusters of vessels are generally called *nervi* or *costæ*, nerves or ribs, and the smaller *venæ*, veins, whether they are branched and reticulated, or simple and parallel.

Avenium, veinless, and *Enerve*, ribless, are opposed to the former.

Trinerve, *f.* 90, three-ribbed, is applied to a leaf that has three ribs all distinct from the very base, as well as unconnected with the margin, in the manner of those many-ribbed leaves just cited; see *Blakea trinervis*.*

Basi trinerve, *f.* 91, three-ribbed at the base, is when the base is cut away close to the lateral ribs, as in Burdock, *Arctium Lappa*, *Tussilago*, and the great Annual Sunflower.

Triplinerve, *f.* 92, triply-ribbed, when a pair of large ribs branch off from the main one above the base, which is the case in many species of Sunflower or *Helianthus*, *Laurus Cinnamomum* and *L. Camphora*, as well as *Blakea triplinervis*.

Coloratum, coloured, expresses any colour in a leaf besides green, as in *Arum bicolor*, *Amaranthus tricolor*, and others of that genus, *Justicia picta*, *Hedysarum pictum*, *Tradescantia discolor*, *Pulmonaria officinalis*.

Variegatum, variegated, is applied to a sort of variety or disease, by which leaves become irregularly blotched with white or yellow, like those of Striped Grass, *Phalaris arundinacea*, as also the Elder, the *Mentha rotundifolia*, and the *Aucuba Japonica*, which last is not known in our gardens in its natural green state.

* Authors incorrectly use the termination *trinervius*, *trinervia*, &c, for the more classical *trinervis*, *trinerve*, *enervis*, *enerve*.

Nudum, naked, implies that a leaf is destitute of all kinds of clothing or hairiness, as in the genus *Orchis*. *Nudus* applied to a stem means that it bears no leaves, and to a flower that it has no calyx.

8. The following terms express the substance, peculiar configuration, or any other remaining circumstances of leaves, not already explained.

Teres, *f.* 93, cylindrical, as those of *Conchium gibbosum*, and several *Mesembryanthema*.

Semicylindraceum, *f.* 94, semicylindrical, flat on one side, as *Salsola fruticosa*, and *Chenopodium maritimum*.

Subulatum, *f.* 95, awl-shaped, tapering from a thickish base to a point, as *Salsola Kali*.

Tubulosum, tubular, hollow within, as *Allium Cepa*, the Common Onion. The leaf of *Lobelia Dortmanna* is very peculiar in consisting of a double tube, *f.* 96.

Carnosum, *f.* 98, fleshy, of a thick pulpy substance, as in all those called succulent plants, *Crassula*, *Sedum*, *Mesembryanthemum*, *Sempervivum*, &c.

Gibbum, gibbous, swelling on one side or both, from excessive abundance of pulp, as *Aloe retusa*.

Compressum, *f.* 98, compressed, flattened laterally, as *Mesembryanthemum uncinatum*, and *M. acinaciforme*.

Depressum, depressed, flattened vertically, as *M. linguiforme*. See *p.* 73.

Canaliculatum, *f.* 97, channelled, having a longitudinal furrow, as *M. pugioniforme*, *Plantago maritima*, and *Narcissus poeticus*.

Carinatum, keeled, when the back is longitudinally prominent, as *Narcissus biflorus*.

Ensiforme, sword-shaped, is a two-edged leaf, tapering to a point, slightly convex on both surfaces, neither of which can properly be called upper or under, as in most of the genus *Iris*.

Anceps, two-edged, is much the same as the last.

Acinaciforme, cimeter-shaped, compressed, with one thick and straight edge, the other thin and curved, like *Mesembryanthemum acinaciforme* above-mentioned.

Dolabriforme, *f.* 98, hatchet-shaped, compressed, with a very prominent dilated keel and a cylindrical base, like *M. dolabriforme.*

These two last terms might well be spared, as they seem contrived only for the plants in question, and indeed are not essentially distinct from each other.

Trigonum, *f.* 99, three-edged, having three longitudinal sides and as many angles, like *M. deltoides.* Linnæus has erroneously referred to this figure to illustrate his term *deltoides;* misled, as it should seem, by the name of the plant to which it belongs; but his definition is foreign to the purpose, see *p.* 76, and alludes to the outline of a flat leaf.

Triquetrum differs from *trigonum* only in being used by Linnæus for a three-sided awl-shaped leaf, as *M. emarginatum*, and *bicolorum*, also *Saxifraga Burseriana.*

Tetragonum, *f.* 100, four-edged, having four prominent angles, as *Iris tuberosa.*

Lingulatum, tongue-shaped, of a thick, oblong, blunt figure, generally cartilaginous at the edges, as *Mesembryanthemum linguiforme*, and several species of *Saxifraga*, as *S. Cotyledon*, &c.

Membranaceum, membranous, of a thin and pliable texture, as in *Aristolochia Sipho*, *Rubus odoratus*, *Magnolia purpurea*, &c.

Coriaceum, leathery, thick, tough and somewhat rigid, as *Magnolia grandiflora*, and *Hydrangea hortensis.*

Sempervirens, evergreen, permanent through one, two, or more winters, so that the branches are never stripped, like the Ivy, the Fir, the Cherry-Laurel, the Bay, &c.

Deciduum, deciduous, falling off at the approach of winter, as in most European trees and shrubs.

Alienatum, *f.* 101, alienated, when the first leaves of a plant give place to others totally different from them and from the natural habit of the genus,* as in many *Mimosæ* of

* This is only in appearance, not in reality; for it is now well known that in the New Holland *Mimosæ* (or rather *Acaciæ*) above alluded to, the supposed leaves are only remarkably dilated, leaf-like *petioles;* while in *Lathyrus Nissolia*, the *stipules* have the appearance of leaves.—*Ed.*

New Holland, *M. verticillata*, and *myrtifolia;* also *Lathyrus Nissolia.*

Cucullatum, f. 102, hooded, when the edges meet in the lower part, and expand in the upper, as those of the curious genus *Sarracenia.*

Appendiculatum, f. 103, furnished with an additional organ for some particular purpose not essential to a leaf, as *Dionæa muscipula*, whose leaves each terminate in a pair of toothed irritable lobes, that close over and imprison insects; or *Nepenthes distillatoria*, the leaf of which bears a covered pitcher full of water. *Aldrovanda vesiculosa*, and our *Utriculariæ* have numerous bladders attached to the leaves, which seem to secrete air, and float the plants.

Many of the preceding terms applied to leaves are occasionally combined, to express a form between the two, as *ovato-lanceolatum*, lanceolate inclining to ovate, or *elliptico-lanceolatum*, like the Privet. When shape, or any other character, cannot be precisely defined, *sub* is prefixed to the term used, as *subrotundum*, roundish, *subsessile*, not quite destitute of a footstalk, to which is equivalent *subpetiolatum*, obscurely stalked. By the judicious use of such means, all necessary precision is attained. It is to be wished that authors were always uniform and consistent, at least with themselves, in the application of terms; but as Linnæus, the father of accurate botanical phraseology, very frequently misapplies his own terms, it is perhaps scarcely to be avoided. I have observed botanists most critical in theory, to be altogether deficient in that characteristic phraseology, that power of defining, which bears the stamp of true genius, and which renders the works of Linnæus so luminous in despite of incidental errors. Perhaps no mind, though ever so intent on the subject, can retain all the possible terms of description and their various combinations, ready for use at any given moment. There are few natural objects to which a variety of terms are not equally applicable in description, so that no two writers would exactly agree in their use. Neither is Nature herself so constant as not perpetually to elude our most accurate research. Happy is that naturalist who can seize at a glance what is most characteristic and permanent, and define all that is essential, without trusting to fallacious, though ever so specious, distinctions !

9. *Folia composita*, compound leaves, consist of two or any greater number of *foliola*, leaflets, connected by a common footstalk.*

Folium articulatum, *f.* 104, a jointed leaf, is when one leaflet, or pair of leaflets, grows out of the summit of another, with a sort of joint, as in *Fagara (Zygophyllum, DC.,) tragodes*,† *Jacq. Amer. t.* 14.

Digitatum, *f.* 22, digitate or fingered, when several leaflets proceed from the summit of a common footstalk, as *Potentilla verna* and *P. reptans*, *Alchemilla alpina*.

Binatum, *f.* 105, binate, is a fingered leaf consisting of only two leaflets, as in some *Zygophylla*.

Ternatum, *f.* 106, ternate, consists of three leaflets, as *Fagonia Cretica*, and the genus *Trifolium*, Trefoil.

Quinatum, quinate, of five leaflets, as *Potentilla alba*, *P. reptans*, &c.

Pinnatum, pinnate, when several leaflets proceed laterally from one footstalk, and imitate a pinnatifid leaf, *p.* 78. This is of several kinds.

cum impari, *f.* 116, with an odd, or terminal leaflet, as in Roses and Elder.

cirrosum, *f.* 115, with a tendril, when furnished with a tendril in place of the odd leaflet, as the Pea and Vetch tribe.

* Strictly speaking, the truly compound leaf should have the leaflets *articulated* upon the petiole; thus in *Cardamine pratensis*, and in many plants of the same natural family, De Candolle employs the term *folia pinnatisecta* rather than *folia pinnata*. The Rose and the Orange tribes afford examples of truly compound leaves, whether there be many leaflets, as in most of the Roses, and in *Murraya exotica*, or only one leaflet, as in the curious *Rosa berberidifolia*, or in the Orange and Lemon. These distinctions are indeed rarely attended to, but they are of great importance in connexion with the natural affinities of plants.—*Ed.*

† In this case it is the petiole of a compound leaf that is jointed, of which each joint bears, or ought to bear, 2 opposite leaflets. A more familiar kind of jointed leaf is in the instance of the Lemon and the Orange, where there is a single joint; all above this the articulation is the leaf proper, or blade of the leaf, all below is the winged petiole. This, therefore, is the most simple kind of compound leaf, the petiole bearing only one leaflet.—*Ed.*

abruptè, f. 101, abruptly, without either a terminal leaflet or a tendril, as *Cassia Chamæcrista*, and the genus *Mimosa*. See *M. pudica*, the Common Sensitive plant. This form of leaf is much more uncommon than the *imparipinnatum*, and we have no perfect example of it among British plants. The nearest approach to it is the genus *Orobus*, whose leaves have only the rudiments of a tendril. A truly wonderful variety of the *Orobus sylvaticus* with large simple leaves, has been found in Wales.

oppositè, oppositely, when the leaflets are opposite, or in pairs, as Saint-foin, Roses, *Sium angustifolium*, &c.

alternatìm, alternately, when they are alternate, as *Vicia dumetorum*, and occasionally in our *V. sativa*, *lutea*, &c.

interruptè, f. 107, interruptedly, when the principal leaflets are ranged alternately with an intermediate series of smaller ones, as *Spiræa Filipendula*, *S. Ulmaria*, and *Potentilla anserina*.

articulatè, jointedly, with apparent joints in the common footstalk, as *Weinmannia pinnata*.

decursivè, decurrently, when the leaflets are decurrent, as *Eryngium campestre*, and *Potentilla fruticosa*.

lyratò, f. 108, in a lyrate manner, having the terminal leaflet largest, and the rest gradually smaller as they approach the base, like *Barbarea præcox*, and with intermediate smaller leaflets, as *Geum rivale*; also the Common Turnep. Such leaves are usually denominated lyrate in common with those properly so called (whose shape is simple, and not formed of separate leaflets; nor is this from inaccuracy in botanical writers. The reason is, that these two kinds of leaves, however distinct in theory, are of all leaves most liable to run into each other, even on the same plant, examples of which are frequent in the class *Tetradynamia*.

verticillatò, f. 109, in a whorled manner, the leaflets cut into fine divaricated segments embracing the footstalk, as *Sium* (*Carum*, *Brit. Fl.*) *verticillatum*.

Auriculatum, f. 110, an auricled leaf, is furnished at its base with a pair of leaflets, properly distinct, but occasionally liable to be joined with it, as *Salvia triloba*, and

Dipsacus pilosus. Linnæus in the last example uses the term *appendiculatum*, which is correct, but superfluous, and I have therefore ventured to apply it somewhat differently, *p.* 65.

Conjugatum, *f.* 105, conjugate, or yoked, consists of only a pair of *pinnæ* or leaflets, and is much the same as *binatum.* Instances of it are afforded by the genus *Zygophyllum*, whose name equivalent to Yoke-leaf, expresses this very character; also *Lathyrus sylvestris*, and *latifolius. Bijugum*, *trijugum*, *quadrijugum*, *multijugum*, &c., express particular numbers of pairs of leaflets, and are used for that purpose where such discrimination is requisite for specific characters, as in the *Mimosæ.*

The different degrees in which leaves are compounded are thus distinguished, without any reference to the mode.

Compositum, *f.* 111, simply compound, as in the above instances.

Decompositum, *f.* 112,* doubly compound, as *Athamanta* (*Seseli*, *Brit. Fl.*) *Libanotis*, *Ægopodium Podagraria*, and *Fumaria claviculata.*

Supradecompositum, *f.* 113, thrice compound, or more, as *Torilis*, *Anthriscus*, and many umbelliferous plants.

Bigeminatum, twice paired, as *Mimosa Unguiscati;* and *tergeminatum*, thrice paired, as *M. tergemina;* also

Biternatum, *f.* 112, twice ternate, as *Ægopodium*, *triternatum;* thrice ternate, as *Fumaria* (*Corydalis*, *Brit. Fl.*) *lutea;* and

Bipinnatum, doubly pinnate, *tripinnatum*, triply pinnate, of which examples have just been given, all apply to the mode, as well as the degree, in which leaves are compounded.

Pedatum, *f.* 114, pedate, is a peculiar kind of leaf, being ternate, with its lateral leaflets compounded in their fore part, as *Helleborus fœtidus*, and *H. niger.* There is an affinity between a pedate leaf and those simple ones which are three-ribbed at the base, *p.* 82. See

* Linnæus, in *Phil. Bot.* 47, gives an erroneous definition of this term, which does not accord with his own use of it. Professor Martyn has rightly defined it.

also the disposition of the lateral veins in *Aristolochia Clematitis*, *Engl. Bot. t.* 398.

In compounding the foregoing terms we must take care not to express a contradiction. Thus the leaves of many *Mimosæ*, as the *purpurea*, *Andr. Repos. t.* 372, and *sensitiva*, are *Conjugata pinnata*, conjugate in the first instance, pinnate in the next, not *conjugato-pinnata*, of an intermediate nature between conjugate and pinnate, which is impossible. Neither are the leaves of *Mimosa pudica digitato-pinnata*, for there is no medium between the two terms; but they are digitate, or composed of leaflets proceeding from the top of a common footstalk, and those leaflets are pinnate. On the other hand, *ovato-lanceolatum*, lanceolate approaching to ovate, or *elliptico-lanceolatum*, approaching to elliptic, as in the Privet, whose leaves often assume that shape, are easily understood.

CHAP. XVI.—*Of the Functions of Leaves.*

THE knowledge of the functions of leaves, and their real use with regard to the plant, is a curious branch of vegetable physiology, which made but a slow progress long after the nature of many other parts had been deeply scrutinized and thoroughly explained.

Cæsalpinus (*De Plantis, p.* 6,) thought leaves merely a clothing, or a protection against cold and heat. He conceived that the rays of the sun, being moderated in passing through them, were prevented from acting too violently on the fruit and young buds. "Accordingly," says he, "many trees lose their leaves in autumn, when their fruits are perfected, and their buds hardened, while such as retain the fruit long, keep also their leaves; even till a new crop is produced, and longer, as in the Fir, the *Arbutus*, and the Bay. It is reported that in hot climates, where there is almost perpetually a burning sun, scarcely any trees lose their leaves, because they require them for shade." Cæsalpinus goes on to show that leaves proceed from the bark, with some remarks on the pith, in which we may trace the origin of the Linnæan hypothesis of vegetation, but which are now superseded by more accurate inquiries.

The above is certainly a very small part of the use of leaves. Yet the observations of this writer, the father of botanical philosophy among the moderns, are so far correct, that if the leaves of a tree be stripped off, the fruit comes to nothing, which is exemplified every year in Gooseberry bushes devoured by caterpillars; and though the fruit-trees of warm climates, partly naturalized with us, Grapes and Peaches for instance, ripen their fruit sooner perhaps if partially deprived of their leaves; yet if that practice be carried too far, the fruit perishes, as gardeners who tried it soon discovered. The White Mulberry indeed, cultivated in the south of Europe for the food of silkworms only, bears wonderfully the loss of its foliage three or four times a-year. How far the fruit is injured nobody thinks it worth while to inquire, as it is never eaten, but it certainly does not fall off prematurely.

That leaves imbibe and give out moisture has been long known, this being one of the most obvious facts belonging to them. Dr. Hales thought they might probably imbibe air: but since his time, more certain discoveries have been made concerning this point, as well as the effects of light upon leaves, which also did not escape the consideration of that great philosopher. All these subjects we shall investigate in their turn.

That leaves give out moisture, or are organs of insensible perspiration, is proved by the simple experiment of gathering the leafy branch of a tree, and immediately stopping the wound at its base with mastick, wax, or any other fit substance, to prevent the effusion of moisture in that direction. In a very short time the leaves droop, wither and are dried up. If the same branch, partly faded, though not dead, be placed in a very damp cellar, or immersed in water, the leaves revive, by which their power of absorption is also proved. Hence the use of a tin box to travelling botanists, for the purpose of restraining the evaporation of plants, and so preserving them fresh for some days till they can be examined; as well as of reviving faded plants, if the inside of the box be moistened before they are shut up in it.

Dr. Hales found that a plant of the Great Annual Sunflower, *Helianthus annuus*, lost 1 lb. 14 oz. weight in the course of twelve hours in a hot dry day. In a dry night it lost about three ounces; in a moist night scarcely any alteration was observable, but in a rainy night it gained two or three ounces. The surface of the plant compared with that of its roots was, as nearly as could be calculated, in the proportion of five to two; therefore the roots must have imbibed moisture from the earth of the pot in which the plant grew, and which was all previously weighed, in the same proportion of five to two, otherwise the leaves would have faded. The same experiment was made on the Vine, the Cabbage, &c., with various results as to the exact degree of perspiration, but all proving it to be considerable. Evergreens are found to perspire much less than other shrubs.

The state of the atmosphere has a great effect on the rapidity of this perspiration. Practical botanists know how much sooner plants fade, and haymakers experience how much faster their work is done, some days than others, and those days are by no means always the most sunny. In a hot dry day plants are often exhausted, so as to droop very much towards evening, especially in the dry unsheltered bed of a garden. Such as have fleshy roots, indeed, have a singular power of resisting drought, which has already been explained, *p.* 57. Succulent plants, destined to inhabit sunny rocks, or sandy deserts, imbibe with the greatest facility, and perspire very sparingly. Evergreens are not generally very succulent, but their cuticle appears to be constructed like that of succulent plants, so as to allow of little evaporation. The Cornelian Cherry, whose immense perspiration is recorded at *p.* 34, has a thin dry leaf, capable of holding very little moisture.

The nature of the liquor perspired has been already noticed, *p.* 34. In hot weather it has been observed by Hales, Du Hamel, and Guettard, to partake occasionally of the peculiar scent of the plant that yields it; but in general the odorous matter is of too oily a nature to be combined with the watery perspiration.

The sensible perspiration of plants is of various kinds. When watery, it can be considered only as a condensation of their insensible evaporation, perhaps from some sudden change in the atmosphere. Groves of Poplar or Willow exhibit this phenomenon, even in England, in hot calm weather, when drops of clear water trickle from their leaves like a slight shower of rain. Sometimes it is of a saccharine nature, as De la Hire observed in Orange trees; *Du Hamel Arb. v.* 1. *p.* 150. It is more glutinous in the *Tilia* or Lime tree, more resinous in Poplars, as well as in *Cistus Creticus*, from which last the resin called *Labdanum* is collected, by beating the shrub with leather thongs. See Tournefort's *Voyage*, *p.* 29. In the Fraxinella, *Dictamnus albus*, it is a highly inflammable vapour. Ovid has made an elegant use of the resinous exudation of Lombardy Poplars, *Populus dilatata*, which he supposes to be the tears of Phaeton's sisters, who were transformed into those trees. Such exudations must be considered as effusions of the peculiar secretions: for it has been observed that Manna may be scraped from the leaves of *Fraxinus Ornus*, as well as procured by incision from its stem. They are often perhaps a sign of unhealthiness in the plant; at least such appears to be the nature of one kind of honey-dew, to which the Beech in particular is subject, and which, in consequence of an unfavourable wind, covers its leaves in the form of a sweet exudation, similar in flavour to the liquor obtained from its trunk. So likewise the Hop, according to Linnæus, is affected with the honey-dew, and its flowers rendered abortive, in consequence of the attacks of the caterpillar of the Ghost Moth, *Phalæna Humuli*, upon its roots. In such case the saccharine exudation must decidedly be of a morbid nature.* That wax is also an exudation from the leaves of plants, appears from the experiments recorded by Dr. Thomson in his *Chemistry*, *v.* 4. *p.* 298, and it has been long ago asserted that wax may easily be gathered from the leaves of Rosemary. On this subject I have not made any experiments to satisfy myself.

With respect to the absorbing power of leaves, the best

* I do not mean to dispute the accuracy of Mr. Curtis's excellent paper, *Trans. of Linn. Soc. v.* 6, written to prove honey-dew to be the dung of *Aphides*. I only contend that there is more than one kind of honey-dew.

observations that have been made are those of Bonnet, recorded in the beginning of his *Recherches sur l'Usage des Feuilles.* His aim was, by laying leaves of various plants upon the top of a jar of water, some with their upper, and others of the same species with their under, surfaces applied to the water, to discover in which situation the leaves of each plant continued longest in health and vigour, and also how far different species differed from each other in this respect. The results were in many instances highly curious.

Of fourteen herbaceous plants tried by this philosopher, six lived nearly as long with one surface applied to the water as with the other; these were the common *Arum maculatum*, the French Bean, the Sunflower, Cabbage, Spinach, and the Small Mallow. By the last I presume is meant *Malva rotundifolia.* Six others, Plantain, White Mullein, the Great Mallow, (probably *M. sylvestris*,) the Nettle, Cock's-comb, and Purple-leaved Amaranth (probably *Amaranthus hypochondriachus)*, lived longest with their upper surface laid upon the water. The Nettle lived but three weeks with its under surface on the water, and about two months in a contrary position. The Mullein scarcely survived five or six days, and the Amaranth not a week, in the first-mentioned posture, while the leaves of the former remained in vigour about five weeks, and of the latter three months, when their upper surfaces imbibed the water. Marvel of Peru and Balm, the two remaining plants of the fourteen on which the experiment was made, had also an evident advantage in receiving that fluid by their upper surfaces. The leaves of some of the above species were found to thrive better when their stalks only were immersed in water, than when either of their sides was supplied with it, and the reverse was observable in several others; but the White Mullein, the Plantain and the Amaranth survived longer when they received the water by the stalk than by their under surface, though not so long as when it was applied to their upper sides.

Of sixteen trees tried by Bonnet, the Lilac and the Aspen, *Populus tremula*, were the only leaves that seemed to imbibe water equally well by either surface, whilst all the others evidently succeeded best with their under sides laid upon the water, being in that respect the reverse of herbaceous plants. Of these the White Mulberry leaf was the most remarkable, not living more than five days when supplied by the upper surface, while such of its leaves as floated on their backs continued in perfection nearly six months. The Vine, the Poplar (probably *Populus nigra*), and the Walnut, were no less remarkable for fading almost as soon, when fed by their upper surface, as when left without any water at all. Many of the other trees imbibed water as well, or better, by their footstalks than by their upper surfaces. Hazel-nut and Rose leaves, when laid with their backs upon the water, imbibe sufficiently to nourish other leaves on the same branch; so will one leaflet of a French Bean supply its neighbour that does not touch the water.

Those who wish to repeat these experiments should be careful to choose full-grown healthy leaves, all as nearly as possible of the same age and vigour. It is also desirable that the precise species of plant should be recorded by its scientific name. For want of this, Bonnet, who despised method and nomenclature, has left us in uncertainty concerning several of the plants he examined. We ought to have been accurately informed what species of Poplar differed so remarkably in its power of absorption from the Aspen, another of the same genus. We ought likewise to have been told what Sunflower, what Nettle, Amaranth and Mallows were examined; for want of which information the authority of such experiments is much impaired.

From the foregoing observations we learn the importance of shading and watering plants newly removed, cuttings, grafts, &c.; and on the other hand the benefit of heat and air to promote due perspiration and evaporation.

The perspiration of aquatic plants seems to be remarkably copious. Of these some grow constantly immersed in the water, as most species of *Potamogeton*, Pond-weed, &c. Their leaves are peculiarly vascular, and dry very quickly in the air, withering in a very few minutes after exposure to it. Their absorbing power seems equally great, so that they appear to be continually in their natural situation imbibing and giving out a quantity of water much greater than has been observed in land plants. Other aquatics, like the *Nymphæa*, float with only the upper surface of their leaves exposed to the air, which surface is so contrived that water will scarcely remain upon it. These leaves, though extremely juicy, dry with great rapidity, as does every part of the plant when gathered. It is probable that they imbibe copiously by their under sides and perspire by the upper.

The economy of the *Sarracenia*, an American genus of which we now know five species, and of the East Indian *Nepenthes distillatoria*, deserves particular mention. Both grow in bogs, though not absolutely in the water. The former genus has tubular leaves which catch the rain like a funnel and retain it; at least such is the nature of *S. purpurea*, whose margin seems dilated expressly for this purpose, while the orifice of the tubular part just below is contracted to restrain evaporation. Linnæus conceived this plant to be allied in constitution to *Nymphæa*, and consequently to require a more than ordinary supply of water, which its leaves were calculated to catch and to retain, so as to enable it to live without being immersed in a river or pond. But the consideration of some other species renders this hypothesis very doubtful. *S. flava*, and more especially *S. adunca*, are so constructed that rain is nearly excluded from the hollow of their leaves, and yet that part contains water, which seems to be secreted by the base of each leaf. What then is the purpose of this unusual contrivance? An observation communicated to me in 1805, in the botanic garden at Liverpool seems to unravel the mystery. An insect of the *Sphex* or *Ichneumon* kind, as far as I could learn from description, was seen by one of the gardeners to drag several large flies to the *Sarracenia adunca*, and, with some difficulty forcing them under the lid or cover of its leaf, to deposit them in the tubular part, which was half filled with water. All the leaves, on being examined, were found crammed with dead or drowning flies. The *S. purpurea* is usually observed to be stored with putrefying insects, whose scent is perceptible as we pass the plant in a garden; for the margin of its leaves is beset with inverted hairs, which, like the wires of a mouse-trap, render it very difficult for any unfortunate fly, that has fallen into the watery tube, to crawl out again. Probably the air evolved by these dead flies may be beneficial to vegetation, and, as far as the plant is concerned, its curious construction may be designed to entrap them, while the water is provided to tempt as well as to retain them. The *Sphex* or *Ichneumon*, an insect of prey, stores them up unquestionably for the food of itself or its progeny, probably depositing its eggs in their carcases, as others of the same tribe lay their eggs in various caterpillars, which they sometimes bury afterwards in the ground. Thus a double purpose is answered; nor is it the least curious circumstance of the whole, that an European insect should find out an American plant in a hothouse, in order to fulfil that purpose.

If the above explanation of the *Sarracenia* be admitted, that of the *Nepenthes* will not be difficult. Each leaf of this plant terminates in a sort of close-shut tube, like a tankard, holding an ounce or two of water, certainly secreted through the footstalk of the leaf, whose spiral-coated vessels are uncommonly large and numerous. The lid of this tube either opens spontaneously, or is easily lifted up by insects and small worms, who are supposed to resort to these leaves in search of a purer beverage than the surrounding swamps afford. Rumphius, who has described and figured the plant, says, "various little worms and insects crawl into the orifice, and die in the tube, except a certain small *Squilla* or shrimp, with a protuberant back, sometimes met with, which lives there." —I have no doubt that this shrimp feeds on the other insects and worms, and that the same purposes are answered in this instance as in the *Sarraceniæ.* Probably the leaves of *Dionæa Muscipula*, as well as of the *Droseræ*, catch insects for a similar reason.*

I proceed to consider the effects of Air and Light upon vegetables.

Dr. Grew, by the assistance of the microscope, detected a quantity of vesicles full of air in the leaves of plants, as

* The correctness of the supposition, that insects have the power of lifting up the lid, and the statement of Rumphius, that small shrimps are found to inhabit the fluid in the tubes, may safely be called in question.—Ed.

also the spiral-coated vessels of their stems, which last he and all other physiologists, till very lately, considered as air-vessels likewise. Malpighi made the same observations about the same time; and as these two acute and laborious philosophers pursued their inquiries without any mutual communication, their discoveries strengthen and confirm each other. Their books have long served as magazines of facts for less original writers to work with. From their remarks physiologists have *theoretically* supposed that leaves imbibed air, which the spiral vessels were believed to convey all through the plant, in order that it might act on the sap as it does on the animal blood. The analogy thus understood was not correct, because air is conveyed no further than the lungs of animals: but without this hypothesis no use could be found for the supposed longitudinal air-vessels.

The observations of Dr. Hales come next in order to those of Grew and Malpighi. By means of the air-pump, an instrument much in use in his time, Hales obtained abundance of air from every part of the vegetable body, as well as from recently extracted sap. Plants were found to perish very soon in an exhausted receiver. Some of this great man's experiments, however, require to be received with caution. He rightly remarked that air was not only taken in by plants very copiously along with their food, but also imbibed by their bark; see *Vegetable Staticks, ch.* 5. But when, from observing that it would freely from the bark pervade the longitudinal vessels of a branch, he concluded that Malpighi and Grew were right in their ideas of longitudinal air-vessels, he was misled by appearances. We cannot but be aware that, when a branch is gathered, the sap must soon flow out of those spiral-coated tubes, which are large, elastic, and, no doubt, irritable. After they are emptied, air may unquestionably pass through them, especially when the whole weight of the atmosphere is acting, as in Dr. Hales' experiments with the air-pump, upon so delicate a fabric as the internal vascular structure of a plant, forcing its way through pores or membranes not naturally designed to admit it. We must also recollect that a plant, cut even for a short time, begins to lose its vital principle, after which no just judgment can be formed, by any experiments, concerning the movements of its fluids in life and vigour. See *Chapter* 1. These experiments of Dr. Hales therefore prove no more than that the vegetable body is pervious in various directions; and perhaps the only point they correctly establish is, that air is imbibed through the bark, a part known to be full of air-vessels. But the seventh chapter of the *Vegetable Staticks* contains some remarks much more to our purpose. Dr. Hales there clearly anticipates by conjecture, what succeeding philosophers, more enlightened chemists, have ascertained. His words are remarkable:

"We may therefore reasonably conclude, that one great use of leaves is what has been long suspected by many, *viz.*, to perform in some measure the same office for the support of the vegetable life, that the lungs of animals do, for the support of the animal life; plants very probably drawing through their leaves some part of their nourishment from the air." *p.* 326. A little further on he adds, "And may not light also, by freely entering the expanded surfaces of leaves and flowers, contribute much to the ennobling the principles of vegetables?" *p.* 328.

Next in order of time to those of Hales follow the experiments of Bonnet. We have already detailed his observations on the power of leaves to imbibe moisture; whence it is ascertained that plants are furnished with a system of cuticular absorbents, which carry fluids into their sap-vessels, so as to enable them in some degree to dispense with supplies from the root. With respect to the effects of air upon leaves, this ingenious philosopher has not been equally successful. He is recorded as the discoverer of the expiration of plants; but it appears from his work that he merely observed the bubbles of air which cling to leaves, dead as well as living, and indeed to any other body, when immersed in water and exposed to the light of the sun. He found that these bubbles disappeared in the evening, and returned again when the sun shone, and he faithfully reports that by their attachment to the surfaces of leaves, the latter were rendered more buoyant, and rose in the water; a sure proof that the air had not previously existed, in the same volume at least, in the substance of those leaves. Accordingly, Bonnet concluded that the latter, in imbibing the surrounding water, left the air which had been contained in the water, and that this liberated air became visible from being warmed and rarefied by the sun. This was as near the truth as Bonnet could come, it not being then known that light has a power of separating air of a peculiar kind, carbonic acid gas, from water. I find no indications in his work of his having had any idea of leaves absorbing air and giving it out again; still less of their effecting any change in its properties.

Dr. Priestley was the first who suggested this last-mentioned quality in vegetables. He ascertained their power of absorbing carbonic acid gas, denominated by him fixed air, and giving out oxygen gas, or pure respirable air. It was also his opinion that leaves imbibed the former by their upper, and gave out the latter by their under surface. He found some aquatic or marsh plants extremely powerful in this respect, especially the Willow-herb, or *Epilobium*, and the *Conferva*, a minute branching cotton-like vegetable which grows in putrid water, and the production of which, in water become foul from long keeping on shipboard, Dr. Priestley judged to operate principally in restoring that fluid to a state fit for use.

Dr. Ingenhousz, pursuing Dr. Priestley's inquiries, found light to be necessary to these functions, and that in the dark, leaves gave out a bad air. He observed moreover that fruits and flowers almost invariably gave out a bad, or carbonic, air, but more especially in the dark. He probably carries his ideas of the deleterious effects of this air on animal life, too far; for no mischief has ever happened, as far as common experience goes, to persons sleeping in apple or olive chambers, neither do the inhabitants of the confined huts in Covent Garden market apparently suffer, from living day and night among heaps of drying herbs. Mischiefs have unquestionably arisen from flowers in a bed-room, or any other confined apartment, but that is to be attributed to their perfumed effluvia, see *p.* 41. So the bad effects, observed by Jacquin, of *Lobelia longiflora* on the air of a hothouse, the danger incurred by those who sleep under the Manchineel-tree, *Hippomane Mancinella*, or, as it is commonly believed, under a

Walnut-tree, are probably to be attributed as much to poisonous secretions as to the air those plants evolve.

Dr. Ingenhousz introduced leaves into glass jars filled with water, which he inverted in a tub of the same water, and placed the whole together in the sunshine. From their under sides came streams or bubbles of air, which collected in the inverted bottom of each jar. The air thus procured proved oxygen gas, more or less pure. The *Nymphæa alba* affords an extraordinary abundance of it. Dr. Ingenhousz observed plants to be very various in their mode of emitting these bubbles, but it was always uniform in the same species. Air collected from water placed in similar circumstances without plants, proved not oxygen, but much worse than common air, *viz.*, carbonic acid gas, which following chemists have confirmed, and which has been already mentioned. Ingenhousz also found the air collected from plants under water in the dark worse than common air, especially that from walnut-leaves; which confirms the common opinion, above alluded to, respecting this tree.

Plants purify air very quickly. A vine-leaf in an ounce phial of carbonic acid gas, that immediately extinguished a candle, placed in the sun, without water, changed it to pure respirable air in an hour and half. Dr. Priestley found plants to alter even unmixed inflammable air, or *hydrogen*, especially the *Epilobium hirsutum*, if I mistake not, and *Polygonum Hydropiper*.

Succulent plants are found to afford most air, in consequence of the abundance of their Cellular Integument, or *Parenchyma*, in which, as I have hinted in the fourth chapter, the chemical operations of the leaves are performed.

That Light has a very powerful effect upon plants has long been known, independent of the remarks of Hales or Ingenhousz. The green colour of the leaves is owing to it, insomuch that plants raised in darkness are of a sickly white. It has even been observed that when light is admitted to the leaves through different glasses, each tinged of a different prismatic colour, the plant is paler in proportion as the glass approaches nearer to violet. The common practice of blanching Celery in gardens, by covering it up from the light, is an experiment under the eyes of every one. This blanching of plants is called by the French *étiolation*, and our chemists have adopted the term, though I think they err in deriving it from *étoile*, a star. When blanched plants are brought into the light, they soon acquire their natural green colour, and even in the dark they are green, if exposed to the action of hydrogen gas. Tulip and Crocus flowers have long ago been observed by Senebier to be coloured even in the dark, apparently because their hue depends on a different principle from the green of leaves.

Light acts beneficially upon the upper surface of leaves, and hurtfully upon the under side; hence the former is always turned towards the light, in whatever situation the plant may happen to be placed. Trees nailed against a north wall turn their leaves from the wall, though it be towards the north, and in direct opposition to those on a southern wall over against them. Plants in a hothouse all present the fronts of their leaves, and this influences even the posture of the branches to the side where there is most light, but neither to the quarter where most air is admitted, nor to the flue in search of heat. If the branches of a trained fruit-tree in full foliage be disturbed in their position, the leaves resume their original direction in the course of a day or two. The brighter the day, the more quickly is this accomplished. If the experiment be often repeated, they continue to turn, but more weakly, and are much injured by the exertion. Black spots appear about the veins on their under sides, and the cuticle scales off. Succulent leaves, though so thick and firm as many of them are, have been observed to be peculiarly sensible to light; while other plants, as Mallows, according to Bonnet, are much less so. The Miseltoe, *Viscum album*, the two sides of whose leaves are alike in appearance, and both equally, in general, presented to the light, are not found to turn upon any change in the posture of the branch. Neither do upright sword-shaped leaves alter their position, because in them both sides must be presumed to perform the same functions with respect to light as well as air.

M. Calandrini found vine-leaves turned to the light when separated from the stem and suspended by a thread. Of this any one may be easily satisfied, provided the experiment be made with sufficient care and delicacy. It is important, as demonstrating the turning to be accomplished by an impression made on the leaf itself, and not upon its footstalk.

Nor is this effect of light peculiar to leaves alone. Many flowers are equally sensible to it, especially the compound radiated ones, as the Daisy, Sunflower, Marigold, &c. In their forms Nature seems to have delighted to imitate the radiant luminary to which they are apparently dedicated, and in the absence of whose beams many of them do not expand their blossoms at all. The stately Annual Sunflower, *Helianthus annuus*, displays this phenomenon more conspicuously on account of its size, but many of the tribe have greater sensibility to light. Its stem is compressed in some degree, to facilitate the movement of the flower, which, after following the sun all day, returns after sunset to the east, by its natural elasticity, to meet his beams in the morning. Dr. Hales thought the heat of the sun, by contracting the stem, on one side, occasioned the flower to incline that way; but if so, it would scarcely return completely at night. There can be no doubt, from the observation of other similar flowers, that the impression is made on their radiated florets, which act as wings, and seem contrived chiefly for that purpose, being frequently destitute of any other use. A great number of leaves likewise follow the sun in its course; a clover-field is a familiar instance of this.

Of all leaves those of pinnated leguminous plants are found most affected by light, insomuch that it appears, in several cases, the sole cause of their expansion, for when it is withdrawn they fold over each other, or droop, as if dying; and this is called the Sleep of Plants by Linnæus, who has a dissertation on the subject in his *Amœnitates Academicæ*. The term Sleep may not really be so hyperbolical as at first sight it seems; for the cessation of the stimulus of light, and of the consequent restrained position of the leaves, may be useful to the vegetable constitution, as real sleep is to the animal. Another purpose is answered by the nocturnal folding of some leaves, that they shelter their flowers from the dew, the advantage of which we shall explain hereafter.

Some pinnated leaves display a more extraordinary sensibility, not merely to light, but to the touch of any extraneous body, or to any sudden concussion, as those of *Mimosa sensitiva* and *M. pudica*, *Oxalis sensitiva*, and *Smithia sensitiva*. An impression made even in the most gentle manner, upon one of their leaflets, is communicated in succession to all of them, evincing an exquisite irritability, for it is in vain to attempt any mechanical solution of this phenomenon. One of this tribe, *Hedysarum gyrans*, has a spontaneous motion in its leaves, independent of any external stimulus, even of light, and only requiring a very warm, still, atmosphere to be performed in perfection. Each leaf is ternate, and the small lateral leaflets are frequently moving up and down, either equably or by jerks, without any uniformity or co-operation among themselves. It is difficult to guess at the purpose which this singular action is designed to answer to the plant itself; its effect on a rational beholder cannot be indifferent.

The chemical actions of light, heat, and the component parts of the atmospheric air upon leaves, and, where the latter are wanting, on the green stems of plants, are now, as far as concerns all plants in common, tolerably well understood. The observations and experiments of Priestley and Ingenhousz have been confirmed, extended in a variety of ways, or explained on the principles of improved chemistry, by Dr. Percival and Mr. Henry in England, Dr. Woodhouse in America, and M. Senebier and M. Théodore de Saussure, as well as various other philosophers, on the Continent of Europe. It is agreed, that in the daytime plants imbibe from the atmosphere carbonic acid gas, (which was formerly called fixed air, and is an union of oxygen and carbon,) that they decompose it, absorb the carbon as matter of nourishment, which is added to the sap, and emit the oxygen. So they absorb the same gas from water, when it is separated from that fluid by the action of light. The burning of a candle, or the breathing of animals, in confined air, produces so much of this gas, that neither of these operations can go on beyond a certain time; but the air so contaminated serves as food for vegetables, whose leaves, assisted by light, soon restore the oxygen, or, in other words, purify the air again.

This beautiful discovery, for the main principles of which we are indebted to the celebrated Dr. Priestley, shows a mutual dependence of the animal and vegetable kingdoms on each other, which had never been suspected before his time. Comparative experiments upon the lower tribes of these kingdoms have not yet been made, but they would probably afford us a new test for distinguishing them. The air so copiously purified by a *Conferva*, one of the most inferior in the scale of plants, may be very extensively useful to the innumerable tribes of animated beings which inhabit the same waters. The abundant air-bubbles which have long ago given even a botanical name to one supposed species, *Conferva bullosa*, are probably a source of life and health to whole nations of aquatic insects, worms and polypes, whenever the sun shines.

In the dark, plants give out carbon and absorb oxygen; but the proportion of the latter is small, compared to what they exhale by day, as must likewise be the proportion of carbon given out; else the quantity of the latter added to their substance would be but trifling, especially in those climates where the proportion of day to night is nearly equal, and which, notwithstanding, we know to be excessively luxuriant in vegetation. Plants also give out azotic gas; but M. de Saussure is of opinion that this proceeds from their internal substance; and it appears by his experiments to be rather a sign of disease or approaching decay, than a regular chemical production of their constitution when in health; for Senebier found the quantity of oxygen emitted was in proportion to the thickness of the leaf, or quantity of parenchyma. Yet the parenchyma must be in its original organized state, for when bruised its functions are destroyed.

Possibly such an alternation in the functions of vegetables between day and night may afford a necessary repose to their vital principle, whose share in them we cannot but believe to be of primary importance. Whatever may happen to plants in the dark, there can be no doubt of their principal business in the economy of nature being what we have described. The most luminous and compendious view of the whole subject is given by Dr. Thomson of Glasgow in the fourth volume of his *Chemistry*, which is well worth the attention of those who wish to enter more deeply into all the various chemical examinations respecting it than suits our purpose. It is only necessary to add a short view of Dr. Darwin's hypothesis which Dr. Thomson has not mentioned, probably on account of its insufficiency. That lively writer thought the watery perspiration of leaves, acted upon by light, gave out oxygen for the use of the plant itself, such oxygen being immediately absorbed by the air-vessels. This is by no means adequate to explain any of the phenomena, but rather contradictory to most of them, and is totally superseded by the observations and experiments of other writers.

There can be no question of the general purpose answered to the vegetable constitution by these functions of leaves. They confirm Mr. Knight's theory of vegetation, who has proved that very little alburnum, or new wood, is secreted when light is kept from the leaves. They also help us to understand how essential oils may be produced, which are known, as well as sugar, to be composed of oxygen, hydrogen, and carbon, in different proportions. We can now have a general idea how the nutritious sap, acted upon by all the agents above-mentioned during its stay in the cellular substance of the leaf, and returned from thence impregnated with them into the bark, may prove the source of increase, and of peculiar secretions, in the vegetable frame. That portion of sap sent to the flower and fruit undergoes no less remarkable changes, for purposes to which those curious organs are devoted; nor is it returned from thence, as from the leaves, to answer any further end. The existence of those organs is still more temporary, and more absolutely limited to their own purposes, than even that of the leaves, from whose secretions theirs are very distinct.

But when we attempt to consider how the particular secretions of different species and tribes of plants are formed; how the same soil, the same atmosphere, should in a leaf of the vine or sorrel produce a wholesome acid, and in that of a spurge or manchineel a most virulent poison; how sweet and nutritious herbage should grow among the acrid crow-foot and aconite, we find ourselves totally unable to comprehend the existence of such wonderful powers in so small and seemingly simple an organ as the leaf of a plant. The agency of the vital principle alone can account for these wonders, though it cannot, to our understanding, explain them. "The thickest veil," says Dr. Thomson at the end of his chapter on vegetation, "covers the whole of these processes; and so far have philosophers hitherto been from removing this veil, that they have not even been able to approach it. All these operations, indeed, are evidently chemical decompositions and combinations: but we neither know what these decompositions and combinations are, nor the instruments in which they take place, nor the agents by which they are regulated."

The vain Buffon caused his own statue to be inscribed, "a genius equal to the majesty of nature," but a blade of grass was sufficient to confound his pretensions.

CHAP. XVII.—*Of the several kinds of Fulcra, or Appendages to a plant.*

THE word *Fulcrum*, whose proper meaning is a prop or support, has been applied by Linnæus not only to those organs of vegetables correctly so denominated, such as tendrils, but also to various other appendages to the herbage of a plant, none of which are universal, or essential, nor is there any one plant furnished with them all. I prefer the English term *Appendages* for these organs in general, to *Props*, because the latter applies only to one of them. Seven kinds of these are distinguished by Linnæus, nor do I find it necessary to enlarge that number.

1. *Stipula.* The Stipule, a leafy appendage to the proper leaves or to their footstalks. It is commonly situated at the base of the latter, in pairs, and is extremely different in shape in different plants.

The most natural and usual situation of the Stipules is in pairs, one stipule on each side of the base of the footstalk, as in *Lathyrus latifolius*, whose stipules are half arrow-shaped, *f.* 115; also in Willows, as *Salix stipularis*, and *S. aurita*. In *Rosa*, *Potentilla*, and many genera allied to them, the stipules are united laterally to the footstalk, *f.* 116. In all these cases they are *extrafoliaceæ*, external with respect to the leaf or footstalk; in others they are *intrafoliaceæ*, internal, and are then generally simple, as those of *Polygonum*. In a large Natural Order, called *Rubiaceæ*, these internal stipules in some cases embrace the stem in an undivided tube above the insertion of the footstalks, like those of *Polygonum* just mentioned; in others, as the Coffee, *Coffea Arabica*, and the *Hamellia patens*, they are separate leaves between the footstalks, but meeting just above their insertion. The European *Rubiaceæ* have whorled leaves, as *Asperula*, *Galium*, *Rubia*, &c.; but *Asperula cynanchica* has sometimes two of its four leaves so small as to look like stipules, seeming to form an intermediate link between such as have whorled leaves, and such as have opposite ones with stipules. The next step from *Asperula* is *Diodia*, and then *Spermacoce*. In the two last the bases of the stipules and footstalks are united into a common tube.

Some stipules fall off almost as soon as the leaves are expanded, which is the case with the Tulip-tree, *Liriodendron tulipifera*; in general they last as long as the leaves.

The absence or presence of these organs, though generally an indication that plants belong to the same Natural Order and even Genus, is not invariably so. Some species of *Cistus* have Stipules, others none, which is nearly the case with Grasses. The stipule in this, one of the most distinct of all natural orders, is peculiar, consisting of an internal white membrane crowning the sheath of their leaf, and clasping the culm. (*Suppl. f.* 141.) In *Aira cærulea*, a few minute hairs supply its place, while *Sesleria cærulea*, and some maritime grasses, have scarcely more than the rudiment of a stipule. Old writers call this organ in grasses by a peculiar name, *ligula*,* and others denominate it *membrana foliorum*, but both terms are superfluous. A curious instance of stipules supplying the place of leaves is observable in *Lathyrus Aphaca*, which has only one or two pair of real leaves on the seedling plants, and those soon disappear, serving chiefly to prove, if any proof were wanted, that the rest are true stipules.

Remarkably scariose, or dry membranous stipules are seen in *Illecebrum Paronychia*, and in the genus *Pinus*.

2. *Bractea*. The floral leaf, a leafy appendage to the flower or its stalk. It is of a variety of forms, and sometimes green, sometimes coloured. The Lime-trees, *Tilia europæa*, *f.* 117, and *parvifolia*, have a very peculiar oblong pale floral leaf, attached to the flower-stalk. The Lavanders, *f.* 118, have coloured bracteas, and the Purple Topped Clary, *Salvia Horminum*, exhibits a gradation from the proper leaves to green bracteas, and from them to coloured ones, which last are barren, or unaccompanied by flowers. Hence I am induced to believe this plant a mere variety of *S. viridis*, all whose bracteas are green and fertile. *Bartsia alpina*, and *Melampyrum arvense*, display an elegant transition from leaves to coloured bracteas. The Orchis tribe have green leafy bracteas, different in size in different species. A most beautiful large and coloured bractea is produced in *Mussænda frondosa*, from one of the teeth of the calyx, also in *M. glabra* of Willdenow, and two new species brought from America by Mr. John Frazer. Spinous bracteas of a curious construction guard the calyx in *Atractylis cancellata*, *f.* 119. Linnæus observes that no bracteas are to be found in the class *Tetradynamia*.

The *Ocrea* of Rottboll, (*Willdenow's Principles of Botany*, 50,) which enfolds the flower-stalks in *Cyperus*, seems to me a species of bractea, requiring no particular appellation.

* This *ligula* ought by no means to be confounded with the stipula, its situation being totally different, at the top of the sheath which surrounds the culm. It is an organ peculiar to the grasses.

3. *Spina, f.* 120. A Thorn. This proceeds from the wood itself, and is either terminal, like *Hippophäe rhamnoides*, and *Rhamnus catharticus*, or lateral, as in *Cratægus Crus-galli*, *tomentosa*, *parvifolia*, &c.

Linnæus observes that this sometimes disappears by culture, as in the Pear-tree, *Pyrus sativa*, which when wild has strong thorns: hence he denominates such cultivated plants *tamea*, or deprived of their natural ferocity. Professor Willdenow considers thorns as abortive buds, and thence very ingeniously and satisfactorily accounts for their disappearance whenever the tree receives more nourishment.

The permanent footstalks of the Gum Tragacanth shrub, *Astragalus Tragacantha*, are hardened into real spines, as are the flower-stalks in *Pisonia*, as well as the stipules of *Xanthium spinosum*, and the *Mimosæ*.—*Linn. Mss.*

4. *Aculeus, f.* 121, a Prickle, arises from the bark only, and comes off with it, having no connexion with the wood, as *Rosa*, *Rubus* (the Bramble, Raspberry, &c.,) and *Zizyphus*. This is not liable to disappear by culture, being very distinct in nature from the last.

5. *Cirrus, t.* 9. *f.* 122. A Tendril. This is indeed properly called a *fulcrum* or support, being intended solely to sustain weak and climbing stems upon more firm and sturdy ones. By its means such climbers often reach in tropical forests, to the summits of lofty trees, which they crown with adventitious blossoms. Tendrils or claspers when young are usually put forth in a straight direction; but they presently become spiral, making several circumvolutions, by which they take hold of any thing in their way, and then assume a firmer texture. After accomplishing a certain number of turns in one direction, some tendrils have a power of twining subsequently the contrary way; many of them moreover are branched or compound, so that the chances of their meeting with a support are multiplied. The Vine, *Vitis vinifera*, the various species of Passion-flower, and the Pea or Vetch tribe

afford good examples of spiral tendrils. The Virginian Creeper, *Vitis* (*Ampelopsis, Mich.*) *quinquefolia*, has branched tendrils, whose extremities adhere to the smoothest flint, like the fibres of Ivy. *Gloriosa superba*, *f.* 76, and *Flagellaria Indica*, have a simple spiral tendril at the end of each leaf; for they belong to the *Monocotyledones*, the structure of whose whole herbage is generally of the most simple and compendious kind. The flower-stalks of *Cardiospermum Halicacabum* bear tendrils; but a most singular kind of tendril, if it may be so called, which certainly has a right to the name of *fulcrum*, is found in the *Annona hexapetala*. The flower-stalk of this tree forms a hook, and grasps the neighbouring branch, serving to suspend the fruit, which is very heavy, resembling a bunch of grapes, and indicates the plant in question to be either a *Michelia* or an *Uvaria*.

6. *Glandula*, a Gland, is defined by Linnæus as a little tumour discharging a fluid. Such are abundant on the stalk and calyx of a Moss Rose, and between the serratures of the leaf of *Salix pentandra*, Bay-leaved Willow; also on the footstalks of *Viburnum Opulus*, and various species of Passion-flower. The liquor discharged is in the first-mentioned instances resinous and fragrant, in the latter a sort of honey.

7. *Pilus*, *f.* 124. A Hair. This, according to the Linnæan definition, is an excretory duct of a bristle-like form. Such it undoubtedly is in the Nettle, *Urtica*, whose bristles are tubular and pervious, having each a bag of poison at its base, like the fang of a serpent; as well as in numerous plants whose hairy coats exude a viscid moisture. But the hairs which clothe many plants are merely a protection against cold, heat, or insects. Sometimes they are hooked, sometimes branched and entangled, as in Mullein, *Verbascum*, &c. In *Croton*, *Solanum*, and *Lavatera*, they have often a starry figure. Very generally they are found, under a microscope, to be curiously jointed. Some *Begoniæ* bear on their leaves, flat little straps called by authors

fragmenta, shavings, instead of cylindrical hairs; but I know not that these at all differ in nature from the usual pubescence, nor do they merit to be particularly distinguished. Some of the Natural Order of *Asperifoliæ*, as *Echium*, and *Lycopsis*, especially some exotic species of this order, are clothed with curious white hard tubercles, from which their bristles proceed. *Echium Pyrenaicum* is an instance of this, *f.* 125.

The pubescence of plants varies greatly in degree according to differences of soil or exposure; several kinds, as *Mentha hirsuta*, naturally hairy, being occasionally found smooth; but if transplanted they soon resume their proper habit. Yet the direction of the hairs or bristles proves a very sure means of distinguishing species, especially in the genus *Mentha*, the hairs about whose calyx and flower-stalk point differently in different species, and I have found it the only infallible distinction between one Mint and another. The accurate Dr. Roth has since applied the same test to the species of *Myosotis*, which all botanists before him had either confounded under *M. scorpioides*, or else separated upon vague principles. Some species of *Galium* are admirably characterized by the bristles of their leaves, or of parts of their leaves, being hooked backward or forward. We therefore accept the 272d maxim of Linnæus, *Philosophia Botanica*, with that limitation which he himself has allowed in his commentary upon it. "The Pubescence," says he, "is a ridiculous distinction, being for the most part effaced by culture." After quoting examples, he concludes: "We are therefore not to have recourse to the hairiness or spines of plants, but in case of absolute necessity." Such necessity every botanist will allow to have existed in the *Menthæ* and in *Myosotis;* and though the *degree* of pubescence varies from culture, and even its *structure* be changeable, as in *Apargia hispida*, and *hirta*, its *direction* is I believe as little liable to exception as any character that vegetables present.

Chapter XVIII.—*Of the inflorescence, or mode of flowering, and its various forms.*

Inflorescence, *inflorescentia*, is used by Linnæus to express the particular manner in which flowers are situated upon a plant, denominated by preceding writers the *modus florendi*, or manner of flowering. The several kinds are distinguished as follows.

Verticillus, *f.* 126. A Whorl. In this the flowers surround the stem in a sort of ring; though they may not perhaps be inserted on all sides of it, but merely on two opposite ones, as in Dead Nettle, *Lamium*, *Mentha rubra*, and *Clinopodium vulgare;* or even on one side only, as *Rumex maritimus.* The flowers of *Hippuris vulgaris* are truly inserted in a ring round the stem; but they are not whorled independent of the leaves, and are therefore more properly, with a reference to the leaves, denominated axillary and solitary.

Racemus, *f.* 128, a Cluster, or Raceme, consists of numerous rather distant flowers, each on its own proper stalk, and all connected by one common stalk, as a bunch of Currants, *Ribes rubrum*, and *Orobus sylvaticus.* A raceme is generally drooping or pendulous, and the flowers are all expanded nearly at the same time.

A compound *racemus* occurs in *Solanum Dulcamara*, and an aggregate one, several being gathered together, in *Actæa racemosa;* but the example of a bunch of Grapes, quoted by Linnæus for a *racemus*, appears to me a true *thyrsus;* see below.

Spica, *f.* 129, a Spike, bears numerous flowers ranged along one common stalk, without any partial stalks, as in *Orchis hircina* and *O. bifolia*, *Plantago major* and *P. media*, *Potamogeton heterophyllum* and *P. fluitans;* but this is so seldom the case, that a little latitude is allowed. *Veronica spicata*, therefore, *f.* 130, and *Ribes spicatum*, as well as the Common Lavander, *Lavandula Spica*, are sufficiently good examples of a spike, though none of them has entirely sessile flowers; and Linnæus uses the term in numerous instances where it is still less correctly applicable. A spike generally grows erect. Its mode of expansion is much more progressive than that of the raceme, so that a long period elapses between the fading of the lowest flowers and the opening of the upper ones. The flowers are commonly all crowded close together, or if otherwise, they form separate groupes, perhaps whorls, when the spike is said to be either interrupted, or whorled; as in some Mints. In *Sanguisorba officinalis* the spike begins flowering at the top. See *Capitulum* below.

A compound spike is seen in *Lavandula pinnata* and *L. abrotanoides* of Willdenow.

Spica secunda, a unilateral spike, the flowers leaning all on one side, occurs in *Nardus stricta*.

Spicula, *f.* 131, a Spikelet, is applied exclusively to grasses, (often likewise to the Cyperaceous plants, *Ed.*) that have many florets in one calyx, such florets, ranged on a little stalk, constituting the spikelet, which is therefore a part of the flower itself, and not of the inflorescence; see *Poa*, (or *Glyceria*,) *aquatica* and *fluitans*, *Briza minor*, &c.

Corymbus, *f.* 132, a 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, of which *Spiræa opulifolia*, a common shrub in gardens, is an excellent specimen. The Linnæan class *Tetradynamia* exemplifies this less perfectly, as *Cardamine pratensis*, *Cheiranthus (Mathiola) sinuatus*, and the common Cabbage, *Brassica oleracea*, in which the *corymbus* of flowers becomes a *racemus* of fruit, as happens also in that section of the *Veronicæ*, entitled by Linnæus *corymboso-racemosæ*. The flowers of Yarrow, *f.* 133, *Achillea*, with several others of the compound class, as well as the Mountain Ash, grow in a corymbose manner, though their inflorescence may not come exactly under the above definition. It is worthy of remark that Linnæus in that definition uses the word *spica*, not *racemus*, nor has he corrected it in his own copy of *Phil. Bot. p.* 41, though he has properly altered a slip of the pen in the same line, *petiolis*, to *pedunculis.** This shows he did not restrain his idea of a spike absolutely to sessile flowers, but admitted that extended signification which nature justifies. Many plants acquire partial stalks, as the fruit advances towards maturity.

Fasciculus, *f.* 134, a Fascicle, is applied to flowers on little stalks, variously inserted and subdivided, collected into a close bundle, level at the top, as the Sweet William, *Dianthus barbatus*, and *D. Armeria.*

Capitulum, *f.* 135, a Head or Tuft, bears the flowers sessile in a globular form, as *Statice Armeria*, *Adoxa Moschatellina* and *Gomphrena globosa*, the Globe Amaranthus of the gardens.

Perhaps the inflorescence of *Sanguisorba officinalis* might be esteemed a *capitulum*, because its upper flowers come first to perfection, as in *Adoxa*, which seems contrary to the nature of a spike; but it does not appear that all capitate flowers expand in the same way, and *Sanguisorba Canadensis* has a real spike, flowering in the usual manner, from the bottom upwards. So *Allium descendens* opens its upper, or central, flowers first, contrary to the usual order in its genus; both which instances prove such a diversity to be of small moment.

Umbella, an Umbel, for which some authors retain the obsolete old English name of Rundle. In this several flower-stalks, or rays, nearly equal in length, spread from one common centre, their summits forming a level, convex, or even globose surface, more rarely a concave one. When each ray is simple and single-flowered, it is called

* It might be expected from the numerous learned editors and copiers of this and other works of Linnæus, that they should correct such manifest errors as the above, which any tyro might perceive.

a simple umbel, *f.* 136, as those of *Allium ursinum*, Ivy, *Primula veris, farinosa, elatior.* In a compound umbel, each ray or stalk mostly bears an *umbellula*, or partial umbel, as *Athamanta Libanotis.* This is usually the case in the very natural Order of plants called Umbelliferous, *f.* 138, to which the last-mentioned, as well as the common Carrot, Parsnep, Parsley, Hemlock, &c., belongs.

A few only of this order have simple umbels, as *Hydrocotyle vulgaris*, the curious *Astrantiæ, f.* 137; and *Eriocaliæ.* In *Euphorbia* the umbel is differently compounded, consisting of 3, 4, 5, or numerous rays, each of which is repeatedly subdivided, either in a threefold or forked manner.

Cyma, *f.* 139, a Cyme, has 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. Examples are found in *Viburnum*, and the common Laurustinus, as also in *Sambucus*, Elder. This mode of inflorescence agrees with a *corymbus* also in general aspect; 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 *cyma.*

Panicula, *f.* 140, a Panicle, bears the flowers in a sort of loose subdivided bunch or cluster, without any order. When the stalks are distant, it is called *diffusa*, a lax or spreading panicle, as in *Saxifraga umbrosa*, so frequent in gardens under the name of London Pride, and *S. Geum*, but particularly in many grasses, as the common cultivated Oat, and *Avena strigosa.* In this tribe the branches of the panicle are mostly semiverticillate. A divaricated panicle is still more spreading, like those of *Prenanthes muralis*, and *Spergula arvensis;* the last being dichotomous or forked. A dense or crowded panicle, *coarctata*, is observable in *Milium, (Gastridium,) lendigerum*, and *Agrostis alba*, but still more remarkably in *Phleum paniculatum*, whose inflorescence looks, at first sight, like a cylindrical spike, but when bent to either side it separates into branched lobes, constituting a real panicle. The name of *asperum* however has been preferred for this grass, and I have adopted it.

THYRSUS, *f.* 141, a Bunch, is a dense or close panicle, more or less of an ovate figure, of which the Lilac, *Syringa vulgaris*, *Tussilago hybrida* and *Petasites*, are examples cited by Linnæus. I presume likewise to consider a bunch of grapes, *Vitis vinifera*, as a true *thyrsus*, to the characters and appearance of which it correctly answers. Its ultimate terminations are sometimes obscurely umbellate, especially while in blossom, which is no objection here, but can never be the case in a *racemus*, whether simple or compound. See *Racemus*.

Of simple flower-stalks, whether solitary or clustered, radical or cauline, axillary, lateral or terminal, I have already spoken.

Linnæus remarks that the most elegant specific characters are taken from the inflorescence. Thus the Apple, and the Pear, form two species of *Pyrus*, so far at least a most natural genus, the former of which bears an umbel, the latter a corymb. *Pyrola uniflora*, *secunda* and *umbellata*, are admirably distinguished by their several forms of inflorescence.

CHAP. XIX.—*Of the Flower and Fruit.*

HAVING examined the general structure and external form of plants, we now come to more important and even essential, though more transitory organs—the flower and fruit, or parts of fructification. By these each species is perpetually renewed without limits, so far at least as the observation of mankind has reached; while, as has already been mentioned, all other modes of propagation are but the extension of an individual, and sooner or later terminate in its total extinction.

Nothing can be more happy than the Linnæan definition of these organs; *Phil. Bot.* 52. "The fructification is a temporary part of vegetables, destined for the reproduction of the species, terminating the old individual and beginning the new."

Pliny had long ago beautifully said that "blossoms are the joy of trees, in bearing which they assume a new aspect, vying with each other in the luxuriance and variety of their colours." Linnæus has justly applied this to plants in general, and, improving upon the idea, he considers their herbage as only a mask, or clothing, by no means indicative of their true nature or character, which can be learned from the flower and fruit alone.

Mr. Knight has traced his central vessels, by which the sap is conveyed from the root, into the flower and fruit. On the returning sap in the bark of these parts he has not been able to make any distinct observation; but he has determined that no matter of increase is furnished from the flowers or their stalks, as from leaves, to the part of the branch below them, nor indeed to any other part; *Phil. Trans.* for 1801, *p.* 340. There can be no doubt that certain parts of the flower, which we shall presently describe, perform functions respecting air and light analogous to those of leaves, but entirely subservient to the benefit of the flower and fruit. Their secretions, formed from the returning sap, are confined to their own purposes. As soon as these are accomplished, a decided separation of vessels takes place, and the ripe fruit, accompanied perhaps by its stalk, falls from the tree. Dr. Hales tried in vain to give any flavour to fruit by the most penetrating and volatile fluids conveyed through the sap-vessels; for the laws of secretion are absolute in the organs of the flower, and their various results are, if possible, more strikingly distinct than even those we have contemplated in the leaves.

It is scarcely necessary to repeat that the fructification is *essential* to vegetables. A plant may be destitute of stem, leaves, or even roots, because, if one of these parts be wanting, the others may perform its functions, but it can never be destitute of those organs by which its species is propagated.

Hence, though many individual plants may be long without blossoms, there are none, so far as nature has been thoroughly investigated, that are not capable, in favourable circumstances, of producing them, as well as seeds; to whose perfection the blossoms are altogether subservient.

Linnæus distinguishes seven parts of fructification, some of which are essential to the very nature of a flower or fruit, others not so indispensably necessary, and therefore not universal.

I. *Calyx*, the Calyx or Flower-cup, generally resembling the leaves in texture and colour, and forming the outermost part of a flower. This is not essential, and is often absent.

II. *Corolla*, the Corolla or more delicate coloured internal leaf or leaves, properly *petals*, of a flower, likewise not essential.

III. *Stamen* or *Stamina*, the Stamen, or Stamens, commonly of a slender or thread-like form, bearing some kind of knob or cellular body, and ranged internally with respect to the Corolla. These are essential.

IV. *Pistillum*, or *Pistilla*, the Pistil, or Pistils, in the centre of the flower, consisting of the rudiments of the fruit, with one or more organs attached to them; and, of course, essential.

V. *Pericarpium*, the Seed-vessel, of a pulpy, woody, or leathery texture, inclosing the seeds, but wanting in many plants (?).

VI. *Semen*, the Seed, the perfecting of which is the sole end of all the other parts.

VII. *Receptaculum*, the Receptacle, basis or point of connexion. This must necessarily be present in some form or other.

I. Calyx. The flower-cup, or more correctly the external covering of the flower, being so called from καλυπτω, to cover, when present, was originally divided by Linnæus into seven kinds,* some of which are more justly so de-

* Of the following seven kinds, the Perianth, properly restricted, can only be said to belong to the flower. The *Involucre, Spatha*, and even *Gluma* are kinds of bracteas: the *Amentum* belongs to the inflorescence, while the *Perichætium* and

nominated than the others, and I have ventured to make an alteration in his list.

1. *Perianthium, f.** 142. Calyx, properly and commonly so called, when it is contiguous to and makes a part of the flower, as the five green leaves which encompass a Rose, including their urn-shaped base; the two green bristly ones which enfold the bud in *Glaucium luteum*, (and the Poppy); the tubular part, comprehending the scales † at its base, in the Pinks, or the globular scaly cup in *Centaurea*. The Tulip is a naked (or rather an incomplete) flower, having no calyx at all.

This part is of an infinite variety of forms in different *genera*, being either simple or compound, divided or undivided, regular or irregular, (the pieces or divisions are called *foliola*, leaflets, by the older botanists; *sepala*, or sepals, by De Candolle and others). In some instances, the calyx is permanent till the fruit is ripe, in others it falls even before the flower is well expanded.

Some *genera* have a double *perianthium*, as *Malva*, ‡ or even a triple one, as *Scabiosa*.

Volva belong to Cryptogamic Plants, which are now almost universally admitted to have no real flowers.—*Ed.*

* Linnæus, it must be confessed, was singularly unfortunate in his definition of *Calyx* and *Perianth*. The latter term (περι, around, and ανθος, the flower), *perigonium* of De Candolle, is with great propriety applied to the immediate floral-covering, whether it be single or double; when double, the outer is the calyx, and the inner a corolla. Jussieu, however, always designated the single perianth, in the greater number, but certainly not in all the Monocotyledones, a *calyx*, in which he is followed by Professor Lindley; whilst according to Linnæus and Sir J. E. Smith, such plants have "no calyx." As it appears to me, all difficulty is obviated by using the term "single perianth" in such a case, which is petaloid, if resembling a corolla (that is, more or less coloured); herbaceous, if of the colour and texture which we find to be prevalent in a real calyx.—*Ed.*

† These, however, are true bracteas.—*Ed.*

‡ In *Malva*, what is considered the outer of the two perianths is a true involucre, consisting of three verticillate bracteas. In *Scabiosa*, there is indeed an appearance of a double (not a triple) calyx, of which the outer is a highly curious organ, which M. Coulter, in his excellent Mémoire sur les *Dipsacées*, considers an involucellum or partial involucre, and with justice too, seeing that it sometimes includes more than one flower.

2. *Involucrum, f.* 143. (*Suppl. f.* 100.) Involucre, of Professor Martyn; but I generally retain the Latin termination. This is (more or less) remote from the flower, and can scarcely be distinguished clearly from a *Bractea.* The term was first adopted by Linnæus, at the suggestion of his friend Artedi, in order to distinguish the *genera* of umbelliferous plants, for which purpose the latter deemed the part in question very important. But according to the laws which Linnæus had laid down, the parts of the flower and fruit alone were to afford generic characters, and the most sound botanists have ever since kept to this rule, with infinite advantage over less correct ones, however ready to derive ideas respecting the natural habit and *secondary* characters of a genus, not only from the inflorescence and bracteas, but even from the leaves, stipules, or other parts. Linnæus and Artedi, therefore, were obliged to consider the *involucra* and *involucella,* the former accompanying the general and the latter the partial umbels, as a sort of calyx, and the umbel altogether as one aggregate flower, composed of florets united by a common radiated receptacle. Consequently a cyme must be looked upon in the same light; nor are reasons wanting in support of this hypothesis, which we shall consider after having first explained all the parts of fructification.

In *Euphorbia,* however, the term *bractea* would surely be more proper than *involucrum* or *involucellum,* as is evident from a consideration of the inflorescence of the whole genus, so very different in different species. In *E. Peplis,* and many others, the flowers are solitary and axillary; in others again, as *E. amygdaloides,* and *E. Characias,* some flower-stalks are umbellate, some scattered; and the subdivisions of the umbel in all are ultimately forked, that is, of a nature between umbellate and scattered. This genus has, moreover, a proper *involucrum,* of a most distinct and peculiar nature. Some species of *Anemone,* a genus destitute of a *perianthium* (of one of the two floral coverings, and that the *corolla,* judging from analogy) are said by Linnæus to have an *involucrum,* as *A. Pulsatilla,* for which the name of *bractea* might be more correct, though in *A. Hepatica,* it is placed so near the flower as to seem a part of it, which, however, is really not the case.

The name of *Involucrum* is applied by Gleditsch to the membrane covering the fructification of Ferns, *f.* 144, 145; nor have I, in studying this part with peculiar attention in order to reform the genera of these plants, (see *Tracts relating to Natural History,*) found reason to contrive any new appellation. My learned friends Willdenow and Swartz have judged otherwise, calling this membrane the *indusium,* or covering; which seems to me altogether superfluous.

3. *Amentum, f.* 146, *Suppl. f.* 85—91. Catkin, denominated by authors before Linnæus, *julus, nucamentum,* or *catulus,* consists of a common receptacle of a cylindrical form, 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 receptacle itself and the bases of the scales are firmly united, and the whole catkin falls off entire, except that in some instances the upper part of each scale withers away, as in the Willow genus, *Salix,* where the seed-vessels are quite distinct from the scales. In others, the whole scale remains, enlarges, hardens and protects the seed, as in *Pinus,* the Fir tribe, (where it is called a *strobilus*). Such is the case with catkins of fertile flowers, which are necessarily permanent till the seed is ripe; barren ones fall as soon as the stamens have performed their office. Every catkin consists generally of either one kind of flower or the other. There are few certain and invariable instances of stamens and pistils in the same catkin, that circumstance occurring chiefly in a few species of *Salix* and *Carex;* nor is *Typha* an exception to this. Examples of barren-flowered catkins are seen, not only in *Salix* and *Pinus,* but in several plants whose fertile or fruit-bearing flowers are not catkins, such as the Walnut, and unless I am much mistaken, the Hasel-nut. Each nut or seed of the latter has a permanent coriaceous calyx of its own, inadvertently called by Gærtner an *invo-*

lucrum,* though he considers the whole as an *amentum*, which this very calyx proves it not to be.† *Humulus* has a catkin for the fertile flower only.

4. *Spatha, f.* 147. Sheath, a covering which bursts longitudinally, and is more or less remote from the flower. This is exemplified in the Snow-drop, *Galanthus nivalis*, the various species of *Narcissus*, and the *Arum.* The *Spatha* of the latter encloses a *Spadix*, or elongated receptacle, common to many flowers, according to the genuine Linnæan idea of this kind of calyx, taken from Palm-trees. In these the *Spadix* is branched. In the bulbous genera above-mentioned I have thought it best to denominate the part in question a *Bractea.* See *Engl. Fl. v.* 2.

5. *Gluma, f.* 148. Husk,‡ the peculiar calyx of Grasses and Grass-like plants, of a chaffy texture. These husks are usually compressed, embracing each other at the base, as in *Phleum pratense*, &c. Sometimes they are depressed, flattened vertically, as in *Briza.* To the husk belongs the *Arista, f.* 149, Beard or Awn, a bristle-shaped appendage, usually spiral, and possessing the property of an hygrometer. This, however, is not always present, even in different individuals of the same species.

> "Unfortunately for the science,
> On the awn there's no reliance."

So says, or rather sings, with more truth than sublimity, the ingenious author of the *Flora Londinensis ; fasc.* 6, *t.* 8.

The spiral kind of awn is most frequently attached to the *Corolla* of grasses, which is precisely of the same husky nature as their calyx, and is, by some botanists, considered

* Analogy shows it to be so.—*Ed.*

† It appears moreover that *Carpinus*, the Hornbeam, has hitherto erroneously been supposed to have an *amentum* for the fertile flower. The true nature of the covering of the seed, as well as that of the common stalk, proves it otherwise.

‡ The real nature of this part will be explained when we come to speak of the Grasses in the natural arrangement.—*Ed.*

as such. Specimens of *glumæ muticæ*, beardless husks, are seen in *Phalaris Canariensis*, and of *glumæ aristatæ*, awned ones, in *Lagurus ovatus*, and *Stipa pennata*.

6. *Perichætium*, *f.* 150. A scaly Sheath, investing the fertile flower, and consequently the base of the fruit-stalk, in some Mosses.* In the genus *Hypnum* it is of great consequence, not only by its presence, constituting a part of the generic character, but by its difference in shape, proportion, and structure, serving frequently to discriminate species. Linnæus appears by his manuscripts to have intended adding this to the different kinds of calyx, though it is not one of the seven enumerated in his printed works. Nor is he, surely, correct in allowing it to the genus *Jungermannia*. The membranous part which he there calls *perichætium* is strictly analogous indeed to the *calyptra*, *f.* 151, 152, *b*, or veil of real mosses, esteemed by him a kind of calyx; but as I presume with Schreber to reckon it rather a corolla, and Hedwig once thought the same, and *Jungermannia* has more or less of a real calyx besides, *f.* 152, *a*, I would no longer apply the term *perichætium* to this genus at all.

The part called *calyptra* being removed from the list, as being a corolla, the *perichætium* takes its place among the seven kinds of calyx. We lay less stress upon this coincidence than Linnæus might have done, when, according to the fashion of the times, he condescended to distribute his immortal *Philosophia Botanica* into 12 chapters and 365 sections, and reckoned seven parts of fructification, as well as seven species of calyx.

7. *Volva*, *f.* 153, *Suppl. f.* 159, *a. b.* Wrapper, or covering of the *Fungus* tribe, of a membranous texture, concealing their parts of fructification, and in due time bursting all round, forming a ring upon the stalk, as in *Agaricus procerus*, and *A. campestris*, the Common Mushroom; such at least is the original meaning of this term, as explained in the *Phil. Bot.*; but it has become more generally used,

* In accordance with the views expressed in the Preface, I have here retained Sir J. E. Smith's arrangement of the terms "applicable to the flower." The Perichætium, however, and the *Volva*, belong exclusively to Cryptogamic plants.—*Ed.*

even by Linnæus himself, for the fleshy external covering of some other *Fungi*, which is scarcely raised out of the ground, and enfolds the whole plant when young, *f.* 154. See *Agaricus volvaceus, Sowerb. Fung. t.* 1, and *Lycoperdon fornicatum, t.* 198; also the very curious *L. phalloides, t.* 390, now made a distinct genus by the learned Persoon, under the name of *Batarrea phalloides.*

Linnæus adopted from Cæsalpinus the opinion that the *Calyx* proceeded from the bark, like the leaves, because of its similarity in colour and texture to those organs. He even refined upon the original idea, and supposed this part to proceed from the outer bark, while the more delicate *corolla* originated in the *liber.* What is now known of the physiology of the bark, as explained in several of our preceding chapters, renders this hypothesis totally inadmissible.

The knowledge of the real use of leaves, see *chapter* 16, may however throw some light upon that of the calyx. Besides protection of the flower from external injuries, which is one evident use of this part, it appears highly probable that it may often contribute to the growth and strength of the stalk which supports it, as the leaves do to that portion of branch below them. The stalk often swells considerably during the growth of the flower, especially just below the calyx, becoming more woody, an alteration frequently necessary for the support of the ripening fruit. When the calyx falls very early, as in the Poppy tribe, *Papaver* and *Glaucium*, I cannot find that the flower-stalk is subsequently enlarged, nor in any manner altered; while in genera without number, whose calyx is permanent, the stalk becomes not only more woody, but often considerably thickened.

II. Corolla. The Corolla, vulgarly called the leaves of the flower, consists of those more delicate and dilated, generally more coloured leaves, which are always internal with respect to the calyx, and constitute the chief beauty of a flower. In the Rose the Corolla is red and fragrant; in the Violet purple; in the Primrose yellow.

This term includes two parts, the Petal, *Petalum*, and the Nectary, *Nectarium.* The former is either simple, as in the Primrose, in which case the Corolla is said to be monopetalous, of one petal; or compound, as in the Rose, in which it is polypetalous, of several petals. The Nectary is sometimes a part of the petal, sometimes separate from it.

A monopetalous Corolla consists of two parts; the tube, *tubus,* the cylindrical part enclosed in the calyx of the Primrose; and the limb, *limbus,* which is the horizontal spreading portion of the same flower, *f.* 155. The analogous parts of a polypetalous Corolla, as in the Wall-flower or Stock, *f.* 156, are named the claw, *unguis, f.* 157, *a,* and the border, *lamina, b.*

The Corolla is infinitely diversified in form, in different *genera,* whence Tournefort and Rivinus derived their methods of arrangement. It is called regular when its general figure is uniform, as in the Rose, the Pink, the Columbine, *Aquilegia vulgaris,* and *Gentiana Pneumonanthe;* irregular when otherwise, as the Violet, Dead-nettle, and *Lathyrus.* An equal Corolla, *f.* 156, is not only regular, but all its divisions are of one size, like those of the Primrose, *Campanula,* or *Saxifraga;* an unequal one, *f.* 158, is when some segments are alternately smaller than the others, as in *Butomus,* or otherwise different, as in *Aquilegia.* It is by no means always necessary, in defining characters of genera, to use these last terms, it being sufficient in general to say that a Corolla is regular, in opposition to one that is irregular; more especially as some species of a genus may possibly have an equal Corolla, others an unequal one.

The most usual shapes of a monopetalous corolla are,

campanulata, f. 159, bell-shaped, as in *Campanula.*

infundibuliformis, f. 160, funnel-shaped, *Pulmonaria.*

hypocrateriformis, f. 155, salver-shaped, *Primula.*

rotata, wheel-shaped, that is, salver-shaped with scarcely any tube, *Borago.*

ringens, f. 161, ringent, irregular and gaping like the mouth of an animal, *Lamium;* called by former botanists *labiata,* lipped.

personata, *f.* 162, personate, irregular and closed by a kind of palate, *Antirrhinum.*

Those of a polypetalous one are

cruciformis, *f.* 156, cruciform, regular, and like a cross, *Dentaria* and *Cheiranthus.*

rosacea, rosaceous, spreading like a rose, *Dryas.*

papilionacea, *f.* 163, papilionaceous, irregular and spreading, somewhat like a butterfly, *Lathyrus.* The various petals which compose such a flower are distinguished by appropriate names, as *vexillum*, *f.* 164, standard, the large one at the back; *alæ*, *f.* 165, wings, the two side petals; and *carina*, *f.* 166, the keel, consisting of two petals, united or separate, embracing the internal organs, *f.* 167. In *Trifolium*, all the petals are sometimes united into one at the lower part.

incompleta, incomplete, when parts, which analogy would lead us to expect, are deficient, as in *Amorpha*, a papilionaceous flower, apparently, but consisting of the *vexillum* only; or *Rittera* of Schreber, *f.* 168, a rosaceous one with a single lateral petal, seeming as if four others had been stripped off.

It is remarkable that irregular flowers sometimes vary to regular ones on the very same plant, as in *Bignonia radicans;* and *Antirrhinum Linaria*, (*Linaria vulgaris*, *Brit. Fl.*) *f.* 169.

Linnæus was of opinion that the Corolla originated from the *Liber* or inner bark, as the Calyx from the outer, but this cannot be defended, now the real physiology of the bark is better understood.

The whole use and physiology of the Corolla have not yet been fully explained. As a protection to the tender and important parts within, especially from wet, its use in many cases is obvious, but by no means in all. Linnæus imagined it to serve as wings, to waft the flower up and down in the air, and so to promote the functions of the Stamens and Pistils, as will hereafter be described; nor is this opinion unfounded.

The late Mr. Christian Conrad Sprengel, of Spandau, in Brandenburgh, has ingeniously demonstrated, in some hundreds of instances, how the Corolla serves as an attraction to insects, indicating by various marks, sometimes perhaps by its scent, where they may find honey, and accommodating them with a convenient resting-place, or shelter while they extract it. This elegant and ingenious theory receives confirmation from almost every flower we examine. Proud man is disposed to think that

"Full many a flower is born to blush unseen,"

because he has not deigned to explore it; but we find that even the beauties of the most sequestered wilderness are not made in vain. They have myriads of admirers, attracted by their charms, and rewarded with their treasures, which very treasures would be as useless as the gold of a miser to the plant itself, were they not thus the means of bringing insects about it. The services rendered by such visitants will be understood when we have described all the parts of a flower.

Besides the above purposes, I have always conceived the Corolla to fulfil some important office to the essential parts of the flower with respect to air, and especially light. It not only presents itself in a remarkable manner to the sunbeams, frequently closing or drooping when they are withdrawn, but it is so peculiarly distinguished by beauty or brilliancy of colour, that one cannot help supposing its functions somewhat different from those of the leaves, even with regard to light itself. Dr. Darwin calls the Corolla the lungs of the stamens and pistils, and with great probability, for they abound in air-vessels. But when we consider the elaborate and peculiar secretions of a flower, the elastic inflammable *pollen*, the honey, and the exquisitely volatile perfume, as we know from the curious discoveries of modern chemistry how great a share light has in the production of such, we cannot but conclude that the petals must be of primary importance with respect to their secretion by its means.

Sometimes the Corolla is very short-lived, sometimes very lasting, even till the fruit is perfected, though mostly in a faded condition. In double flowers I have observed it to be much more durable than in single ones of the same species, as Anemonies and Poppies, because, as I conceive, of its not having performed its natural functions, the stamens and pistils of such flowers being obliterated or changed to petals; hence the vital principle of their corolla is not so soon exhausted as usual.

The Corolla, as already mentioned, is not essential. Whatever its functions may be, they can be occasionally performed by the Calyx perhaps, or even by the Filaments of the Stamens; as those of leaves are, in leafless plants, by the stems. When a flower has only one covering, it is not always easy to say whether that be a Calyx or Corolla. When green and coarse in texture, like the former, we call it so, as in *Chenopodium*, and the natural relationship of this genus to *Polygonum*, leads us to reckon the same part in the latter a coloured calyx. On the other hand, when the part present is delicate and finely coloured, like the generality of Corollas, we denominate it such, as in *Tulipa*, *Suppl. f.* 146, and others of the Liliaceous order. The great Jussieu terms this part in the Liliaceous plants, however beautiful, a Calyx. His definition of a Corolla is "that covering of a flower which is invested with the Calyx, being very rarely naked; a continuation of the inner bark of the flower-stalk, not of its cuticle; not permanent, but mostly falling off from the stamens; surrounding or crowning the fruit, but never growing united with it; and having its parts or segments for the most part alternate with the stamens, which are equal to them in number." By this rule the tube and six segments of a *Narcissus*, *f.* 150, constitute the Calyx, and then surely what Jussieu calls a Crown, *f.* 147, *b*, and Linnæus a Nectary, must be allowed the name of Corolla. On the other hand the *Spatha* becomes a *Bractea*. Consequently the whole Order of Liliaceous flowers in general have a coloured Calyx only, which seems hardly admissible; and yet I cannot conceal a recent discovery which strongly confirms the opinion of my acute and candid friend. Two species of a new genus,* found by Mr. Menzies on the West coast of

* I have, in a paper sent to the Linnæan Society, named this genus *Brodiæa*, in honour of the late James Brodie, of Brodie, Esq., F.L.S. See *Tr. of Linn. Soc. v.* 10. 1.

North America, have beautiful liliaceous flowers like an *Agapanthus*, with three internal petals besides!* *Tulbaghia* is a similar instance. I must however protest against the idea of the Corolla originating exclusively from the inner bark, as well as of the cuticle not being continued over it, for reasons sufficiently apparent from the former part of this work.

It is a Linnæan rule that the Stamens should be opposite to the segments of the Calyx, and alternate with the parts of the Corolla. Its author nevertheless seems of opinion that no absolute means of distinction between these two parts can be pointed out, except colour; of the insufficiency of which he is aware. If, however, the Corolla performs functions with respect to light which the Calyx does not, and those functions are indicated by its colour, a distinction founded on such a principle is both correct and philosophical. We must then conclude that in *most* liliaceous plants, not in *all*, the two organs are united into one, and indeed the outside is often green and coarse like a Calyx, the inner coloured and delicate; witness *Ornithogalum*, *Narthecium*. Linnæus has the same idea respecting *Daphne*, and the analogy is confirmed by *Gnidia*, which is a *Daphne* with petals. In *Trollius* and *Helleborus* Linnæus considers as Petals what Jussieu, following Vaillant, thinks a Calyx. Of these plants we shall soon have occasion to speak again.

I cannot but consider as a sort of Corolla the *Calyptra* or Veil of Mosses, which Linnæus reckoned a Calyx. Schreber, very deep and critical in his inquiries concerning these plants, and Hedwig, so famous for his discoveries among them, were both of this opinion, though the latter seems to have relinquished it. The organ in question is a membranous hood, covering the unripe fruit of these diminutive vegetables, like an extinguisher, *f.* 151; but soon torn from its base, and elevated along with the ripening capsule. The great peculiarity of this part, whatever it be called, consists in its summit performing the office of a stigma, (?) as Hedwig first remarked. In *Jungermannia*, *f.* 152, the very same part, differing only in usually bursting at the top to let the

* These supposed internal petals, cannot, I fear, be looked upon in any other light than as three imperfect stamens.—*Ed.*

fruit pass, is named by Linnæus a *perichætium*, but very incorrectly, as has already been hinted.

Whatever office the petals may perform with respect to air and light, it is probable that the oblong summit of the *Spadix* in *Arum*, answers the same purpose. When this part has been for a short time exposed to the light, it assumes a purplish-brown hue, which M. Senebier seems to attribute to the same cause which he thinks produces the great heat observed in this flower, the rapid combination of oxygen gas with the carbon of the plant; a hypothesis hardly adequate to explain either.

Nectarium, Nectary, may be defined that part of the Corolla which contains or which secretes honey. It is perhaps in effect nearly universal, as hardly a flower can be found that has not more or less honey, though this liquor is far from being invariably, or even generally, formed by an apparatus separate from the Petals. In monopetalous flowers, as *Lamium album*, the Dead Nettle, *Suppl. f.* 21, the tube of the Corolla contains, and probably secretes, the honey, without any evident Nectary. Sometimes the part under consideration is a production or elongation of the Corolla, as in Violets; sometimes indeed of the Calyx, as in the Garden Nasturtium, *Tropæolum*, *Suppl. f.* 228, whose Calyx, *f.* 170, partakes much of the nature of the petals. Sometimes it is distinct from both, either resembling the petals, as in *Aquilegia*, *f.* 171, and in the *Orchideæ;* or more different, as in *Epimedium*, *f.* 172, 173, *Suppl. f.* 234, *Helleborus*, *Suppl. f.* 214, 215, *Aconitum*, the common Monkshood, and *Delphinium*, the Larkspur. Such at least is the mode in which Linnæus and his followers understand the four last-mentioned flowers; but Jussieu is of a different opinion, and he even calls the decided Nectary of *Epimedium* an internal petal! Difficulties attend both theories. It seems paradoxical to call petals those singular bodies in *Aconitum*, *f.* 174, like a pair of little birds, which are manifestly formed only to hold the honey, and not situated nor constructed so as to perform the proper functions of petals; but on the other hand *Ranunculus*, one of the same Natural Order, has evident calyx and petals, which latter have a honey-bearing pore in their claw, evincing their affinity to the less petal-like Nectaries just described. Other instances indeed of Nectaries in the claws of petals are found in the Crown Imperial and Lily. These only confirm more strongly the compendious construction of the Lily tribe, the leaves of their flowers in these examples being Calyx, Petals and Nectaries all in one.

The most indubitable of all Nectaries, as actually secreting honey, are those of a glandular kind. In the Natural Order of Cruciform plants, composing the Linnæan class *Tetradynamia*, these are generally four green glands at the base of the Stamens. See *Dentaria*, *Sisymbrium*, and *Brassica*. In *Salix*, *Suppl. f.* 86, *a* and *b*, and *Geranium*, &c., similar glands are observable; whilst in *Pelargonium*, the African Geranium, *Suppl. f.* 227, the Nectary is a tube running down one side of the flower-stalk.

The elegant *Parnassia*, of which we are now acquainted with some new American species, has a most elaborate apparatus, called by Linnæus Nectaries, *f.* 175, but which the cautious Jussieu names Scales only. Linnæus usually called every supernumerary part of a flower Nectary, from analogy alone, though he might not in every case be able to prove that such parts produced honey. This is convenient enough for botanical distinctions, though perhaps not always right in physiology; yet there is nothing for which he has been more severely and contemptuously censured. He was too wise to answer illiberal criticism, or he might have required his adversaries to prove that such parts were not Nectaries. Sometimes possibly he may seem to err, like L'Héritier, in calling abortive stamens by this name. Yet who knows that their filaments do not secrete honey, as well as the tubes of numerous flowers? And though abortive as to Anthers, the Filament, continuing strong and vigorous, may do this office.

Honey is not absolutely confined to the flower. The glands on the footstalks of Passion-flowers yield it, and it exudes from the flower-stalks of some liliaceous plants.

The sweet viscid liquor in question has given rise to much diversity of opinion respecting its use. Pontedera thought it was absorbed by the seeds for their nourishment while forming, as the yolk of the egg by the chick. But Linnæus observes in reply that barren flowers produce it as well as fertile ones, witness *Urtica* and *Salix*. In some instances the fertile flowers only are observed to bear honey, as *Phyllanthus* and *Tamus*, but such cases are rare. Even Darwin says that honey is the food of the stamens and pistils, not recollecting that it is often lodged in spurs or cells quite out of their reach.

There can be no question that the sole use of the honey, with respect to the plant, is to tempt insects, who in procuring it fertilize the flower, by disturbing the dust of the Stamens, and even carry that substance from the barren to the fertile blossoms.

III. Stamina. The Stamens, formerly called Chives, are various in number in different flowers, from one to some hundreds. Their situation is *internal* with respect to the parts we have been describing; *external* to the Pistils, at least in simple flowers.

These organs are essential, there being no plant (exclusive of the Acotyledonous ones, *Ed.*) hitherto discovered, after the most careful research, that is destitute of them, either in the same flower with the pistils, or a separate one of the same species.

A Stamen, *f.* 176, commonly consists of two parts, the Filament, a, *Filamentum*, and Anther, b, *Anthera*, the former being merely what supports the latter, which is the only essential part. Various forms and proportions of Filaments may be seen in the Tulip, where they are six in number, thick and short; the Pink, where they are ten, much more slender, and answering to the idea of a filament or thread; and *Anemone*, where they are numerous. They are commonly smooth, but sometimes, as in *Verbascum*, bearded. In *Melaleuca*, they are branched; and in *Prunella*, forked, one point only bearing an Anther. In *Aristolochia*, they are wanting, and nearly so in *Potamogeton*, *Suppl. f* 135.

The Anther is the only essential part of a Stamen. It is generally of a membranous texture, consisting of two cells or cavities, bursting longitudinally at their outer edges, as in the Tulip. In *Erica* it opens by pores near the summit, as it does in the Potatoe-blossom. Very rarely the Anther has four cells, as in *Tetratheca.* Sometimes it is ornamented with a crest, as in many *Ericæ,* and the genus *Pinus.*

The *Pollen,* or Dust, is contained in the Anther, from which it is thrown out chiefly in warm dry weather, when the coat of the latter contracts and bursts. The Pollen, though to the naked eye a fine powder, and light enough to be wafted along by the air, is so curiously formed, and so various in different plants, as to be an interesting and popular object for the microscope. Each grain of it is commonly a membranous bag, round or angular, rough or smooth, which remains entire till it meets with any moisture, being contrary in this respect to the nature of the Anther; then it bursts with great force, discharging a most subtile vapour. In the Orchis family, and some other plants, the pollen is of a glutinous nature, very different from its usual aspect. See remarks on *Mirabilis longiflora, Exot. Bot. v.* 1. *p.* 44, *Suppl. f.* 167.

The Stamens are changed to petals in double flowers, and rendered useless. They are often obliterated by excessive nourishment, or when the plant increases much by root, as in the Fiery Lily, or true *Lilium bulbiferum,* as well as in Mints.

IV. Pistilla. The Pistils, no less essential than the Stamens, stand within them in the centre of the flower, and are generally fewer. When in a different flower, on the same or a different plant, they are not always central. Linnæus conceived them to originate from the pith, and the stamens from the wood, and hence constructed an ingenious hypothesis, relative to the propagation of vegetables, which is not destitute of observations and analogies to support it, but not countenanced by the anatomy and physiology of the parts alluded to.

Each Pistil, *f.* 177, consists of three parts. 1, the *Germen,* (or *Ovarium,*) a, or rudiment of the young fruit and seed, which of course is essential; 2, the *Stylus*, b, style, various in length and thickness, sometimes altogether wanting, and when present serving merely to elevate the third part, *Stigma*, c. This last is indispensable. Its shape is various, either simple, scarcely more than a point; or capitate, forming a little round head; or variously lobed. Sometimes it is hollow and gaping, more especially when the flower is in the highest perfection; very generally downy, and always more or less moist with a peculiar viscid fluid, which in some plants is so copious as to form a large drop, though never big enough to fall to the ground. This moisture is designed for the reception of the pollen, which explodes on meeting with it; and hence the seeds are rendered capable of ripening, which, though, in many plants fully formed, they would not otherwise be.

The germen appears under a variety of shapes and sizes. It is of great moment for botanical distinctions to observe whether it be superior, that is, above the bases of the calyx and corolla, as in the Strawberry and Raspberry; or inferior, below them, as in the Apple and Pear. Very rarely indeed the Germen is betwixt the calyx and corolla, as in *Linnæa*,* of which also *Sanguisorba* is reckoned by Linnæus an example; but the corolla there has really a tube closely embracing the Germen. In *Adoxa*, the calyx is half inferior, the corolla superior. When in botanical language we say *germen superior*, it is equivalent to *flower inferior;* but it is sometimes more convenient and proper, for the sake of analogy or uniformity, to use one mode of expression than the other.

Pistils are sometimes obliterated, though oftener changed to petals, in double flowers, as well as the stamens; but I have met with a much more remarkable change in the Double Cherry, of the pistil into a real leaf, exactly conformable to the proper leaves of the tree, only smaller. By

* What Sir J. E. Smith here calls the calyx, is in reality a few bracteas forming a kind of involucre at the base of the inferior germen (to use the language of Linnæus); the true calyx being superior. But in these cases of the so called inferior germen, the fact is that the tube of the calyx is incorporated with the included germen, forming an additional coat to it.—*Ed.*

this we may trace a sort of round in the vegetable constitution. Beginning at the herbage or leaves, we proceed insensibly to bracteas in many species of *Salvia*, or to both calyx and corolla in the Garden Tulip, which frequently has a leaf half green half coloured, either in the flower or on the stalk just below it. *Anemone alpina* produces occasionally a petal among the segments of its involucrum or bractea. *Geum rivale*, when cultivated in dry gravelly ground, exhibits such transformations in abundance. Between petals and stamens there is evidently more connexion, as to their nature and functions, than between any other organs, and they commonly flourish and fall together. Yet only one instance is known of petals changing to stamens, which Dr. Withering has commemorated in the Black Currant, *Ribes nigrum*. On the other hand, nothing is more frequent than the alteration of stamens to petals. Here then the metamorphosis begins to be retrograde, and it is still more so in the Cherry above-mentioned, by which we return to the herbage again.—The line of distinction seems to be most absolute between stamens and pistils, which never change into each other*; on the contrary, pistils, as we see, rather turn into petals, or even into leaves.†

V. Pericarpium. The seed-vessel, extremely various in different plants, is formed of the germen enlarged. It is not an essential part, the seeds being frequently naked, and guarded only by the calyx, as in the first order of the Linnæan class *Didynamia*, of which *Lamium*, and *Galeopsis*, are examples; also in the great class of compound flowers, *Syngenesia*, as well as in *Rumex*, *Polygonum*, the Umbelliferous tribe, numerous Grasses,‡ &c.

* Except perhaps in Willows. See *Engl. Fl. v.* 4.

† On this subject see the interesting "Essai sur la Metamorphose des Plantes," by the poet Goethe, printed at Geneva, 1829.—*Ed.*

‡ Accurate dissection, especially in the different stages of growth, will show that in all these examples there is a real pericarp to the fruit, often indeed closely applied to it, especially in the grasses; nay in some here enumerated, as in the *Umbelliferæ*, and *Compositæ*, the tube of the calyx (as in other cases of the so called inferior germen,) forms an additional covering to the pericarp. The

The use of the seed-vessel is to protect the seeds till ripe, and then in some way or other to promote their dispersion; either scattering them by its elastic power; or serving for the food of animals in whose dung the seeds vegetate; or promoting the same end by various other means. The same organ which remains closed so long as it is juicy or moist, splits and flies asunder when dry, thus scattering the seeds in weather most favourable for their success. By an extraordinary provision of Nature, however, in some annual species of *Mesembryanthemum*, *f.* 178, natives of sandy deserts in Africa, the seed-vessel opens only in rainy weather; otherwise the seeds might in that country, lie long exposed before they met with sufficient moisture to vegetate.

Mons. Richard, a most able physiological botanist, has thrown much light upon the seed-vessels and seeds of plants, in his *Analyse du Fruit*, translated into English by Professor Lindley in 1819. We have only to regret that the subject is encumbered with too many new, generally needless, terms, of which the editor seems to have been aware.

The chief novelties in this publication, besides various particular corrections, and a luminous precision of observation throughout, consist, first, in the author's peculiar idea of a *Pericarpium* taken as a whole. Whatever substances occur between the cuticle and the internal skin, or parietal membrane, the latter immediately surrounding the seed, M. Richard considers as one body or organ, under the name of *Sarcocarp*, meaning the Flesh of a Fruit. Thus the flesh of a Peach or Plum is identified with the shell of its nut or stone, and that of an apple with its core. This may be called a difference of words only, but it seems incorrect in fact. There is from the first a distinct line drawn between the shell of a stone fruit, and its surrounding pulp, nor does it appear to me that any thing is gained by confounding them. The next novelty which M. Rich-

only instances, perhaps, of a really naked seed, naked even in the state of the Ovule, are in the *Coniferæ* and *Cycadeæ*, concerning which see a detailed history by Mr. Brown in the "Appendix to Captain King's Australia."—*Ed.*

ard proposes, is no less than a new primary principle of natural classification, founded indeed, like the old one, on the germination of plants, but not on the same part of the Embryo. It will be more easily explained when we come to consider the structure of a Seed, in a subsequent part of this chapter.

1. *Capsula*, a Capsule, is a dry seed-vessel of a woody coriaceous or membranous texture, generally splitting into several valves; more rarely discharging its contents by orifices or pores, as in *Campanula* and *Papaver;* or falling off entire with the seed. Internally it consists either of one cell or several; in the latter case the parts which separate the cells are called *dissepimenta*, partitions. The central column to which the seeds are usually attached is named *columella, (placenta* or *receptaculum.)* See *Datura Stramonium, f.* 179.

Gærtner, a writer of primary authority on fruits and seeds, reckons several peculiar kinds of Capsules, besides what are generally understood as such; these are,

Utriculus, a Little Bladder, which varies in thickness, never opens by any valves, and falls off with the seed. I believe it never contains more than one seed, of which it is most commodiously, in botanical language, called an external coat, rather than a Capsule. Gærtner applies it to *Chenopodium*, as well as to *Clematis*,* &c. In the former it seems a *Pellicula*, in the latter a *Testa*, as we shall hereafter explain.

Samara is indeed a species of Capsule, of a compressed form and dry coriaceous texture, with one or two cells, never bursting, but falling off entire, and dilated into a kind of wing at the summit or sides. It is seen in the Elm, the Maple, *Suppl. f.* 221, *c*, the Ash, and some other plants. This term however may well be dispensed with, especially as it is the name of a genus in Linnæus; an objection to which *Cotyledon* too is liable. The same thing,

* In *Clematis*, the hard indehiscent 1 seeded pericarp constitutes a true chenium.—*Ed.*

or nearly so, is now called *Achenium*, as if science were not enough burthened with terms already.

Folliculus, a Follicle or Bag, reckoned by Linnæus a separate kind of seed-vessel from the Capsule, ought perhaps rather to be esteemed a form of the latter, as Gærtner considers it. This is of one valve and one cell, bursting lengthwise, and bearing the seeds on or near its edges, or on a receptacle parallel therewith. Instances are found in *Vinca*, *Suppl. f.* 186, *d*, *Pæonia*, and *Embothrium*.

Coccum of Gærtner, separated by him from capsule, is a dry seed-vessel, more or less aggregate, not solitary, whose sides are elastic, projecting the seeds with great force, as in *Euphorbia*. This seems by no means necessary to be esteemed otherwise than a sort of capsule, though the Linnæan Natural Order of *Tricoccæ* derives its name from hence.

2. *Siliqua*, *f.* 180, a Pod, is a long dry solitary seed-vessel of two valves, separated by a linear receptacle, along each of whose edges the seeds are ranged alternately, as in the class *Tetradynamia*. See *Cheiranthus* and *Cardamine;* also *Bignonia echinata*, figured by Gærtner, which, though cautiously called by him a *capsula siliquosa* only, is as true a *Siliqua*, according to his own definition, and every body's ideas, as possible; so is also that of *Chelidonium*. He justly indeed names the fruit of *Pæonia*, *capsula leguminosa*, a follicle with him being a single-valved capsule, with the seeds marginal as in a legume.

Silicula, *f.* 181, a Pouch, is only a Pod of a short or rounded figure, like *Draba verna*, and *Capsella*, *Suppl. f.* 24. In some instances it nearly approaches a *Siliqua*, but the difference is generally sufficient for practical use.

3. *Legumen*, *f.* 182, a Legume, is the peculiar solitary fruit of the Pea kind, formed of two oblong valves, without any longitudinal partition, and bearing the seeds along one of its margins only. The Tamarind is a Legume filled with pulp, in which the seeds are lodged. The Capsules of *Helleborus* and some other plants allied thereto, justly indi-

cated by Gærtner as approaching very nearly to the definition of Legumes, differ essentially in not being solitary, and in consisting each but of one valve, being in reality Follicles. Some Larkspurs indeed bear such capsules solitary, but analogy teaches us their true nature.

When a Legume is divided into several cells, it is either by transverse constrictions, or by inflexion of the valves; never by a separate longitudinal partition.

A Legume composed of single-seeded joints, which do not burst, but often separate from each other in decay, has lately been distinguished by the name of *Lomentum*, a word not in this case correctly applied. *Hedysarum* is an example of such a seed-vessel. Sometimes it consists of only one joint or cell.

Sometimes a Legume of two valves lodges but one seed, as in many species of *Trifolium*. It is only by analogy that such are known to be Legumes. *Viminaria denudata* has rather a *lomentum* of one joint.

4. *Drupa*, *f.* 183, a Stone-fruit, has a fleshy coat, not separating into valves, containing a single hard and bony Nut, to which it is closely attached; as in the Peach, Plum, Cherry, &c. The Cocoa-nut is a *Drupa* with a less juicy coat.

Sometimes the Nut, though not separating into distinct valves, contains more than one cell, and consequently several seeds. Instances are found in *Cornus* and *Olea*, the Olive, *Suppl. f.* 173, though one cell of the latter is commonly abortive.

5. *Pomum*, *f.* 184, an Apple, has a fleshy coat like the *Drupa*, but containing a Capsule, or Capsules, with several seeds, as in common Apples and Pears.

This is comprehended by Gærtner under the different kinds of *Bacca*, it being sometimes scarcely possible to draw the line between them; witness the Linnæan genus *Sorbus*.

6. *Bacca*, *f.* 185, a Berry, is fleshy, without valves, contain-

ing one or more Seeds, enveloped with pulp. It becomes more juicy internally as it advances to maturity, quite contrary to the nature of a Capsule, though the difference between these two unripe fruits may not be discernible, and though some true Berries, when fully ripe, finally become of a dry and spongy texture; but they never open by valves or any regular orifice. Examples of a *Bacca* are seen in *Atropa Belladonna*, and *Ribes*. The same part in *Hedera* is of a more mealy substance. In *Cucubalus*, the coat only is pulpy. In *Trientalis*, the fruit has been mistaken for a berry till very lately, having been wrongly described by Linnæus, and inaccurately delineated by Gærtner; see his *tab.* 50. It is really a Capsule, naturally of 7 valves, and the roundish dark-coloured Seeds are each invested with a white reticulated Tunic or *Arillus*, of great beauty, essentially distinguishing this genus from *Lysimachia*, independent of number of parts. See *Engl. Fl. v.* 2. 207.

Bacca composita, *f.* 186, a Compound Berry, consists of several single ones, each containing a seed, united together, as in *Rubus*, the Raspberry, Bramble, &c. Each of the separate parts is denominated an *Acinus*, or Grain, which term Gærtner extends to the simple many-seeded berries of the Vine, Gooseberry, &c. Some call these Grains *Drupæ*, very erroneously; their Seeds, though hard, being no real Nuts, as they have but a simple *Testa*, lined with as simple a *Membrana*. A Nut must have a shell besides the true *Testa*, like the Walnut, Hasel-nut, Peach-stone, &c.

The Orange and Lemon are true Berries, with a thick coat. The Melon and Cucumber tribe have a peculiar sort of Berry, for which Gærtner uses the name of *Pepo*, Gourd; and he defines it a Berry whose cells, together with the seeds, are remote from the *axis*, or centre, the seeds being inserted into the sides of the fruit. *Passiflora suberosa*, *f.* 187, shows this insertion, being nearly allied to the same tribe; but in this genus the pulp invests each seed separately, forming *Acini* within the common cavity.

Some fruits ranged by Linnæus as *Drupæ* with many seeds, on account of the hardness of the shells of those seeds, are best perhaps, on account of their number, considered by Gærtner as *Baccæ*. *Mespilus*, the Medlar, has been esteemed one of these, but it is rather a *Pomum*.

There are several spurious kinds of berries, whose pulp is not properly a part of the fruit, but originates from some other organ. Thus, in the Mulberry, as well as the Strawberry-Spinach, *Blitum*, the Calyx, after flowering, becomes coloured and very juicy, investing the seed, like a genuine berry. The Corolla of *Commelina Zanonia* undergoes a similar change, forming a black very juicy coat to the capsule, being totally altered both in shape and substance from its appearance in the flower. In the Juniper, a few scales of the fertile catkin (*Involucrum*, *Rich.*) become succulent, and coalesce into a globular berry with three or more seeds, to which Gærtner applies the term *galbulus*, the classical name of the Cypress fruit, which last however is as true a *strobilus* or cone as that of the Fir. In the Yew, *Suppl. f.* 275, some have thought it a calyx, others a peculiar kind of receptacle, which becomes red and pulpy, embracing the seed. (This likewise is an *Involucrum*, Ed.) Lamarck has, in his *Encyclopédie*, *v.* 3. 228, considered this fruit as a real *bacca* or *drupa*, with the idea or definition of either of which it cannot by any means be made to accord, being open at the top, and having no connexion with the *stigma*, which crowns the seed itself. The same writer mistakes for a calyx the scales, which analogy shows to be bracteas; and I cannot but think Jussieu and Gærtner more correct in their ideas of this singular fruit, when they call the pulpy part in question a receptacle, though the term calyx seems less paradoxical, and is perhaps still more just.* We do not know enough of *Taxus nucifera* to draw any conclusions from thence. See *Gærtner*, *t.* 91. In the Strawberry, *Suppl. f.* 259, *a*, what is commonly called the berry is a pulpy receptacle, studded with naked seeds. In the

* *Hernandia* has a similar, though not succulent, calyx, and the green cup of the Hasel-nut is akin to it.

Fig, *Suppl. f.* 92—95, the whole fruit is a juicy calyx, or rather common receptacle, containing in its cavity innumerable florets, each of which has a proper calyx of its own, that becomes pulpy and invests the seed, as in its near relation the Mulberry. The Paper Mulberry of China is indeed an intermediate genus between the two, being as it were a Fig laid open, but without any pulp in the common receptacle.* This last very interesting tree, hardy in our climate, now bears the name of *Broussonetia papyrifera*, in honour of Dr. Peter Maria Augustus Broussonet, whose life has appeared in the *Annales* of the Linnæan Society of Paris, fasc. 1, for March, 1824. Few botanists could better deserve such a memorial; and the intimate friend of many years who now bears testimony to his worth, could have supplied many more particulars of his eventful life and various talents. After suffering all the persecution that an honest man could undergo, during the tyranny of the execrable Robespierre, and seeking shelter at different times in Spain, Barbary, and England, he died at Montpellier, his native place, July 27, 1807, aged 46.—The parts of fructification of the *Broussonetia* are well delineated in the 69th plate, fig. 19, of M. Mirbel's *Elémens de Botanique*, in which work also, I cannot help remarking, the structure and germination of numerous seeds are represented with peculiar beauty and fidelity.

7. *Strobilus*, *f.* 188, a Cone, is a Catkin hardened and enlarged into a Seed-vessel, as in *Pinus*, the Fir, *Suppl. f.* 276.

In the most perfect examples of this kind of fruit, the Seeds are closely sheltered by the scales, as if by a capsule, of which the Fir, Cypress, &c., are instances. In the Birch and Alder they have a kind of capsule besides, and in the Willow, *Suppl. f.* 85—87, and Poplar, a stalked

* The Genus *Dorstenia*, *Suppl. f.* 272, *a*, beautifully exemplifies the structure of the fig, the receptacle being laid open, only here the flowers have no calyx or perianth, and the pistils are in part imbedded in the fleshy disk of the receptacle.—*Ed.*

bivalve capsule, still more separate from the scales. The Plane-tree, *Platanus*, the *Liquidambar* and the *Comptonia*, have globular catkins, in which bristles or tubercles supply the place of scales. See *Gærtner*, *t.* 90.

VI. SEMINA. The Seeds are the sole "end and aim" of all the organs of fructification. Every other part is, in some manner, subservient to the forming, perfecting, or dispersing of these. A seed consists of several parts, some of which are more essential than others, and of these I shall speak first.

Embryo, *f.* 2, 4, the Embryo, or Germ, is the most essential of all, to which the rest are wholly subservient, and without which no seed is perfect, or capable of vegetation, however complete in external appearance. Linnæus, after Cæsalpinus, names it the *Corculum*, or Little Heart, and it is the point whence the life and organization of the future plant originate, as already explained, *p.* 49. In some seeds it is much more conspicuous than in others. The Walnut, the Bean, Pea, Lupine, &c., show the Embryo in perfection. Its internal structure, before it begins to vegetate, is observed by Gærtner to be remarkably simple, consisting of an uniform medullary substance, enclosed in its appropriate bark or skin. Vessels are formed as soon as the vital principle is excited to action, and parts are then developed which seemed not previously to exist, just as in the egg of a bird. In position, the Embryo is, with respect to the base of the whole flower or fruit, either erect, as in the Dandelion and other compound flowers, reversed as in the Umbelliferous tribe, or horizontal as in the Date Palm, *f.* 199, b. In situation it is most commonly within the substance of the seed, and either central, as in Umbelliferous plants, or excentric, out of the centre, as in Coffee; in Grasses however it is external. Its direction is either straight, curved, or even spiral, in various instances. The Embryo of seeds that have a single cotyledon, or none at all, is peculiarly simple, without any notch or lobe, and is named by Gærtner *Embryo monocotyledoneus.*

Cotyledones, the Cotyledons, or Seed-lobes, are immediately attached to the Embryo, of which they form, properly speaking, a part. They are commonly two in number, *f.* 7; but in *Pinus*, and *Dombeya*, the Norfolk Island Pine, they are more, *f.* 3, as already mentioned, *p.* 50. When the seed has sufficiently established its root, these generally rise out of the ground, and become a kind of leaves. Such is the true idea of the organs in question; but the same name is commonly given to the body of the seed in the Grass and corn tribe, the Palms and several other plants, thence denominated *Monocotyledones*, because the supposed *Cotyledon* is single. The nature of this part we shall presently explain. It neither rises out of the ground, nor performs the proper functions of a *Cotyledon*, for what these plants produce is, from the first, a real leaf; or, if the plant has no leaves, the rudiment of a stem, as in *Cuscuta*. In either case, the part produced is solitary, never in pairs: hence Gærtner was led to reckon *Cyamus Nelumbo*, *Exot. Bot. t.* 31, 32, among the monocotyledonous plants, the body of its seed remaining in the earth, and the leaves springing one at a time from the Embryo, just as in the Date Palm, Wheat, Barley, &c. But it has a pair of subterraneous Cotyledons.

The supposed Seed-lobes of Mosses, according to the observations of Hedwig, *Fund. part* 2. *t.* 6, so numerous and subdivided, *f.* 195, 196, are shown by the observations of Mr. James Drummond, *Tr. of Linn. Soc. v.* 13, 24—27, to be truly radicles, some of which serve to imbibe nourishment from the earth, others perhaps from the atmosphere, like those of many parasitical *Orchideæ* in India. The stems of numerous Mosses, growing in wet situations, abound with these fibrous appendages. Mr. Lindley, in a note at *p.* 42 of his translation of Richard on Fruits and Seeds, alludes to Mr. Drummond's paper as materially supporting the opinion of Cryptogamous plants being propagated without impregnation. But it rather proves the contrary, as demonstrating the vegetation of their Seeds, whose impregnation, by the means of Anthers, Hedwig has sufficiently ascertained.

Albumen, Albumen,* is a farinaceous, fleshy, or horny substance, which makes up the chief bulk of some seeds, as Grasses, Corn, Palms, Lilies, never rising out of the ground, nor assuming the office of leaves, being destined solely to nourish the germinating embryo, till its roots can perform their office. In the Date Palm, *f.* 199, this part is nearly as hard as a stone; in *Mirabilis*, it is like wheat flour. It is wanting in several tribes of plants, as those with compound, or with cruciform flowers, and the Cucumber or Gourd kind, according to Gærtner. Some few Leguminous plants have it, and a great number of others which, like them, have cotyledons besides. We are not however to suppose that so important an organ is altogether absent, even in the above-mentioned plants. The farinaceous matter, destined to nourish their embryos, is unquestionably lodged in their cotyledons, whose sweet taste as they begin to germinate often evinces its presence, and that it has undergone the same chemical change as in Barley. The *Albumen* of the Nutmeg is remarkable for its eroded variegated appearance, and aromatic quality; the cotyledons of this seed are very small.

Vitellus, the Yolk, first named and fully illustrated by Gærtner, is allowed to be less general than any of the parts already mentioned. He characterizes it as very firmly and inseparably connected with the Embryo, yet never rising out of the integuments of the seed in germination, but absorbed, like the *Albumen*, for the nourishment of the Embryo. If the *Albumen* be present, the *Vitellus* is always situated between it and the Embryo, and yet is constantly distinct from the former. The *Vitellus* is esteemed by Gærtner to compose the bulk of the seed in *Fuci*,† Mosses, and Ferns, as well as in the genus *Zamia*, *f.* 200, closely allied to the latter, see his *t.* 3, and even in *Ruppia*, and *Cyamus*. In the Natural Order of

* Endosperm of Richard, who too strictly insists on its being invariably present in plants of the same Natural Order.

† Surely the minuteness of the supposed seeds of these plants and the difficulty of dissecting them, must render it impossible to comprehend their real structure.—*Ed.*

Grasses the part under consideration is thought to form a scale between the *Embryo* and the *Albumen*.

I cannot but think that the *Vitellus* is nothing else than a subterraneous Cotyledon.* In the Horse Chestnut and Garden Nasturtium, Gærtner almost allows, see his Introduction, *p.* 151, that they are the same thing. It does not appear that any plant with genuine ascending Cotyledons is likewise furnished with this as a distinct organ; on the other hand, it is commonly attributed to such as have the most copious *Albumen*, and therefore should seem to answer some other end than mere nutriment, which is supplied by the latter. The reader may consult *Tr. of the Linn. Soc. v.* 9. 204, where this subject is fully discussed. It seems by De Candolle's *Fl. Franc. v.* 1. 157, that Mr. Correa has also exploded the idea of a *Vitellus* in plants, but his reasons do not appear, and he told me himself, on inquiry, that he only casually suggested the idea.†

We learn from the above statements, that the old distinction between plants with one Cotyledon and those with several may mostly be relied on, though in the former the part which has commonly been so denominated is the *Albumen*, as in Corn, the real Cotyledon of which is the scale or supposed *Vitellus*, which last organ however seems wanting in Palms, Lilies, &c., such having really no Cotyledon at all, nor any thing that can perform its office, except the stalk of their Embryo, which indeed may answer the purpose of a Cotyledon just as the stems of many plants fulfil the office of leaves. In the Horse Chestnut, Oak and Walnut possibly, whose seed-lobes do not ascend, the functions of a real Cotyledon, as far as air is concerned, and those of the *Albumen* may be united in these lobes, as is the case with most Leguminous plants. This is rendered more probable, as several of the latter have the corresponding parts likewise remaining under

* M. Richard, with no less deference for the great Gærtner than I am proud to acknowledge, likewise disowns the existence of a *Vitellus*.

† Our learned countryman Brown, however recognises a *vitellus* or fleshy sac, *sacculus* of De Candolle, in the *Nymphæaceæ*, Peppers and others.—*Ed.*

ground. Hence the divided "*Vitellus*," as Gærtner terms it, of the *Cyamus* is to be considered as a pair of subterraneous Cotyledons, and the plant consequently ranges near its natural allies the Poppy tribe, as Mr. Salisbury, without the aid of physiology, has shown in the *Annals of Botany, v.* 2. *pp.* 70, 75.

Testa, f. 4, the Skin,* contains all the parts of a seed above described, giving them their due shape; for the skin is perfectly formed, while they are but a homogenous liquid. This coat differs in thickness and texture in different plants. It is sometimes single, but more frequently lined with a finer and very delicate film, called by Gærtner *Membrana*, as may be seen in a Walnut, and the kernel of a Peach, Almond, or Plum. In the Jasmine a quantity of pulp is lodged between the *Membrana*, and the *Testa*, constituting a pulpy seed, *semen baccatum*, which is distinct from the *Acinus*, or grain of a compound berry in the Raspberry, the seed of the latter having its proper double covering within the pulp. The *Testa* bursts irregularly, and only from the swelling of its contents in germination.

Hilum, the Scar, is the point by which the seed is attached to its seed-vessel or receptacle, and through which alone life and nourishment are conveyed for the perfecting its internal parts. Consequently, all those parts must be intimately connected with the inner surface of this scar, and they are all found to meet there, and to divide or divaricate from that point, more or less immediately. In describing the form or various external portions of

* Episperm of Richard, who is undoubtedly mistaken in saying it is always simple, though formed of a vascular *parenchyma* between two membranes. A Hasel-nut, the seed of an Apple, and others innumerable, examined at any period, show these two coats to be distinct. (Richard, I apprehend, only meant to imply that the two membranes, the outer of which he calls the *epidermis* and the inner the parietal membrane, were held together by the parenchyma so as to form one body: for he expressly says that the latter is often separable either artificially or spontaneously, and thus some Botanists have regarded the *episperm* as double. *Ed.*)

any seed, the *Hilum* is always to be considered as the base. When the seed becomes quite ripe, the communication through this channel is interrupted : it separates from the parent plant without injury, a cicatrix being formed on each. Yet the *Hilum* is so far capable of resuming its former nature, that the moisture of the earth is imbibed through it previous to germination.

The Radicle is protruded through the *Hilum* in the first stage of Germination. According to its mode of protrusion, and indeed its original conformation, the learned M. Richard has formed his two great primary distinctions of plants, in preference to the old ones of *Monocotyledones* and *Dicotyledones*. His Endorhizæ are mostly analogous to the former; his Exorhizæ, to the latter. The character of *Endorhizæ* consists in "the radicle emitting from its extremity, during germination, a tubercle, which was originally interior, and which becomes the principal root of the young plant." In *Exorhizæ* "the radicular extremity of the Embryo itself becomes the root of the nascent plant." Such are the author's words. He adds that the embryo of the *Endorhizæ* is very rarely without *albumen*, or as he calls it *endosperm*, and moreover that it is almost always internal; yet his exceptions are so numerous, and so important, as greatly to invalidate these rules, consisting, among many other things, of the whole family of Grasses in the latter case; that of the *Junci*, and several more, in the former; and the Order of *Nymphæa*, with its allies, in both. The plants last-named being really dicotyledonous and near the *Papaveraceæ*, if they actually belong to the *Endorhizæ*, form a great exception to the above analogies.

There are various accessory parts, or appendages to seeds, which come under the following denominations.

Pellicula, the Pellicle, called by Gærtner *Epidermis*, closely adheres to the outside of some seeds, so as to conceal the proper colour and surface of their skin, and is either membranous, and often downy, as in *Convolvulus ;* or mucilaginous, not perceptible till the seed is moistened, as in *Salvia verbenaca*. Perhaps the covering of the seed in *Chenopodium*, called by Gærtner *Utriculus*, is merely a

Pellicula. (Surely not, but a true pericarp bearing the styles. *Ed.*)

Arillus, the Tunic, 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. Of this nature is the pulpy orange-coloured coat in *Euonymus, Suppl. f.* 265, the beautiful scarlet cup in *Afzelia, f.* 203, and the double membranous coat in *Hippophäe*, which last invests the seed within the pulp of the berry. The outer of these coats only is described by Gærtner, as a peculiar membrane lining the cell of the berry; his "*integumentum duplex*" refers to the *testa*, which I mention only to prevent misapprehension. The Mace which envelops the Nutmeg is a partial *Arillus ; Narthecium* has a complete membranous tunic, elongated beyond the seed at each end, as in many of the Orchis tribe; and such seeds, acquiring thence a light and chaffy appearance, have been denominated *scobiformia*, whence Bergius was perhaps led, very unscientifically, to call the seeds of ferns literally *scobs* or sawdust! An elastic pouch-like *Arillus*, serving to project the seeds with considerable force, occurs in *Oxalis*. In the Natural Order of *Rutaceæ*, the same part, shaped also like a pouch lining each cell of the capsule, is very rigid or horny; see *Dictamnus albus*, or Fraxinella, *Gærtn. t.* 69, and *Boronia*, *Tracts on Nat. Hist. t.* 4—7, and *Suppl. f.* 237, 238. Besides this coincidence, there are many common points of affinity between these plants and *Oxalis*, concerning colour, flavour, habit and structure. *Fagonia* and its allies form the connecting link between them, which Gærtner and Jussieu did not overlook. I have pointed out this affinity in *English Botany, t.* 762, and it is confirmed by the curious circumstance of Jacquin's *Oxalis rostrata* having the very appendages to its filaments which make a peculiar part of the character of *Boronia*.

It is not easy to say whether the various, and frequently elaborate, coat of the seed among the rough-leaved plants, *Borago*, *Anchusa*, *Lithospermum*, *Cynoglossum*,* *f.* 201,

* See note at p. 135

should be esteemed an *Arillus* or a *Testa*; but the latter seems most correct, each seed having only a simple and very thin membranous internal skin besides. Gærtner therefore uses the term Nut for the seeds in question. The same may be observed of *Ranunculus, Myosurus, Clematis, Anemone*, &c., whose external coats are no less various and elaborate; yet such seeds are as truly naked as those of the *Didynamia* class, each having a double skin and no more, which is one covering less than even the genuine nut of the stone fruit, or of the *Corylus*. In *Geranium, Malva*, &c., what has often been called *Arillus*, is rather a kind of Capsule, not only because their seeds have a double or even triple skin, quite unconnected with this outer cover, but because the latter is analogous to other Capsules.

The loose husky covering of the seed in *Carex*, *f.* 202, open at the summit, I have considered as an *Arillus*. See *Engl. Bot.*; also the Rev. Mr. Wood's observations on this genus in Dr. Rees' *Cyclopedia*; and *Gærtner*, *v.* 1. 13. Schkuhr has shown that when the stamens and pistil meet together in one flower in *C. teretiuscula*, see his *tab.* 286, T, No. 69, the covering in question is placed between them; a strong indication of its belonging to the pistil and seed. But it may be said that the lateral situation of these stamens proves them to belong to a partly suppressed barren flower, and that they do not form, with the said pistil, a real united or perfect flower. Mr. Brown saw, in Mr. D. Turner's herbarium, a strange monster of *C. acuta*, in which this covering, called by him *perianth*, included the stamens, without any traces of a pistil. This could only be a change of the pistil into stamens, of which, indeed, I never saw an example, except in Willows. I have, however, used the term *corolla* in *Engl. Fl. v.* 4. 76. This has the same meaning as Mr. Brown's *perianth*. The origin of the awn in *C. uncinata*, and some others, from the receptacle of the seed, within the tunic, as is correctly noted by Mr. Brown, appears more directly to favour his opinion, but is not to me decisive. Such appendages are very variously situated. The seed of *Carex* has, besides, a double *Testa*, though most of the true Grasses have but one,* which in ground Corn constitutes the bran, the husks of the blossom being the chaff.

Pappus, the Seed-down, is restrained by Gærtner to the chaffy, feathery, or bristly crown of many seeds that have no *Pericarpium*, and which originates from a partial calyx, crowning the summit of each of those seeds, and remaining after the flower is fallen. Instances of this are the feathery appendages to the seeds of Dandelion and Goat's beard, in which the part in question is elevated on a footstalk, *f.* 204. In *Cnicus*, it is sessile, though still feathery; in *Carduus*, bristly; but in *Cichorium*, it consists of mere chaffy teeth, more clearly evincing its affinity to a Calyx. In *Scabiosa* it is double. (See note at *p.* 120. *Ed.*) In *Bidens*, the *Pappus* is formed of two, three, or four rigid barbed bristles. The use of this organ is evidently to transport seeds to a distance from their native spot, either by resigning them to the power of the wind, or by attaching them to the shaggy coats of animals. In due time the crown separates, and leaves the seed behind it, which happens sooner with the Thistle than most other plants. Hence the vacant down of that genus is frequently seen wafted in light masses over a whole country; which has not escaped the notice of poets.

The same term is used by the generality of botanists for the feathery crown of seeds furnished with a capsule, as *Epilobium*, *Asclepias*, *Cynanchum*, &c., as well as for a similar appendage to the base or sides of any seeds, as *Salix*, *Eriophorum*,† &c., neither of which can originate from a Calyx. For the former of these Gærtner adopts

* The close union of the membranes of this *Testa* must often give the appearance of its being single. The seed of *Carex*, and of the Grasses too, is moreover covered by the closely applied pericarp: in Barley and some other Grasses, by the cohering floral coverings. Yet, in all these cases, to a common observer there would appear to be only one integument.—*Ed.*

† In *Eriophorum* the attachment of these hairs is not to the seed, as in the preceding genera, but to the base of the pericarp, and they are clearly analogous to the hypogynous setæ in *Scirpus*, and other allied *Cyperaceæ*, and probably an union of such setæ constitutes the perianth (corolla of Smith,) in *Carex*.—*Ed.*

the term *Coma*, for the latter *Pubes*, which last also serves for any downiness or wool about the *Testa* of a seed, as in the Cotton plant, and *Blandfordia nobilis.*

Cauda, *f.* 205, a Tail, is an elongated, generally feathery, appendage to some Seeds, formed of the permanent style, as in *Clematis*, *Dryas*, *Geum.* (In these instances they are the enlarged and persistent styles of those pericarps which are called *Achenia ;* naked seeds of Sir J. E. Smith. *Ed.*)

Rostrum, a Beak, mostly applies to some elongation of a Seed-vessel, originating likewise from the permanent style, as in *Geranium*, *Helleborus*, &c., though it is also used for the (so called) naked seeds, as in *Scandix*, *f.* 206.

Ala, *f.* 207, a Wing, is a dilated membranous appendage to Seeds, as in *Embothrium*, *Banksia*, *Conchium*, *Bignonia echinata*, and *Rhinanthus*, serving to waft them in the air. Gærtner wished to confine this term to a membranous expansion of the top or upper edge of a Seed or Seed-vessel, using *margo membranaceus* for one that surrounds the whole, but he has not adhered to it in practice. Capsules are sometimes furnished with one wing, as the Ash; oftener with several, as *Halesia*, *Acer*, *Begonia*, &c. In Seeds the Wing is commonly solitary, except some Umbelliferous plants, like *Thapsia*, *Gærtn. t.* 21.

Seeds are occasionally furnished with Spines, Hooks, Scales, Crested appendages, particularly a little gland-like part near the Scar, sometimes denominated *Strophiolum*, as in *Asarum*, *Bossiæa*, *Platylobium*, *Ulex*, *Spartium*, &c. In general, however, smoothness is characteristic of a seed, by which it best makes its way into the soft earth, though sometimes it is barbed, or at least its covering, as in *Stipa*, that it may not easily be withdrawn again by the powerful feathery appendage of that plant, which, after having by its circumvolutions forced the seed deeper and deeper, breaks off at a joint, and flies away.

The various modes by which seeds are dispersed cannot fail to strike an observing mind with admiration. Who has not listened in a calm and sunny day to the crackling of Furze bushes, caused by the explosion of their little elastic pods; or watched the down of innumerable seeds floating on the summer breeze, till they are overtaken by a shower, which moistening their wings stops their further flight, and at the same time accomplishes its final purpose, by immediately promoting the germination of each seed in the moist earth? How little are children aware, as they blow away the seeds of Dandelion, or stick Burs in sport upon each other's clothes, that they are fulfilling one of the great ends of Nature! Sometimes the Calyx, beset with hooks, forms the bur, as in *Arctium Lappa;* sometimes hooks encompass the fruit itself, as in *Xanthium*, and some species of *Galium*, particularly *G. Aparine.* Plants thus furnished are observed by Linnæus to thrive best in a rank manured soil, with which, by being conveyed to the dens of wild animals, they are most likely to meet. The Awns of grasses answer the same end. Pulpy fruits serve quadrupeds and birds as food, while their seeds, often small, hard, and indigestible, pass uninjured through the intestines, and are deposited far from their original place of growth, in a condition peculiarly fit for vegetation. Even such seeds as are themselves eaten, like the various sorts of nuts, are hoarded up in the ground and occasionally forgotten, or carried to a distance, and in part only devoured. The ocean itself serves to waft the larger kinds of seeds from their native soil to far distant shores.

VII. Receptaculum. The Receptacle is the common base or point of connexion of the other parts of fructification. It is not always distinguishable by any particular figure, except in compound flowers constituting the Linnæan class *Syngenesia*, in which it is very remarkable and important. In the Daisy, *f.* 208, it is conical; in *Chrysanthemum*, convex; in others flat, or slightly concave. *Picris* has it naked, that is, destitute of any hairs or scales between the florets or seeds; *Carduus*, hairy; *Anthemis*, scaly; and *Onopordum*, cellular, like a honeycomb, *f.* 209. On this and the seed-down are founded the most solid generic characters of these plants, admirably illustrated by the inimitable Gærtner.

The term Receptacle is sometimes extended by Linnæus to express the base of a flower, or even its internal part between the stamens and pistils, provided there be any thing remarkable in such parts, without reference to the foundation of the whole fructification. It also expresses the part to which the seeds are attached in a seed-vessel, and the common stalk of a spike, or spikelet, in grasses.

Having thus explained the various organs of fructification, we shall add a few remarks concerning flowers in general, reserving the functions of the Stamens and Pistils, with the Linnæan experiments and inquiries relative to that curious subject, for the next chapter.

A flower furnished with both calyx and corolla is called *flos completus*, a complete flower; when the latter is wanting, *incompletus;* and when the *corolla* is present without the calyx, *nudus*, naked.* When the stamens and pistils are both, as usual, in one flower, that flower is called perfect, or united; when they are situated in different flowers of the same species, such I would denominate separated flowers; that which has the stamens being termed the barren flower, as producing no fruit in itself, and that with pistils the fertile one, as bearing the seed. If this separation extends no further than to different situations on the same individual plant, Linnæus calls such flowers *monoici*, monœcious, as confined to one house or dwelling; if the barren and fertile flowers grow from two separate roots, they are said to be *dioici*, diœcious. Some plants have united flowers and separated ones in the same species, either from one, two or three roots, and such are called polygamous, as making a sort of compound household.

* Surely it would be more correct to call that a *flos incompletus*, which was deficient in one of the two floral coverings, (for who is to determine which of them is absent?) and that a *flos nudus*, which has no floral covering, as *Hippuris*, *Fraxinus*, &c.—*Ed.*

A Compound flower consists of numerous florets, *flosculi*, all sessile on a common undivided Receptacle, and enclosed in one contiguous Calyx or *Perianthium*, (properly speaking an *involucrum. Ed.*) It is also essential to this kind of flower that the Anthers should be united into a cylinder, to which only the genus *Tussilago* affords one or two exceptions, and *Kuhnia* another; and moreover, that the stamens should be five to each floret, *Siegesbeckia flosculosa* of L'Héritier, alone, having but three. The florets are always monopetalous and superior, each standing on a solitary naked seed, or at least the rudiments of one, though not always perfected. Some Compound flowers consist of very few florets, as *Humea elegans*, *Prenanthes muralis;* others of many, as the Thistle, Daisy, Sunflower, &c. The florets themselves are of two kinds, *ligulati*, ligulate, shaped like a strap or ribband, *f.* 210, with three or five teeth, as in *Tragopogon*, and the Dandelion; or *tubulosi*, tubular, cylindrical and five-cleft, as in *Carduus*, and *Tanacetum*. The marginal white florets of the Daisy, *f.* 211, are of the former description, and compose its *radius* or ray, and its yellow central ones come under the latter denomination, *f.* 212, constituting its *discus*, or disk. The disk of such flowers is most frequently yellow, the rays yellow, white, red, or blue. No instance is known of yellow rays with a white, red, or blue disk.

An Aggregate flower has a common undivided Receptacle, the Anthers all separate and distant, *Jasione* only having them united at the base, but not into a cylinder, and the florets commonly stand on stalks, each having a single or double partial calyx. Such flowers have rarely any inclination to yellow, but are blue, purple, or white. Instances are found in *Scabiosa*, *Dipsacus*, and the beautiful Cape genus *Protea*.

Such is the true idea of an Aggregate flower; but Linnæus enumerates, under that denomination, seven kinds, his favourite number: these are,

1. The Aggregate flower, properly so called, as just mentioned.

2. The Compound flower, previously described.
3. The Amentaceous flower, or Catkin, of which we have spoken, *p.* 121.
4. The Glumose, or Chaffy flower, peculiar to the Grasses and their allies, see *p.* 122.
5. The Sheathed flower, whose common receptacle springs from a sheath, as in *Arum.*
6. The Umbellate; and
7. The Cymose flowers, concerning which two last a few observations are necessary.

Linnæus and his friend Artedi thought the great Natural Umbelliferous Order could not be divided into good and distinct genera by the seeds or parts of the flower, without taking into consideration the general and partial involucral leaves, which they therefore chose to consider as a part of the fructification and defined as a *calyx remote from the flower.* The rays of the umbel, of course, became the subdivisions of a branched receptacle, and the whole umbel was considered as one aggregate flower. It necessarily followed that a Cyme, see *p.* 115, must be considered in the same light; nor did the sagacity of Linnæus overlook the arguments in favour of this hypothesis. Many of the umbelliferous tribe, as *Heracleum*, *Caucalis*, *Coriandrum*, &c., have their marginal flowers dilated, radiant, and more or less inclined to be imperfect or abortive, thus evincing an analogy with real compound flowers like the Sunflower, which analogy is still more striking between *Oenanthe*, and the Marigold, *Calendula.* So the cymose plants, as *Viburnum Opulus*, bear dilated and abortive marginal flowers, and *Hydrangea hortensis* has scarcely any others. *Cornus sanguinea* has a naked cyme, *C. Suecica*, an umbel accompanied by coloured bracteas, or, as Linnæus judged, a coloured *involucrum*, proving the close affinity between these two modes of inflorescence.

Notwithstanding all this, I presume to dissent from the above hypothesis, as offering too great violence to Nature, and swerving from that beautiful and philosophical Linnæan principle, of characterizing genera by the fructification alone;

a principle which those who are competent to the subject at all, will, I believe, never find to fail. The seeds and flowers of the umbelliferous family are quite sufficient for our purpose, while the involucrum is very precarious and changeable; often deficient, often immoderately luxuriant, in the same genus. In the cymose plants everybody knows the real parts of fructification to be abundantly adequate, the involucrum being of small moment; witness that most natural genus *Cornus*. For all these, and other reasons, to particularize which would lead me too far, I have, *pp*. 114, 115, reckoned the Umbel and Cyme as modes of flowering, and not themselves aggregate flowers. According to this principle, the Umbelliferous Plants are generically arranged and distinguished, in the *English Flora*, *v.* 2, published in 1824, by the parts of the flower and seeds alone, the floral receptacle being taken into consideration as a distinct part from the tumid bases of the styles. The *Involucra* and *Involucella* of Linnæus are therefore termed general and partial Bracteas, and afford specific, not generic, characters.*

CHAP. XX.—*Of the peculiar functions of the Stamens and Pistils, with the experiments and observations of Linnæus and others on that subject.*

THE real use of the Stamens of Plants was long a subject of dispute among philosophers, till Linnæus, according to the general opinion at present, explained it beyond a possibility of doubt. Still there are not wanting persons who from time to time start objections, prompted either by a philosophical pursuit of truth, or an ambitious desire of distinguishing themselves in controverting so celebrated a doctrine, as some have written against the circulation of the animal blood. I propose to trace the history of this doctrine, and especially to review

* Such too is the opinion of the most celebrated writers on the *Umbelliferæ*, especially Koch and De Candolle, who consider the involucre as only of secondary importance; never introducing it into the essential character.—*Ed.*

the facts and experiments upon which Linnæus founded his opinion, as well as the objections it has had to encounter. It would be endless, and altogether superfluous, to bring forward new facts in its support, nor shall I do so, except where new arguments may render such a measure necessary.

The Stamens and Pistils of flowers have, from the most remote antiquity, been considered as of great importance in perfecting the fruit. The Date Palm, from time immemorial a primary object of cultivation in the more temperate climates of the globe, bears barren and fertile flowers on separate trees. The ancient Greeks soon discovered that in order to have abundant and well-flavoured fruit, it was expedient to plant both trees near together, or to bring the barren blossoms to those which were to bear fruit; and in this chiefly consisted the culture of that valuable plant. Tournefort tells us that without such assistance dates have no kernel, and are not good food. The same has long been practised, and is continued to this very day in the Levant, upon the *Pistacia*, and the Fig.

At the revival of learning, botanists were more occupied in determining the species, and investigating the medical properties of plants, than in studying their physiology; and when after a while the subject in question was started, some of them, as Morison, Tournefort and Pontedera, uniformly treated with great contempt the hypothesis which has since been established. We shall, as we proceed, advert to some of their arguments.

About the year 1676, Sir Thomas Millington, Savilian Professor at Oxford, is recorded to have hinted to Dr. Grew that the use of the Stamens was probably to perfect and fertilize the seed. Grew adopted the idea, and the great Ray approved it. Several other botanists either followed them, or had previously conceived the same opinion, among whom R. J. Camerarius, Professor at Tubingen towards the end of the seventeenth century, was one of the most able and original. Vaillant wrote an excellent oration on the subject, which being hostile to the opinions of Tournefort, lay in obscurity till published by Boerhaave. Blair and Bradley assented in England, and several continental botanists imbibed the same sentiments. Pontedera, however, at Padua, an university long famous, but then on the decline, and consequently adverse to all new inquiry and information, in 1720 published his *Anthologia*, quite on the other side of the question.

Linnæus, towards the year 1732, reviewed all that had been done before him, and clearly established the fact so long in dispute, in his *Fundamenta* and *Philosophia Botanica.* He determined the functions of the Stamens and Pistils, proved these organs to be essential to every plant, and thence conceived the happy idea of using them for the purpose of systematical arrangement. In the latter point his merit was altogether original; in the former he made use of the discoveries and remarks of others, but set them in so new and clear a light, as in a manner to render them his own.

I have already mentioned, *p.* 69, the two modes by which plants are multiplied, and have shown the important difference between them. Propagation by seed is the only genuine reproduction of the species, and it now remains to prove that the essential organs of the flower are indispensably requisite for the perfecting of the seed.

Every one must have observed that the flower of a plant always precedes its fruit. To this the Meadow Saffron seems an objection, the fruit and leaves being perfected in the spring, the blossoms not appearing till autumn; but a due examination will readily ascertain that the seed-bud formed in autumn is the very same which comes to maturity in the following spring. A Pine-apple was once, very unexpectedly, mentioned to me as an instance of fruit being formed before the flower, because the green fruit in that instance, as in many others, is almost fully grown before the flowers expand. The seeds, however, the essence of the fruit, are only in embryo at this period, just as in the germen of an apple blossom.

It was very soon ascertained that flowers are invariably furnished with Stamens and Pistils, either in the same individual, or two of the same species, however defective they may be in other parts; of which *Hippuris*, the most simple of blossoms, is a remarkable example. Few botanists indeed had detected them in the *Lemna* or Duck-weed, so abundant on the surface of still waters, and Valisneri alone for a long time engrossed the honour of having seen them. In our days however they rewarded the researches of the indefatigable Ehrhart in Germany, and, on being sought with equal acuteness, were found in England. Three species have been delineated in *Engl. Bot.*, from the discoveries of Mr. Turner and Mr. W. Borrer. The flowers of Mosses, long neglected and afterwards mistaken, were faithfully delineated by Micheli, carefully examined and properly understood by Linnæus as he rambled over the wilds of Lapland,* and at length fully illustrated, and placed out of all uncertainty, by the justly celebrated Hedwig. These parts indeed are still unknown in Ferns, or at least no satisfactory explanation of them has reached me, though the seeds and seed-vessels are sufficiently obvious.

The existence of the parts under consideration is so incontrovertible in every flower around us, that Pontedera was reduced to seek plants without stamens among the figures of the *Hortus Malabaricus;* but the plates in which he confided are now known to be faulty in that very particular.

Plants indeed have occasionally abortive stamens in one flower and barren pistils in another, and the Plantain-tree, *Musa*, is described by Linnæus as having five out of its six stamens perfected in such blossoms as ripen no fruit, while those with a fertile germen contain only a single ripe stamen, five being ineffective. This only shows the resources, the wisdom, and the infinite variety of the creation. When the roots are luxuriantly prolific, the flowers are in some measure defective, Nature relaxing as it were from her usual solicitude, and allowing her children to repose, and indulge in the abundance of good things about them. But when want threatens, she instantly takes the alarm; all her energies are exerted to secure the future progeny, even at the hazard of the parent stock, and to send them abroad to colonise more favourable situations.

Most generally the access of the pollen is not trusted to any accidental modes of conveyance, however numerous,

* This hitherto unknown fact appears in his Tour through that country, lately published in English, *v.* 1. 185.

elaborate, and, if we may so express it, ingenious, such modes may be; but the Stamens are for greater security lodged in the same flower, under the protection of the same silken veils, or of more substantial guards, which shelter their appropriate pistils. This is the case with the majority of our herbs and shrubs, and even with the trees of hot countries, whose leaves, being always present, might impede the passage of the pollen. On the contrary, the trees of cold climates have generally separated flowers, blossoming before the leaves come forth, and in a windy season of the year; while those which blossom later, as the Oak, are either peculiarly frequented by insects, or, like the numerous kinds of Fir, have leaves so little in the way, and pollen so excessively abundant, that impregnation can scarcely fail.

The pollen and the stigma are always in perfection at the same time, the latter commonly withering and falling off a little after the anthers, though the style may remain, to become a useful appendage to the fruit. The *Viola tricolor* or Pansy, the *Gratiola*, the *Martynia*, and many plants besides, have been observed to be furnished with a stigma gaping only at the time the pollen is ripe. The beautiful Jacobæan Lily, *Amaryllis formosissima*, is justly described by Linnæus as provided with a drop of clear liquid, which protrudes every morning from the stigma, and about noon seems almost ready to fall to the ground. It is however re-absorbed in the afternoon, having received the pollen whose vapour renders it turbid, and whose minute husks afterwards remain upon the stigma. The same phenomenon takes place for several successive days.

In opposition to similar facts, proving the synchronous operation of these organs, Pontedera has, with more observation than usual, remarked that in the umbelliferous tribe the style frequently does not appear till the anthers are fallen. But he ought to have perceived that the stigma is previously perfected, and that the style grows out afterwards, in a recurved and divaricated form, for the purpose of providing hooks to the seeds. It is also observable, that in this family the several organs are sometimes brought to perfection in different flowers at different times, so that the anthers of one may impregnate the stigmas of another whose stamens were abortive, or long since withered. The same thing happens in other instances. Linnæus mentions the *Jatropha urens* as producing flowers with stamens some weeks in general before or after the others. Hence he obtained no seed, till he preserved the pollen for a month or more in paper, and scattered it on a few stigmas then in perfection. There can be no doubt that, in a wild state, some or other of the two kinds of blossoms are ripe together, throughout the flowering season, on different trees.

A similar experiment to that just mentioned was made in 1749 upon a Palm-tree at Berlin, which for want of pollen had never brought any fruit to perfection. A branch of barren flowers was sent by the post from Leipsic, twenty German miles distant, and suspended over the pistils. Consequently abundance of fruit was ripened, and many young plants raised from the seeds.*

Tournefort and Pontedera supposed the pollen to be of an excrementitious nature, and thrown off as superfluous. But its being so curiously and distinctly organized in every plant and producing a peculiar vapour on the accession of moisture, shows, beyond contradiction, that it has functions to perform after it has left the anther. The same writers conceived that the stamens might possibly secrete something to circulate from them to the young seeds; a hypothesis totally subverted by every flower with separated organs, whose stamens could circulate nothing to germens on a different branch or root; a difficulty which the judicious Tournefort perceived, and was candid enough to allow.

Both the conjectures just mentioned vanish before one luminous experiment of Linnæus, of all others the most easy

* What species of Palm was the subject of this experiment does not clearly appear. In the original communication to Dr. Watson, printed in the preface of Lee's *Introduction to Botany*, it is called *Palma major foliis flabelliformibus*, which seems appropriate to *Rhapis flabelliformis, Ait. Hort. Kew. ed.* 1. *v.* 3. 473; yet Linnæus, in his dissertation on this subject, expressly calls it *Phœnix dactylifera*, the Date Palm, and says he had in his garden many vigorous plants raised from a portion of the seeds above-mentioned. The great success of the experiment, and the "fanshaped" leaves, make me rather take it for the *Rhapis*, a plant not well known to Linnæus.

to repeat and to understand. He removed the anthers from a flower of *Glaucium phœniceum*, stripping off the rest of that day's blossoms. Another morning he repeated the same practice, only sprinkling the stigma of that blossom, which he had last deprived of its own stamens, with the pollen from another. The flower first mutilated produced no fruit, but the second afforded very perfect seed. "My design," says Linnæus, "was to prevent any one in future from believing that the removal of the anthers from a flower was in itself capable of rendering the germen abortive."

The usual proportion and situation of stamens with respect to pistils are well worthy of notice. The former are generally shortest in drooping flowers, longest in erect ones. The barren blossoms stand above the fertile ones in *Carex*, *Coix*, *Arum*, &c., that the pollen may fall on the stigmas. This is the more remarkable, as the usual order of Nature seems in such plants, as well indeed as in compound and even umbelliferous flowers, to be reversed; for the pistils are invariably central, or internal, in every simple flower, and would therefore, if drawn out into a monœcious spike, be above the stamens.

Many curious contrivances of Nature serve to bring the anthers and stigmas together. In *Gloriosa*, the style is bent, at a right angle from the very base, for this evident purpose. In *Saxifraga*, and *Parnassia*, the stamens lean one or two at a time over the stigma, retiring after they have shed their pollen, and giving place to others; which wonderful economy is very striking in the garden Rue, *Ruta graveolens*, whose stout and firm filaments cannot be disturbed from the posture in which they may happen to be, and evince a spontaneous movement unaffected by external causes. The five filaments of the *Celosia*, Cock's-comb, are connected at their lower part by a membranous web, which in moist weather is relaxed, and the stamens spread for shelter under the concave lobes of the corolla. When the air is dry the contraction of the membrane brings them together, to scatter their pollen in the centre of the flower. The elastic filaments of *Parietaria*, for a while restrained by the calyx, as those of the lovely *Kalmiæ* are by the minute pouches in the corolla, relieve themselves by an elastic spring, which in both instances serves to dash the pollen with great force upon the stigma. The same end is accomplished by the curved germen of *Medicago falcata*, releasing itself by a spring from the closed keel of the flower.

But, of all flowers, that of the Barberry-bush is most worthy the attention of a curious physiologist. In this the six stamens, spreading moderately, are sheltered under the concave tips of the petals, till some extraneous body, as the feet or trunk of an insect in search of honey, touches the inner part of each filament near the bottom. The irritability of that part is such, that the filament immediately contracts there, and consequently strikes its anther, full of pollen, against the stigma. Any other part of the filament may be touched without this effect, provided no concussion be given to the whole. After a while the filament retires gradually, and may again be stimulated; and when each petal, with its annexed filament, is fallen to the ground, the latter on being touched shows as much sensibility as ever. See *Tracts on Nat. History*, 165. I have never detected any sympathy between the filaments, nor is any thing of the kind expressed in the paper just mentioned, though Dr. Darwin, from some unaccountable misapprehension, has quoted me to that effect. It is still more wonderful that the celebrated Bonnet, as stated in Senebier's *Physiologie Végétale*, *v.* 5. 105, should have observed this phenomenon in the Barberry so very inaccurately, as to compare it to the relaxation of a spring, and that the ingenious Senebier himself, in quoting me, *p.* 103, for having ascertained the lower part only of each filament to be irritable, should express himself as follows. "It has not yet been proved that the movement of the stamens is attended with the contraction of the filaments; which nevertheless was the first proof necessary to have been given in order to ascertain their irritability; it is not even yet well known which is the irritable part of the filaments, and whether it be only their base, as Smith has had the address to discover." In answer to which I need only request any one to read the above account, or the more ample detail in my original paper, and above all, to examine a Barberry-blossom for himself; and if any doubts remain concerning the existence of vegetable irritability, let him read Senebier's whole chapter intended to disprove it, where that candid philosopher, while he expresses his own doubts, has brought together every thing in its favour. Among the whole of his facts nothing is more decisive than the remarks of Coulomb and Van Marum on the *Euphorbia*, whose milky juices flow so copiously from a wound, in consequence of the evident irritability of their vessels; but when the life of the plant is destroyed by electricity, all the flowing is at an end. It is superfluous to add any thing on this subject, and I return to that of the impregnation of flowers.

I have already mentioned that any moisture causes the pollen to explode, consequently its purpose is liable to be frustrated by rain or heavy dews. Linnæus observes that husbandmen find their crops of rye to suffer more from this cause than barley, because in the latter the anthers are more protected by the husks; and the Juniper berries are sparingly, or not at all, produced in Sweden when the flowering season has been wet. The same great observer also remarks, what yearly experience confirms, that Cherry-trees are more certainly fruitful than Pear-trees, because in the former the opening of the anthers is, in each blossom, much more progressive, so that a longer period elapses for the accomplishment of the fertilization of the germen, and there is consequently less chance of its being hindered by a few showers.

To guard against the hurtful influence of nocturnal dews or drenching rains, most flowers either fold their petals together, or hang down their heads, when the sun does not shine; by which, their internal organs are sheltered. In some which always droop, as the Snowdrop, *Galanthus*, and Snowflake, *Leucojum*, the Fritillary, the Crown Imperial, various species of *Campanula*, and others, while the over-shadowing corolla keeps off rain, the air has free access underneath to blow the pollen to the stigma. Nor is this drooping caused by the weight of the blossoms, for the fruit in most of them is much heavier, and yet stands erect on the very same stalk. The papilionaceous flowers in general spread their wings in fine weather, admitting the sun and air to the parts within; whereas many of them not only close their petals at night, but also derive additional protection from the green leaves of the plant folding closely about them. *Convolvulus arvensis*, *Anagallis arvensis*, *Callendula pluvialis*, and many others, are well known to shut up their flowers against the approach of rain; whence the *Anagallis* has been called the Poor Man's Weather-glass. It has been observed by Linnæus that flowers lose this fine sensibility, either after the anthers have performed their office, or when deprived of them artificially; nor do I doubt the fact. I have had reason to think that, during a long continuance of wet, the sensibility of the *Anagallis* is sometimes exhausted; and it is evident that very sudden thunder-showers often take such flowers by surprise, the previous state of the atmosphere not having been such as to give them due warning.

That parts of vegetables not only lose their irritability, but even their vital principle, in consequence of having accomplished the ends of their being, appears from an experiment of Linnæus upon Hemp. This is a diœcious plant, see *p.* 154, and Linnæus kept several fertile-flowered individuals in separate apartments from the barren ones, in order to try whether they could perfect their seeds without the aid of pollen. Some few however remained with the barren-flowered plants, and these ripened seed in due time, their stigmas having faded and withered soon after they had received the pollen. On the contrary, the stigmas which had been out of its reach continued green and vigorous, nor did they begin to fade till they had thus lasted for a very long while. Since I read the history of this experiment, I have found it easy, in many plants, to tell, by the appearance of the stigma, whether the seed be fertilized or not. The above experiment is the more important as the Abbé Spallanzani has recorded one made by himself upon the same species of plant, with a contrary result. But as he has said nothing of the appearance of the stigmas, his experiment must yield to that of Linnæus, in point of accuracy; and even if his account be otherwise correct, the result is easily explained. Hemp, Spinach, some Nettles, &c., naturally diœcious, are occasionally not completely so, a few latent barren or fertile flowers being frequently found among those of the other sort, by which provision is made against accidents, and the perfecting of a few seeds, at any rate, secured.

In general, germens whose stigmas have not received the pollen wither away without swelling at all; but some grow to a considerable size, and in such the substance of the seed, its skin, and even its cotyledons, are often to be found, the embryo only being wanting. In a Melon or Cucumber it is common to find, among numerous perfect seeds, many mere unimpregnated husks. In the magnificent *Cycas revoluta* which bore fruit at the late bishop of Winchester's, and of which a history with plates is given in the sixth volume of the Linnæan Society's Transactions, I found the *drupa* and all its contents apparently perfect, except that there was only a minute cavity where the embryo should have been, in consequence of the want of another tree with stamens, which was not to be found perhaps nearer than Japan. Gardeners formerly attempted to assist Nature by stripping off the barren flowers of Melons and Cucumbers, which having no germen, they found could not come to fruit, and were therefore, as they supposed, an unnecessary encumbrance to the constitution of the parent plant. But finding that, by such a practice, they obtained no fruit at all, they soon learned the wiser method of admitting air as often as possible to the flowering plants, for the purpose of blowing the pollen from one blossom to the other, and even to gather the barren kind, and place it over that destined to bear fruit.

The economy of various aquatic plants throws great light upon the subject before us. Different species of *Potamogeton*, *Ruppia maritima*, and others, float entirely under water, often at some considerable depth, till the flowering season arrives, when they rise near the surface, and throw up their flowering spikes above it, sinking afterwards to ripen and sow their seeds at the bottom. *Nymphæa alba* is very truly described by Linnæus in his *Flora Suecica*, as closing its flowers in the afternoon, and laying them down upon the surface of the water till morning, when it raises and expands them, often, in a bright day, to several inches above the water. To this I can speak from my own knowledge, and it is confirmed by the history given by Theophrastus of his *Lotus*, which, according to all appearance, is the *Nymphæa Lotus* of Linnæus. "This," says he, "as well as the *Cyamus*, bears its fruit in a head. The flower is white, consisting of many crowded leaves about as broad as those of a lily. These leaves at sunset fold themselves together, covering the head (or seed-vessel). At sunrise they expand, and rise above the water. This they continue till the head is perfected, and the flowers fall off." So far Theophrastus writes as of his own knowledge; he continues as follows: "It is reported that in the Euphrates the head and flowers keep sinking till midnight, when they are so deep in the water as to be out of reach of the hand, but towards morning they return, and still more as the day advances. At sunrise they are already above the surface, with the flower expanded; afterwards they rise high above the water." Pliny repeats the same account; and Prosper Alpinus, whose purpose is to prove the *Lotus* of Theophrastus not different from the common *Nymphæa*, in which, as far as *genus* is concerned, he is correct, has the following remarkable passage: "The celebrated stories of the *Lotus* turning to the sun, closing its flowers and sinking under water at night, and rising again in the morning, are conformable to what everybody has observed in the *Nymphæa*."

I have been the more particular in the above quotations, because the veracity of Theophrastus has lately been somewhat rudely impeached, on very questionable authority. For my own part, I think what we see of the *Nymphæa* in England is sufficient to render the above account highly probable in a country where the sun has so much more power, even if it did not come from the most faithful and philosophical botanist of antiquity, and I have always with confidence cited it on his authority. The reader, however, will perceive that the only important circumstance for our purpose is the closing of the flowers at night, which is sufficiently well established.

But the most memorable of aquatic plants is the *Valisneria spiralis*, well figured and described by Micheli, *Nov. Gen. t.* 10, which grows at the bottoms of ditches in Italy. In this, the fertile flowers stand on long spiral stalks, and these by uncoiling elevate them to the surface of the water, where the calyx expands in the open air. In the mean while, plenty of barren flowers are produced on a distinct root, on short straight stalks, from which they rise like little separate white bubbles, suddenly expanding when they reach the surface, and floating about in such abundance as to cover it entirely. Thus their pollen is scattered over the stigmas of the first-mentioned blossoms, whose stalks soon afterwards resume their spiral figure, and the fruit comes to maturity at the bottom of the water. All this Micheli has described, without being aware of its final purpose; so different is it to observe and to reason!

Some aquatic vegetables, which blossom under water, seem to have a peculiar kind of glutinous pollen, destined to perform its office in that situation, as *Chara;* as well as the *Fucus* and *Conferva* tribe; but of the real nature of the fructification of these last we can at present only form analogical conjectures.

The fertilization of the Fig is accomplished in a striking manner by insects, as is that of the real Sycamore, *Ficus Sycamorus.* In this genus the green fruit is a hollow common calyx, or rather receptacle, lined with various flowers, seldom both barren and fertile in the same fig. This receptacle has only a very small orifice at the summit. The seeds therefore would not in general be perfected, were it not for certain minute flies of the genus *Cynips,* continually fluttering from one fig to the other, all covered with pollen, and depositing their eggs within the cavity.

A very curious observation is recorded by Schreber and Willdenow concerning the *Aristolochia Clematitis.* The stamens and pistils of this flower are enclosed in its globular base, the anthers being under the stigma, and by no means commodiously situated for conveying their pollen to it. This therefore is accomplished by an insect, the *Tipula pennicornis,* which enters the flower by the tubular part. But that part being thickly lined with inflexed hairs, though the fly enters easily, its return is totally impeded, till the corolla fades, when the hairs lie flat against the sides, and allow the captive to escape. In the mean while the insect, continually struggling for liberty, and pacing his prison round and round, has brushed the pollen about the stigma. I do not doubt the accuracy of this account, though I have never caught the imprisoned *Tipula*.* Indeed I have never seen any fruit formed by this plant. Probably for want of some insect adapted to the same purpose in its own country, the American *Aristolochia Sipho*, though it flowers plentifully, rarely forms fruit in our gardens. That it sometimes does, I have been informed by the late Lady Amelia Hume, since the first edition of this work was published.

The ways in which insects serve the same purpose are innumerable. These active little beings are peculiarly busy about flowers in bright sunny weather, when every blossom is expanded, the pollen in perfection, and all the powers of vegetation in their greatest vigour. Then we see the rough sides and legs of the bee, laden with the golden dust, which it shakes off, and collects anew, in its visits to the honeyed stores inviting it on every side. All nature is then alive, and a thousand wise ends are accomplished by innumerable means that "seeing we perceive not;" for though in the abundance of creation there seems to be a waste, yet in proportion as we understand the subject, we find the more reason to conclude that nothing is made in vain.

CHAP. XXI.—*On the Diseases of Plants, particularly as illustrative of their Vital Principle.*

THE diseases of Vegetables serve in many instances to prove their vitality, and to illustrate the nature of their constitution.

Plants are subject to Gangrene or *Sphacelus*, especially the more succulent kinds, of which a very curious account,

* Dr. Lamb of Newbury sent me specimens of the flowers, with the insect enclosed, from the Oxford garden, where they were discovered by a young gardener.—*August*, 1813.

concerning the *Cactus coccinellifer*, Indian Fig, or Nopal, extremely to our present purpose, is given by M. Thiery De Menonville, in his work on the culture of the Nopal as the food of the Cochineal insect. This writer travelled many years since, through the Spanish settlements in South America, chiefly noted for the cultivation of this precious insect, on purpose to transport it clandestinely to some of the French islands. Such were the supineness and ignorance of the Spaniards, that he succeeded in conveying, not only the living insects, but the bulky plant necessary for their sustenance, notwithstanding severe edicts to the contrary. He had attended previously to the management of the Nopal, and made his remarks on the diseases to which it is liable. Of these the Gangrene is extremely frequent in the true Nopal of Mexico, beginning by a black spot, which spreads till the whole leaf or branch rots off, or the shrub dies. But the same kind of plant is often affected with a much more serious disease, called by Thiery "*la dissolution.*" This seems to be a sudden decay of the vital principle, like that produced in animals by lightning or strong electricity. In an hour's time, from some unknown cause, a joint, a whole branch, or sometimes an entire plant of the Nopal, changes from apparent health to a state of putrefaction or dissolution. One minute its surface is verdant and shining; the next it turns yellow, and all its brilliancy is gone. On cutting into its substance, the inside is found to have lost all cohesion, being quite rotten. The only remedy in this case is speedy amputation below the diseased part. Sometimes the force of the vital principle makes a stand, as it were, against the encroaching disease, and throws off the infected joint or branch. Such is the account given by Thiery, which evinces a power in vegetables precisely adequate to that of the animal constitution, by which an injured or diseased part is, by an effort of Nature, thrown off to preserve the rest.

Nor need we travel to Mexico to find examples of this. Every deciduous tree or shrub exhibits the very same phenomenon; for the fall of their decaying foliage in autumn, leaving the branches and young buds vigorous and healthy, can be explained in no other way. Yet Du Hamel laboured in vain to account for the fall of the leaf;* nor is it wonderful that he or any body else, who endeavours to explain the physiology of vegetables or of animals according to one principle only, whether it be mechanical or chemical, should entirely fail. To consider the fall of leaves in autumn as a sloughing, or casting off diseased or worn out parts, seems so simple and evident, as to be hardly worth insisting upon. Yet I find myself anticipated in this theory by one physiologist only, named Vrolick, cited by Willdenow, in his *Principles of Botany*, *p.* 304, though several learned speculations to no purpose are extant on the subject. It is but just, however, that I should relate what led me to consider the matter with any attention. My friend the late Mr. Fairbairn of Chelsea garden long ago remarked to me, that when he had occasion to transplant any tree or shrub whilst in leaf, he could soon judge of its success by the ease with which its leaves were detached. The consequence of such treatment is more or less injury to the health of the plant, as will first appear by the drooping of the leaves, most of which will probably die, and the decay will generally be extended to the younger more delicate twigs. The exact progress of this decay may speedily be known, by the leaves of those branches which are irrecoverably dying or dead, remaining firmly attached, so as not to be pulled off without a force sufficient to bring away the bark or buds along with them; whereas the leaves of parts that have received no material injury, and where the vital energy acts with due power, either fall off spontaneously, or are detached by the slightest touch. Plants of hot countries, kept in our stoves, exhibit the same phenomenon when transplanted or otherwise injured, even though not naturally deciduous.

So when fruits are thoroughly ripened, they become with respect to the parent plant, dead substances, and, however strongly attached before, are then thrown off as extraneous bodies. Their stalks fade or wither, though the life of the adjoining branch continues unimpaired, and a line of separa-

* See *Phys. des Arbres*, *v.* I. 127.

tion is soon drawn. In a poor soil, or unfavourable climate, a bunch or spike which should naturally consist of a considerable number of flowers, bears perhaps not half so many. Its upper part very early withers, the vital principle ceases to act at the point beyond which it could not continue to act with effect, and all its energy is directed to perfect what lies within the compass of its resources. This is evident in *Lathyrus odoratus*, the Sweet Pea of our gardens, a native of a very hot climate, at the summits of whose flower-stalks are generally found the rudiments of one or more flowers, not attempted to be perfected. So also the first Barley sown on the sandy heaths of Norfolk, and indeed too many a following crop, bears very few grains in an ear; for the same meagre supply of nourishment, bestowed equally on a numerous spike of blossoms, would infallibly starve them all. In like manner one seed only is usually perfected in the best wild Arabian Coffee, known by its round form; while the West Indian plantation Coffee has two in each berry, both consequently flattened on one side. The former grows in barren open places, in situations sufficiently favourable for the impregnation of its blossoms, but far less so for the perfecting of much seed; while the latter, well supplied with manure and moisture, is enabled to bring every germ to maturity.

Very strange effects are often produced upon plants by the attacks of insects, whence the various kinds of Galls derive their origin. These are occasioned by the punctures of those little animals, chiefly of the *Hymenoptera* order, and of the genus *Cynips*, in some vigorous part of the plant, as the leaves, leaf-stalks, young stem or branches, and sometimes the calyx or germen. The parent insect deposits its egg there, which is soon hatched; and in consequence of the perpetual irritation occasioned by the young maggot, feeding on the juices of the plant, the part where it is lodged acquires a morbid degree of luxuriance, frequently swelling to an immoderate size, and assuming the most extraordinary and whimsical shapes. This often happens to the shrubby species of Hawkweed, *Hieracium Sabaudum*, and *umbellatum*, whose stems in consequence swell into oval knots. Several different kinds of Galls are borne by the Oak, as those light spongy bodies, as big as walnuts, vulgarly named Oak apples; a red juicy berry-like excrescence on its leaves; and the very astringent Galls brought from the Levant, for the purposes of dyeing and making ink, which last are produced by a species of *Quercus* different from either of our own. The common Dog-rose frequently bears large moss-like balls, in whose internal parts numerous maggots are always to be found, till they become the winged *Cynips Rosæ*, and eat their way out. Many of our Willows bear round excrescences, as large as peas, on their leaves; and I remember to have been very much astonished in Provence at a fine branched production on the Willows in winter, which appeared like a tufted *Lichen*, but proved on examination a real Gall. Indeed our *Salix Helix*, is called Rose Willow from its bearing no less remarkable an excrescence, like a rose, at the ends of some of its branches, in consequence of the puncture of an insect; and these are in like manner durable, though the proper leaves fall. The Mastic-tree, *Pistachia Lentiscus*, is often laden, in the south of Europe, with large red hollow finger-like bodies, swarming internally with small insects, the *Aphis Pistachiæ* of Linnæus. The young shoots of *Salvia pomifera*, *S. triloba*, and even *S. officinalis*, in consequence of the attacks probably of some *Cynips*, swell into large juicy balls, very like apples, and even crowned with rudiments of leaves resembling the calyx of that fruit. These are esteemed in the Levant for their aromatic and acid flavour, especially when prepared with sugar.

It may be remarked that all the excrescences above-mentioned are generally more acid than the rest of the plant that bears them, and also greatly inclined to turn red. The acid they contain is partly acetous, but more of the astringent kind.

The diseases of the skin, to which many vegetables are subject, are less easily understood than the foregoing. Besides one kind of Honey-dew, already mentioned, *p.* 92, something like leprosy may be observed in *Tragopogon major*, which, as I have been informed by an accurate observer, does not injure the seed, nor infect the progeny. The stem of Shepherd's Purse is occasionally swelled, and a white cream-like crust, afterwards powdery, ensues.* The White Garden Rose, *Rosa alba*, produces, in like manner, an orange-coloured powder. It proves very difficult, in many cases, to judge whether such appearances proceed from a primary disease in the plant, arising from unseasonable cold or wet, or are owing to the baneful stimulus of parasitical *fungi* irritating the vital principle, like the young progeny of insects as above related. Sir Joseph Banks has, with great care and sagacity, traced the progress of the Blight in Corn, *Uredo frumenti*, and given a complete history of the minute fungus which causes that appearance. See *Annals of Botany*, *v.* 2. 51, *t.* 3, 4. Under the inspection of this eminent promoter of science, Mr. Francis Bauer made microscopical drawings of many similar *fungi* infecting the herbage and seeds of several plants, but he has decided that the black swelling of the seed of corn, called by the French *Ergot*, though not well distinguished from other appearances by the generality of our agricultural writers, is indubitably a morbid swelling of the seed, and not in any way connected with the growth of a fungus. The anthers of certain plants often exhibit a similar disease, swelling, and producing an inordinate quantity of dark purplish powder instead of true pollen, as happens in *Silene inflata*, and the white *Lychnis dioica*, whose petals are, not uncommonly, stained all over with this powder. Our knowledge on all these subjects is yet in its infancy; but it is to be hoped, now the pursuits of agriculture and of philosophical botany begin to be, in some distinguished instances, united, such examples will be followed, and science directed to one of its best ends, that of improving useful arts. And here I cannot but mention the experiments continually going on under the inspection of the ingenious Mr. Knight, of fertilizing the germen of one species or variety with the pollen of another nearly akin, as in apples, garden peas, &c., by which, judiciously managed, the advantages of different kinds are combined. By the same means Linnæus obtained intermediate species or varieties of several plants; and if any thing were wanting to confirm his theory respecting

* *Uredo candida, Pers. Syn.* 223. *U. thlaspeos, Sowerb. Fung. t.* 340.

the stamens and pistils, this alone would place it out of all uncertainty.

CHAP. XXII.—*Of the Systematical Arrangement of Plants.—Natural* and Artificial Methods.—Genera, Species, and Varieties.—Nomenclature.*

THE foregoing chapters have sufficiently explained the parts of plants, and the leading differences in their conformation, for us now to proceed to the Systematical portion of our subject. In this, when properly understood and studied, there is no less exercise for the mind, no less employment for its observation and admiration, than in physiological or anatomical inquiries; nor are the organs of vegetables, when considered only as instruments of classification and discrimination, less conspicuous for beauty, fitness, and infinite variety of contrivance, than under any other point of view. The wisdom of an Infinite Superintending Mind is displayed throughout Nature, in whatever way we contemplate her productions.

When we take into consideration the multitude of species which compose the vegetable kingdom, even in any one country or climate, it is obvious that some arrangement, some regular mode of naming and distinguishing them, must be very desirable, and even necessary, for retaining them in our own memory, or for communicating to others any thing concerning them. Yet the ancients have scarcely used any further classification of plants than the vague and superficial division into trees, shrubs, and herbs, except a consideration of their places of growth, and also of their qualities. The earlier botanists among the moderns almost inevitably fell into some rude arrangement of the objects of their study, and distributed them under the heads of Grasses, Bulbous plants, Medicinal or Eatable plants, &c., in which their successors made several improvements, but it is not worth while to contemplate them.

* The subject of the Natural Method will be more amply treated in a separate Chapter.—*Ed.*

The science of Botanical Arrangement first assumed a regular form under the auspices of Conrad Gesner and Cæsalpinus, who, independent of each other, without any mutual communication, both conceived the idea of a regular classification of plants, by means of the parts of fructification alone, to which the very existence of Botany as a science is owing. The first of these has left us scattered hints only, in various letters, communicated to the world after his premature death in 1565: the latter published a system, founded on the fruit, except the primary division into trees and herbs, in a quarto volume printed at Florence in 1583. This work Linnæus studied with great care, as appears from the many notes and marked passages in his own copy now before me. Hence he adopted his ideas of the supposed origin of the calyx, corolla, stamens, and pistils, from the outer bark, inner bark, wood, and pith, which are now proved to be erroneous. In his own *Classes Plantarum* he has drawn out a regular plan of the system of Cæsalpinus, the chief principles of which are the following:

1. Whether the embryo be at the summit or base of the seed.
2. Whether the germen be superior or inferior.
3. Seeds 1, 2, 3, 4, or numerous.
4. Seed-vessels 1, 2, 3, 4, &c.

The work of Cæsalpinus, though full of information, was too deep to be of common use, and excited but little attention. A century afterwards Morison, Professor of Botany at Oxford, improved somewhat upon the ideas of the last-mentioned writer, but has been justly blamed for passing over in silence the source of his own information. Ray, the great English naturalist, formed a considerably different system upon the fruit, as did Hermann, Professor at Leyden, and the great Boerhaave: but in these last there is little originality.

Rivinus, Ruppius and Ludwig in Germany proposed to arrange plants by the various forms of their Corolla, as did Tournefort the illustrious French botanist, whose system is by far the best of the kind; and this having been more celebrated than most others, I shall give a sketch of its plan.

In the first place we meet with the old but highly unphilosophical division into Herbs and Trees, each of which sections is subdivided into those with a Corolla and those without. The trees with a Corolla are again distributed into such as have one or many petals, and those regular or irregular.—Herbs with a Corolla have that part either compound (as the Dandelion, Thistle and Daisy), or simple; the latter being either of one or many petals, and in either case regular or irregular. We come at last to the final sections, or classes, of the Tournefortian system. Herbs with a simple, monopetalous, regular corolla are either bell-shaped or funnel-shaped; those with an irregular one either anomalous or labiate. Herbs with a simple, polypetalous, regular corolla are either cruciform, rosaceous, umbellate, pink-like or liliaceous; those with an irregular one, papilionaceous or anomalous. The subdivisions of the classes are founded on the fruit.

It is easy to perceive that a system of this kind can never provide for all the forms of corolla which may be discovered after its first contrivance; and therefore the celebrated Dr. Garden, who studied by it, assured me, that when he attempted to reduce the American plants to Tournefort's classes, he found them so untractable, that, after attempting in vain to correct or augment the system, he should probably have given up the science in despair, had not the works of Linnæus fallen in his way.

Magnol, Professor at Montpellier, and even Linnæus himself, formed schemes of arranging plants by the calyx, or rather by the floral integuments taken collectively, which nobody has followed.

All preceding systems, and all controversies respecting their superior merits, were laid aside, as soon as the famous Linnæan method of classification, founded on the Stamens and Pistils, became known in the botanical world. Linnæus, after proving these organs to be the most essential of all to the very being of a plant, first conceived the fortunate idea of rendering them subservient to the purposes of methodical arrangement, taking into consideration their number, situation and proportion. How these principles are applied, we shall presently explain; but some previous observations are necessary.

Linnæus first made a distinction between a *natural* and an *artificial* method of botanical arrangement. His predecessors probably conceived their own systems to be each most consonant with the order of Nature, as well as most commodious for use, and it was reserved for him to perceive and to explain that these were two very distinct things.

The most superficial observer must perceive something of the classification of Nature. The Grasses, Umbelliferous plants, Mosses, Sea-weeds, Ferns, Liliaceous plants, Orchises, Compound flowers, each constitute a family strikingly similar in form and qualities among themselves, and no less evidently distinct from all others. If the whole vegetable kingdom could with equal facility be distributed into tribes or classes, the study of Botany on such a plan would be no less easy than satisfactory. But as we proceed in this path, we soon find ourselves in a labyrinth. The natural orders and families of plants, so far from being connected in a regular series, approach one another by so many points, as to bewilder instead of directing us. We may seize some striking combinations and analogies; but the farther we proceed, the more we become sensible that, even if we had the whole vegetable world before us at one view, our knowledge must be imperfect, and that our "genius" is certainly not "equal to the Majesty of Nature." Nevertheless Linnæus, and all true philosophical botanists, since the first mention of the natural affinities of plants, have ever considered them as the most important and interesting branch, or rather the fundamental part, of systematical botany. Without them the science is truly a study of words, contributing nothing to enlarge, little worthy to exercise, a rational mind. Linnæus therefore suggests a scheme which he modestly calls *Fragments of a Natural Method.* This formed the subject of his occasional contemplation; but he daily and hourly studied the principles of natural affinities among plants, conscious that no true knowledge of their distinctions any more than of their qualities, could be obtained without; of which important truth he was not only the earliest, but ever the most strenuous assertor.

In the mean while, however, Linnæus, well aware that a *natural* classification was scarcely ever to be completely discovered, and that if discovered it would probably be too difficult for common use, contrived an *artificial* system, by which plants might conveniently be arranged, like words in a dictionary, so as to be most readily found. If all the words of a language could be disposed according to their abstract derivations, or grammatical affinities, such a performance might be very instructive to a philosopher, but would prove of little service to a young scholar; nor has it ever been mentioned as any objection to the use of a dictionary, that words of very different meanings, if formed of nearly the same letters, often stand together. The Method of Linnæus, therefore, is just such a dictionary in Botany, while his *Philosophia Botanica* is the grammar, and his other works contain the history, and even the poetry of the science.

But before we give a detail of his artificial system, we must first see how this great man fixed the fundamental principles of botanical science. Nor are these principles confined to botany, though they originated in that study. The Linnæan style of discriminating plants has been extended by himself and others to animals, and even fossils; and his admirable principles of nomenclature are applied with great advantage even to chemistry itself, now become so vast and accurate a science.

Independently of all general methods of classification, whether natural or artificial, plants, as well as animals, are distinguished into *Genera*,* *Species*, and *Varieties*.

By Species are understood so many individuals, or, among the generality of animals, so many pairs, as are presumed to have been formed at the creation, and have been perpetuated

* Our scientific language in English is not sufficiently perfect to afford a plural for genus, and we are therefore obliged to adopt the Latin one, genera, though it exposes us sometimes to the horrors of hearing of "*a* new *genera*" of plants.

ever since; for though some animals appear to have been exterminated, we have no reason to suspect any new species has been produced; neither have we cause to suppose any species of plant has been lost, nor any new one permanently established, since their first formation, notwithstanding the speculations of some philosophers. We frequently indeed see new Varieties, by which word is understood a variation in an established species; but such are imperfectly, or for a limited time, if at all, perpetuated in the offspring.

A Genus comprehends one or more species, so essentially different in formation, nature, and often many adventitious qualities from other plants, as to constitute a distinct family or kind, no less permanent, and founded in the immutable laws of the creation, than the different species of such a genus. Thus in the animal kingdom, a horse, ass and zebra form three species of a very distinct genus, marked, not only by its general habit or aspect, its uses and qualities, but also by essential characters in its teeth, hoofs, and internal constitution. The lion, tiger, leopard, panther, lynx, cat, &c., also compose another sufficiently obvious and natural genus, and the numerous herd of monkeys, apes and baboons, a third. The hippopotamus is, as far as we know, a solitary species of a most distinct and striking genus; and the elephant has, till lately, been thought to stand alone in another.

So among vegetables, the various species of rose compose a beautiful genus, known to every one who ever looked at a plant, merely by a certain combination of ideas, but essentially distinguished, as we shall hereafter find, by clear and decisive characters. The species of *Iris* form also a numerous genus, and the Willows another; while the curious *Epimedium alpinum* is too singular and distinct to be associated with any known plant besides, and constitutes a genus by itself,* as well as the *Adoxa* and *Linnæa.*

The first great and successful attempt to define the genera of plants was made by Tournefort, and in this his transcendent merit will ever be conspicuous, though his system of

* Prof. De Candolle has a new Persian species, *E. pinnatum,* in his *Syst. Veget.* 2. 29, (and Dr. Hooker another, *E. hexandrum,* from the N.W. coast of America, published in his *Flora Boreali-Americana, v.* 1. *t.* 13. *Ed.*)

arrangement should be entirely forgotten. Not that he has excelled in verbal definitions, nor built all his genera on sure foundations; but his figures, and his enumerations of species under each genus, show the clearness of his conceptions, and rank him as the father of this branch of botany.

Linnæus first insisted on generic characters being exclusively taken from the seven parts of fructification, and he demonstrated these to be sufficient for all the plants that can be discovered. He also laid it down as a maxim, that all genera are as much founded in nature as the species which compose them; and hence follows one of the most just and valuable of all his principles, that *a genus should furnish a character, not a character form a genus;* or, in other words, that a certain coincidence of structure, habit, and perhaps qualities, among a number of plants, should strike the judgment of a botanist, before he fixes on one or more technical characters, by which to stamp and define such plants as one natural genus. Thus the *Hemerocallis cærulea* and *alba*, though hitherto referred by all botanists to that genus, are so very different from the other species in habit, that a discriminative character might with confidence be expected in some part or other of their fructification, and such a character is accordingly found in the winged seeds. Yet in the natural genera of *Arenaria* and *Spergula*, winged or bordered seeds are so far from indicating a distinct genus, that they are found insufficient to constitute even a specific character. So *Blandfordia*, *Suppl. f.* 148, is well distinguished from *Aletris*, with which some botanists have confounded it, by its hairy seeds; but the same circumstance will not justify us in separating a few species from *Convolvulus*, which are attached to that genus by stronger ties of another kind.

Some genera are obvious and indubitable both in habit and character, as *Quercus*, *Rosa*, *Euphorbia*, *Begonia*, and *Sarracenia;* others are obvious, but their character extremely difficult to define, as *Valeriana*. The greatest difficulty lies in distinguishing genera that belong to such very natural orders as the Grasses and Umbelliferous plants: and the ablest botanists differ about the best guides in these two particular cases. Yet other orders, equally natural, sometimes afford very excellent generic differences, like that to which *Rosa*, *Rubus*, *Fragaria*, &c., belong; and even in the Papilionaceous plants with ten distinct stamens, a tribe hitherto judged inextricable, a regular examination on scientific principles has led to the discovery of very natural well-defined genera. See *Annals of Botany*, *v.* 1. 501. I have in a preceding chapter hinted that the Umbelliferous plants seem to me very capable of being well discriminated by their seeds, and other botanists have held the same opinion: but the parts of the flower must also be taken into account. See *Engl. Fl. v.* 2.

But though I feel convinced, as far as my experience goes, that genera are really founded in nature, I am far from asserting that Linnæus, or any other writer, has succeeded in fixing all their just limits. This deep and important branch of natural science requires the union of various talents. Many persons who can perceive a genus cannot define it; nor do acuteness of perception, solidity of judgment, and perspicuity of expression, always meet in the same person. Those who excel in this department are named by Linnæus, *Phil. Bot. sect.* 152, theoretical botanists; those who study only species and varieties, practical ones.

In methodical arrangement, whether natural or artificial, every thing must give way to generic distinctions. A natural system which should separate the species of a good genus, would, by that very test alone, prove entirely worthless; and if such a defect be sometimes unavoidable in an artificial one, contrivances must be adopted to remedy it; of which Linnæus has set us the example, as will hereafter be explained.

Generic characters are reckoned by Linnæus of three kinds, the *factitious*, the *essential*, and the *natural*, all founded on the fructification alone, and not on the inflorescence, nor any other part.

The first of these serves only to discriminate genera that happen to come together in the same *artificial* order or section; the second, to distinguish a particular genus, by one striking mark, from all of the same *natural* order, and consequently from all other plants; and the third comprehends every possible mark common to all the species of one genus.

The *factitious* character can never stand alone, but may sometimes, commodiously enough, be added to more essential distinctions, as the insertion of the petals in *Agrimonia*, indicating the Natural Order to which the plant belongs, which character, though essential to that order, here becomes factitious.

Linnæus very much altered his notions of the *essential* character after he had published his *Philosophia Botanica*, whence the above definitions are taken. Instead of confining it to one mark or idea, he, in his *Systema Vegetabilium*, makes it comprehend all the distinctions requisite to discriminate each genus from every other in the system, only avoiding a repetition at every step of the characters of the artificial class and order, which stand at the top of each page, and are not always essential to the character of the genus. This is the kind of generic character now universally adopted, and indeed the only one in common use. The learned Jussieu has given it the sanction of his approbation and adoption, as far as its plan is concerned, throughout his immortal work, subjoining in a different type such characters and remarks as belong to the habit, or refer to other circumstances. For my own part, I profess to retain, not only the plan, but the very words of Linnæus, unless I find them erroneous, copying nothing without examination, but altering with a very sparing hand, and leaving much for future inquiry. I cannot blame my predecessors for implicitly copying the Linnæan characters, nor should I have been the first among the English writers to set a contrary example, had I not fortunately been furnished with peculiar materials for the purpose.

The beauty and perfection of these essential generic characters consist in perspicuity, and a clear concise style of contrasting them with each other. All feebleness, all superfluity, should be avoided by those who are competent to the purpose, and those who are not should decline the task. Comparative words, as *long* or *short*, without any scale of comparison, are among the grossest, though most common, faults in such compositions.

The *natural* character seems to have been, at one time, what Linnæus most esteemed. It is what he has used throughout his *Genera Plantarum*, a work now superseded by the essential characters in his *Systema Vegetabilium* and therefore in some measure laid aside. The disadvantages of the natural character are, that it does not particularly express, nor direct the mind to, the most important marks, and that it can accord only with such species of the genus as are known to the author, being therefore necessarily imperfect. This kind of character is, however, admirable for the illustration of any difficult Natural Order. Mr. Ker's elucidations of the *Ensatæ*, Sword-leaved plants, *Annals of Botany*, *v.* 1. 219, and *Curt. Mag.*, see also *Suppl. f.* 151—153, afford excellent specimens of it, serving as a store of facts and observations for following systematical writers.

Specific characters should be constructed on similar principles to the generic ones, as far as regards certainty, clearness and conciseness. The genus being first well defined we are to seek for characters, not mentioned among the generic marks, for distinguishing the species. A specific difference for a solitary species of any genus, is therefore an absurdity. Linnæus at first intended his specific definitions should be used as names; but the invention of trivial names happily set aside this inconvenient scheme. On this account however he limited each to twelve words, a rule to which all philosophical naturalists have adhered, except in cases of great necessity. Nor is the admission of one or two words beyond the allotted number reprehensible, provided the whole sentence be so neatly and perspicuously constructed, that the mind may comprehend it, and compare it with others, at one view; but this can hardly be done when the words much exceed twelve. This rule, of course, can be strictly applied to Latin definitions only, though it should be kept in view in any language, as far as the genius of that language will allow. Linnæus says, "Genuine specific distinctions constitute the perfection of natural science;" which is strongly confirmed by the striking inferiority of most botanists, in this department, to that great man, and especially by the tedious feebleness and insufficiency, displayed among those who court celebrity by despising his principles.

In constructing generic and specific characters, the arrangement of the different parts on which they are founded is to be considered. Such as are most important in the Natural Order, or genus, are to stand first, and the subordinate, or more peculiar marks of the object before us, ought to close the sentence. On the contrary, in drawing up natural characters of a genus, as well as full descriptions of particular plants, it is proper to take, in the former instance, the calyx, corolla, stamens, pistils, seed-vessels, seed, and receptacle; and in the latter, the root, stem, leaves, appendages, flower and fruit, in the order in which they naturally occur.

Nomenclature is no less essential a branch of methodical science than characteristic definitions; for, unless some fixed laws, or, in other words, good sense and perspicuity be attended to in this department, great confusion and uncertainty must ensue.

The vague names of natural objects handed down to us, in various languages, from all antiquity, could have no uniformity of derivation or plan in any of those languages. Their different origins may be imagined, but cannot be traced. Many of these, furnished by the Greek or Latin, are retained as generic names in scientific botany, though neither their precise meaning, nor even the plants to which they originally belonged, can always be determined, as *Rosa*, *Ficus*, *Piper*, &c. It is sufficient that those to which they are now, by common consent, applied, should be defined and fixed. Botanists of the Linnæan school, however, admit no such generic names from any other language than the Greek or Latin, all others being esteemed barbarous. Without this rule we should be overwhelmed, not only with a torrent of uncouth and unmanageable words, but we should be puzzled where to fix our choice, as the same plant may have fifty different original denominations in different parts of the world, and we might happen to choose one by which it is least known. Thus, the celebrated Indian plant now proved beyond all doubt to be the *Cyamus* of Theophrastus,* having

* See *Exot. Bot. v.* 1. 60, where the arguments in support of this opinion are given, and *Curt. Mag. t.* 903, where some of them are with much candour and

been erroneously reckoned by Linnæus a *Nymphæa*, received from Gærtner, one of the first who well distinguished it as a genus, the Ceylon name of *Nelumbo;* which being contrary to all rules of science, literature, or taste, for a generic name, has by others been made into bad Latin as *Nelumbium.* But the universal Hindu name of the plant is *Tamarà*, which, independent of barbarism, ought to have been preferred to the very confined one of *Nelumbo.* In like manner the Bamboo, *Arundo Bambos* of Linnæus, proving a distinct genus, has received the appellation of *Bambusa*, though Jussieu had already given it that of *Nastus*, from Dioscorides.* Perhaps the barbarous name of some very local plants, when they cannot possibly have been known previously by any other, and when that name is harmonious and easily reconcileable to the Latin tongue, may be admitted, as that of the Japan shrub *Aucuba;* but such a word as *Ginkgo* is intolerable. The Roman writers, as Cæsar, in describing foreign countries, have occasionally latinized some words or names that fell in their way, which may possibly excuse our making *Ailanthus* of *Aylanto*, or *Pandanus* of *Pandang.* Still I can only barely tolerate such names out of deference to the botanical merits, not the learning, of their contrivers; and I highly honour the zeal and correctness of Mr. Salisbury, who, in defiance of all undue authority, has ever opposed them, naming *Aucuba*, on account of its singular base or receptacle, *Eubasis.* I know not how *Pandanus* escaped his reforming hand, especially as the plant has already a good characteristic Greek name in the classical Forster, *Athrodactylis.*

Excellent Greek or Latin names are such as indicate some striking peculiarity in the genus; as *Glycyrrhiza*, a sweet root, for the Liquorice; *Amaranthus*, without decay, for an

ingenuity controverted, though not so as to alter my sentiments; nor can any thing justify the use of *Nelumbium* in a scientific work as a *generic* name.

* It is not indeed clear that this name is so correctly applied as that of *Cyamus*, because *Nastus* originally belonged to "a reed with a solid stem," perhaps a palm; but not being wanted, nor capable of being correctly used, for the latter, it may very well serve for the Bamboo. There is no end of raking up old uncertainties about classical names.

everlasting flower; *Helianthus*, a sunflower; *Lithospermum*, a stony seed; *Eriocalia**, *f.* 205, a flower with a singularly woolly base or cup; *Origanum*, an ornamental mountain plant; *Hemerocallis*, a beauty of a day; *Arenaria*, a plant that inhabits sandy places; and *Gypsophila*, one that loves a chalky soil. Such as mark the botanical character of the genus, when they can be obtained for a nondescript plant, are peculiarly desirable; as *Ceratopetalum*, *Suppl. f.* 244, from the branched horn-like petals; *Lasiopetalum*, from the very singularly woolly corolla; *Calceolaria*, from the shoe-like figure of the same part; *Conchium*, from the exact resemblance of its fruit to a bivalve shell.

In all ages it has been customary to dedicate certain plants to the honour of distinguished persons. Thus *Euphorbia* commemorates the physician of Juba a Moorish prince, and *Gentiana* immortalizes a king of Illyria. The scientific botanists of modern times have adopted the same mode of preserving the memory of benefactors to their science; and though the honour may have been sometimes extended too far, that is no argument for its total abrogation. Some uncouth names thus unavoidably deform our botanical books; but this is often effaced by the merits of their owners, and it is allowable to model them into grace as much as possible. Thus the elegant Tournefort made *Gundelia* from Gundelscheimer; which induced me to choose *Goodenia*, for my much honoured and valued friend Dr. Goodenough, now bishop of Carlisle, though it has, when too late, been suggested that *Goodenovia* might have been preferable. Some difficulty has arisen respecting French botanists on account of the additional names by which their grandeur, or at least their vanity, was displayed during the existence of the old monarchy. Hence *Pittonia* was applied to the plant consecrated to Pitton De Tournefort; but Linnæus preferred the name by which alone he was known out of his own country, or in learned language, and called the same genus *Tourne-*

* When I named this genus in Exotic Botany, I was not aware of its having previously been published by M. La Billardière under the name of *Actinotus*; a name, however, not tenable in Botany, because it has long been pre-occupied in Mineralogy.

fortia. Thus we have a *Fontainesia* and a *Louichea*, after the excellent Louiche Desfontaines; but the latter proving a doubtful genus, or, if a good one, being previously named *Pteranthus*, the former is established. We have even in England, by a strange oversight, both *Stuartia, Suppl. f.* 51, 52, and *Butea*, after the famous earl of Bute; but the former being long ago settled by Linnæus, the latter, since given by Kœnig, is totally inadmissible on any pretence whatever, except perhaps in memory of the late marchioness, to whom our gardens are indebted. In like manner my own *Humea*, *Exot. Bot. t.* 1, has been called in France *Calomeria*, after the late emperor, by the help of a pun, though there has long been another genus *Bonapartea*, which last can possibly be admitted only in honour of the divorced empress, and not of her former consort, who had no botanical pretensions. Our late beloved sovereign could derive no glory from the *Georgia** of Ehrhart; but the *Strelitzia* of Aiton, *Suppl. f.* 154, stands on the sure basis of botanical knowledge and zeal, to which I can bear ample and very disinterested testimony.

Linnæus, in his entertaining book, *Critica Botanica*, *p.* 79, has in several instances drawn a fanciful analogy between botanists and their appropriate plants, thus,—

Bauhinia, after the two distinguished brothers John and Caspar Bauhin, has a two-lobed or twin leaf.

Scheuchzeria, a grassy alpine plant, commemorates the two Scheuchzers, one of whom excelled in the knowledge of alpine productions, the other in that of grasses.

Dorstenia, *Suppl. f.* 272, with its obsolete flowers, devoid of all beauty, alludes to the antiquated and uncouth book of Dorstenius.

Hernandia, an American plant, the most beautiful of all trees in its foliage, but furnished with trifling blossoms, bears the name of a botanist highly favoured by fortune, and allowed an ample salary for the purpose of investigating the natural history of the Western world, but whose labours have not answered the expense. On the contrary,

* *Tetraphis* of Hedwig, and *Engl. Bot. t.* 1020.

Magnolia, *Suppl. f.* 229, with its noble leaves and flowers, and

Dillenia, *Suppl. f.* 230, 231, with its beautiful blossoms and fruit, serve to immortalize two of the most meritorious among botanists.

Linnæa, *Suppl. f.* 200, "a depressed, abject, Lapland plant, long overlooked, flowering at an early age, was named by Gronovius after its prototype Linnæus."

In pursuance of the same idea, *Dicksonia*, a beautiful and curious fern, is well devoted to our great cryptogamist; *Knappia*, a small and singular grass, to an author celebrated for his minute and curious drawings of that tribe; *Sprengelia*, to one distinguished for illustrating the impregnation of plants, which the remarkable form and union of its anthers serve to indicate; while *Smithia sensitiva*, named by Mr. Dryander in the *Hortus Kewensis* of our mutual friend Aiton, could at that time be merited only by a treatise on the Irritability of Plants,* to which the specific name happily alludes.

The generic name being fixed, the specific one is next to be considered. With respect to this, Rivinus has the merit of originality, having been the first to contrive naming each plant in two words. But his names were meant for specific definitions, for which they are totally inadequate. Linnæus, in constructing his more accurate and full specific characters, intended the latter should serve as names, and therefore called them *nomina specifica*. When he, most fortunately for the science and for the popularity of his whole System of Nature, invented the present simple specific names, he called them *nomina trivialia*, trivial, or for common use; but that term is now superfluous.

Specific names should be formed on similar principles to the generic ones; but some exceptions are allowed, not only without inconvenience, but with great advantage. Such as express the essential specific character are unexceptionable, as *Banksia serrata*, *integrifolia*, *dentata*, &c.; but perhaps

* *Phil. Trans. for* 1788.

those which express something equally certain, but not comprehended in that character, are still more useful, as conveying additional information, like *Ixora alba* and *coccinea*, *Scleranthus annuus* and *perennis*, *Aletris fragrans*, *Saxifraga cernua*, &c.; for which reason it is often useful that vernacular names should not be mere translations of the Latin ones. Comparative appellations are very good, as *Banksia ericifolia*, *Andromeda salicifolia*,* *Saxifraga bryoides*, *Milium cimicinum*, *Elymus Hystrix*, *Pedicularis Sceptrum*. Names which express the local situations of different species are excellent, such as *Melampyrum arvense*, *pratense*, *nemorosum* and *sylvaticum*, *Carex arenaria*, *uliginosa* and *sylvatica*, as well as *aquatica*, *maritima*, *rupestris*, *alpina*, *nivalis*, used for many plants. But names derived from particular countries or districts are liable to much exception, few plants being sufficiently local to justify their use. Thus *Ligusticum* (*Physospermum*, *Brit. Fl.*) *Cornubiense* is found, not only in Cornwall, but in Portugal, Italy, and Greece; *Schwenkia Americana* grows in Guinea as well as in South America. Such therefore, though suffered to remain on the authority of Linnæus, will seldom or never be imitated by any judicious writer, unless *Trollius Europæus* and *Asiaticus* may justify our naming the third species of that genus, subsequently brought from America, *Americanus*. The use of a plant is often commodiously expressed in its specific name, as *Brassica oleracea*, *Papaver somniferum*, *Inocarpus edulis;* so is likewise its time of flowering, as *Primula veris*, *Leucojum vernum*, *æstivum* and *autumnale*, and *Helleborus hyemalis*.

When a plant has been erroneously made a distinct genus, the name so applied to it may be retained for a specific appellation, as *Lathræa Phelypæa*, and *Bartsia Gymnandra;* which may also be practised when a plant has been celebrated, either in botanical, medical, or any other history, by a particular name, as *Origanum Dictamnus*, *Artemisia Dracunculus*, *Laurus Cinnamomum*, *Selinum Carvifolia*, *Carica Papaya*. In either case the specific name stands as a substantive,

* Some botanists write *ericæfolia*, *salicisfolia*, *linguæformis*, &c., instead of following the analogy of the Latin in forming adjectives with an *i*, as *palmifer* from *palma*, *æ*; *baccifer*, from *bacca*, *æ*; *barbiger*, from *barba*, *æ*; &c.

retaining its own gender and termination, and must begin with a capital letter; which last circumstance should be observed if a species be called after any botanist who has more particularly illustrated it, as *Cortusa Matthioli* and *C. Gmelini*, *Duranta Plumierii*, and *Mutisii*. The latter genus suggests an improvement in such kind of names. The genitive case is rightly used for the person who founded the genus *D. Plumierii; D. Mutisiana* might serve to commemorate the finder of a species, while *D. Ellisia* implies the plant which bears it to have been once called *Ellisia*.

There is another sort of specific names in the genitive case, which are to me absolutely intolerable, though contrived by Linnæus in his latter days. These are of a comparative kind, as *Lobelia Columneæ*, meaning *Columneæ formis*. We may allow a few such, already established, to remain, but no judicious author will imitate them.

Botanists occasionally adapt a specific name to some historical fact belonging to the plant or to the person whose name it bears, as *Linnæa borealis* from the great botanist of the north: *Murræa exotica* after one of his favourite pupils, a foreigner; *Browallia demissa* and *elata*, from a botanist of humble origin and character, who afterwards became a lofty bishop, and in whose work upon Water I find the following quotation from Seneca in the hand-writing of Linnæus: "Many might attain wisdom, if they did not suppose they had already reached it." In like manner *Buffonia tenuifolia* is well known to be a satire on the *slender* botanical pretensions of the great French zoologist, as the *Hillia parasitica* of Jacquin, though perhaps not meant, is an equally just one upon our pompous Sir John Hill. I mean not to approve of such satires. They stain the purity of our lovely science. If a botanist does not deserve commemoration, let him sink peaceably into oblivion. It savours of malignity to make his crown a crown of thorns, and if the application be unjust, it is truly diabolical.

Before I conclude the subject of nomenclature, I beg leave to offer a few reflections on changes of established names. It is generally agreed among mankind that names of countries, places, or things, sanctioned by general use, should be sacred;

and the study of natural history is, from the multitude of objects with which it is conversant, necessarily so encumbered with names, that students require every possible assistance to facilitate the attainment of those names, and have a just right to complain of every needless impediment. The grateful Hollanders named the island of Mauritius after the hero who had established their liberty and prosperity; and it ill became the French, at that period dead to such feelings, to change it, when in their power, to *Isle de France*, by which we have in some late botanical works the barbarous Latin of *Insula Franciæ*. Nor is it allowable to alter such names, even for the better. Amerigo Vespucci had no very great pretensions to give his own name to a quarter of the world, yet it is scarcely probable that Columbia will ever supersede America. In our science the names established throughout the works of Linnæus are become current coin, nor can they be altered without great inconvenience. Perhaps, if he had foreseen the future authority and popularity of his writings, he might himself have improved upon many which he adopted out of deference to his predecessors,* and it is in some cases to be regretted that he has not sufficiently done so. In like manner, the few great leaders in natural knowledge must and will be allowed to ward off and to correct, from time to time, all that may deform or enfeeble the prevailing system. They must choose between names nearly of the same date, and even between good and bad ones of any date.† A

* See *Linnæan Correspondence, v.* 1. 128, where Linnæus declares he retained *Mirabilis* and *Gloriosa*, merely out of deference to former writers. Yet for these very names Jussieu censures him, *Gen. Pl. præf.* 24.

† I cannot but wish the very eminent Prof. De Candolle had assumed this privilege, so justly his due, in order to do good instead of mischief to the nomenclature of botany. But with him priority of date regulates every thing. He indeed leaves the names of Linnæus untouched, whilst all other authorities, together with sense, taste, and learning, are levelled without distinction. Classical names, long since established by those distinguished and authentic writers, Swartz, Schreber, L'Héritier, Solander, and others, give way to the barbarous and exquisitely uncouth ones of Aublet, which Jussieu himself professed to retain for a time only, and, as he has often declared to me in conversation, till Banks and Solander should publish their new genera. But Solander, alas! was taken away; the new genera in the *Hortus Kewensis* are the only fruits, that the world has seen, of his learning and labour, and these are now arbitrarily changed.

botanist who, by the strength of his own superior knowledge and authority, reforms and elucidates a whole tribe of plants hitherto in confusion, as a Hedwig in Mosses, or Acharius in Lichens, ought to be unshackled in every point in which he can be of service. His wisdom will be evinced by extreme caution and reserve, in using this liberty with respect to new names, but more especially new terms; and, after all, he will be amenable to the general tribunal of botanists, and the judgment of those who come after him. Few indeed are illustrious enough to claim such privileges as these. Those who alter names, often for the worse, according to arbitrary rules of their own, or in order to aim at consequence which they cannot otherwise attain, are best treated with silent neglect. The system should not be encumbered with such names, even as synonyms.

When, however, solid discoveries and improvements are made in the science; when species or genera have been confounded by Linnæus himself, and new ones require to be separated from them, the latter must necessarily receive appropriate appellations; as also when a totally wrong and absurd name has by mistake been given, as *Begonia Capensis.* In such cases names must give place to things, and alterations proceeding from such causes must be submitted to. Thus Mr. Salisbury has well divided *Nymphæa.*

A great and just complaint has arisen in my time among the cultivators of botany, who found the names of many garden plants, with which they had long been conversant, altered for others without any apparent cause, and in many instances for the worse; as *Aristolochia macrophylla*, an excellent and expressive name, for a very inappropriate one, *A. Sipho.* For this I am obliged to censure my much regretted and very intelligent friend, L'Héritier. When he came to England to reap the rich harvest of our undescribed plants, he paid no respect to the generic or specific names by which Dr. Solander or others had called them, because those names were not printed; but he indulged himself, and perhaps thought he confirmed his own importance, by contriving new ones; a factitious mode of gaining celebrity, to which his talents ought to have been infinitely superior. Nor would it have been easy to say how far this inconvenient plan of innovation might have extended, had not the *Hortus Kewensis* come forth to secure our remaining property.

I have only to add a few words respecting a kind of generic names that has of late become more common than Linnæus probably would have approved, though he has once or twice allowed it. I allude to those compounded either of two established names, or of one combined with any other word. Of the former number is *Calamagrostis*, formed of *Calamus* and *Agrostis*, two Linnæan names; and this is nowhere sanctioned by any good authority. Happily the genus to which it has negligently been applied is an *Arundo*. Of the latter sort is *Cissampelos*, formed of *Cissus*, another established genus, and *Ampelos*, a Vine; the latter not among Linnæan names: also *Elæagnus*, constructed of two old Greek names, neither of which is now in botanical use by itself. These are both expressly allowed by Linnæus, nor indeed can there be any objection to the latter. *Cissampelos* may certainly justify *Hyoscyamus*, composed of *Cyamus*, and a word denoting swine; if not, this would prove an objection to the re-establishment of *Cyamus*, much more to the purpose than any that has been advanced; for *Hyoscyamus* having been so long and universally used in systematic botany, could scarcely give place even to its venerable prototype. On the same ground only can several new generic names, used in the fern tribe, be admitted. These are formed out of *Pteris*, the established generic appellation of a common Brake, with some other Greek word prefixed; as *Angiopteris*, a Brake with a capsule, *Tmesipteris*, a cloven Brake, and *Cænopteris*, a *new* Brake. Whatever may become of the former two, I must always protest against the last, given by the celebrated Bergius to the *Darea* of Jussieu, on account of its unexampled impropriety. As well might any new genus, resembling a Rose, be called *Novarosa;* for though the Greek language may assist us with regard to *sound*, it can never make amends for a radical deficiency of *sense*.

Chap. XXIII.—*Explanation of the Linnæan Artificial System.*

The Linnæan System is, as I have already observed, professedly artificial. Its sole aim is to help any one to learn the name and history of an unknown plant in the most easy and certain manner, by first determining its Class and Order in this system; after which its Genus is to be made out by comparing the parts of fructification with all the generic characters of that Order; and finally its Species, by examining all the specific definitions of the Genus. We thus ascertain the generic and specific names of our plant in Linnæus, and under those we find an enumeration more or less ample, of its Synonyms, or the different appellations it has received from other writers, with a reference to figures in various books; and as Linnæus always cites Bauhin's *Pinax*, which is the common botanical catalogue, or index to all previous works, we thus gain a clue to every thing recorded concerning our plant. Of all this mass of information and entertainment we shall find nothing more concise, luminous, or engaging, either with respect to the distinctions, uses, or history of plants, than what is diffused through the various publications of Linnæus himself; and the same may, with at least equal truth, be said of those of his works which illustrate the Animal kingdom. His magic pen turns the wilds of Lapland into fairy land. He has all the animals of Sweden, as much at his call, as our first parent while the terrestrial paradise was as yet in primeval tranquillity. No writer whatever has rendered the natural productions of the happiest and most luxuriant climates of the globe, half so interesting or instructive, as Linnæus has made those of his own northern country.

The Classes of the Linnæan System are 24, and their distinctions are founded on the number, situation, or proportion of the Stamens. The Orders are founded either on the number of the Pistils, or on some circumstance equally easy, which we shall in due time explain.

The first eleven Classes are characterized solely by the number of the Stamens, and distinguished by names of Greek derivation, expressive of these distinctions.

1. Monandria.	Stamen	1.	A small Class.
2. Diandria.	Stamens	2.	
3. Triandria.	———	3.	
4. Tetrandria.	———	4.	
5. Pentandria.	———	5.	A numerous Class.
6 Hexandria.	———	6.	
7. Heptandria.	———	7.	A very small Class.
8. Octandria.	———	8.	
9. Enneandria.	———	9.	A small Class.
10. Decandria.	———	10.	
11. Dodecandria.	———	12 to 19.	

12. Icosandria. Stamens 20 or more, *inserted into the Calyx.* Here we first find the *situation* of the Stamens taken into consideration. They grow out of the sides of the calyx, often from a sort of ring, as in the Strawberry. This is truly a natural Class, as are several of the following ones; so that in these instances the Linnæan method of arrangement performs more than it promises. The character of this Class is the more important, as such a mode of insertion indicates the pulpy fruits which accompany it to be infallibly wholesome, and this holds good, not only when the stamens are numerous, but in all other cases. Thus *Ribes*, the Currant and Gooseberry genus, whose five stamens grow out of the calyx, stands in the fifth Class, a wholesome fruit, among many poisonous berries. No traveller in the most unknown wilderness need scruple to eat any fruit whose stamens are thus situated; while on the other hand he will do well to be cautious of feeding on any other parts of the plant.

13. Polyandria. Stamens numerous, commonly more so than in the last Class, and *inserted into the Receptacle*, or base of the flower, as in the Poppy, Anemone, &c. The plants of this fine and numerous Class are very distinct in nature, as well as character, from those of *Icosandria.*

14. Didynamia. Stamens two long and two short. Here *proportion* comes to our assistance. This is a natural Class, and contains most of the Labiate, Ringent or Personate flowers, as the Dead-nettle, Snap-dragon, Foxglove, &c.

15. Tetradynamia. Stamens four long and two short. A very natural Class, comprehending all the Cruciform flowers, as the Wall-flower, Stock, Radish, Mustard, &c. *Cleome* only does not properly belong to the rest.

16. Monadelphia. Stamens united by their filaments, more or less extensively, into one tube, as the Mallow tribe, in which such union is very remarkable, and the Geranium family, in which it is less evident.

17. Diadelphia. Stamens united into two parcels, both sometimes cohering together at the base. This Class consists of or rather includes the Papilionaceous flowers, and is therefore so far natural, except that some such genera, having distinct Stamens, are excluded, and referred to the tenth Class, in consideration of their numbers solely; as some ringent flowers with only two Stamens are necessarily placed, not in the fourteenth Class, but the second.

18. Polyadelphia. Stamens united into more than two parcels, as in St. John's-wort. A small Class, in some points related to *Icosandria*.

19. Syngenesia. Stamens united by their Anthers into a tube, rarely by their Filaments also; and the flowers are Compound. A very natural and extremely numerous Class. Examples of it are the Dandelion, Daisy, Sunflower, &c.

20. Gynandria. Stamens united with, or growing out of the Pistil; either proceeding from the Germen, as in *Aristolochia*, or from the Style, as in the Orchis family. The Passion-flower is wrongly put by Linnæus and

others into this Class, as its stamens merely grow out of an elongated receptacle or column supporting the Germen.

21. Monoecia. Stamens and Pistils in separate flowers, but both growing on the same plant, or, as the name expresses, dwelling in one house, as the Oak, Hasel, and Fir.

22. Dioecia. Stamens and Pistils not only in separate flowers, but those flowers situated on two separate plants, as in the Willow, Hop, Yew, &c.

These two last Classes are natural when the barren flowers have, besides the difference in their essential organs, a different structure from the fertile ones in other respects; but not so when they have the same structure, because then both organs are liable to meet in the same flower. In some plants, like *Rhodioia*, each flower has always the rudiments of the other organ, though generally inefficient.

23. Polygamia. Stamens and pistils separate in some flowers, united in others, either on the same plant, or on two or three different ones.

This class is natural only when the several flowers have a different structure, as those of *Atriplex;* but in this genus the Pistil of the united flower scarcely produces seed. If with Linnæus, we admit into *Polygamia* every plant on which some separated barren or fertile flowers may be found among the united ones, while all agree in general structure, the Class will be overwhelmed, especially with Indian trees. I have therefore proposed that regard should be had to their general structure, which removes all such inconvenience, and renders the Class much more natural.

24. Cryptogamia. Stamens and Pistils either not well ascertained, or not to be numbered with any certainty, insomuch that the plants cannot be referred to any of the foregoing Classes. Of this, Ferns, Mosses, Lichens, Seaweeds and Mushrooms are examples.

Appendix. PALMÆ, Palm-trees, a magnificent tribe of plants, chiefly tropical, whose flowers were too little known, when Linnæus wrote, to serve the purposes of classification; but they are daily clearing up, and the Palms are found generally to belong to the Classes *Monoecia*, *Dioecia*, or *Hexandria*.

The ORDERS of the Linnæan System are, in the first thirteen Classes, founded on the number of the Styles, or on that of the Stigmas when the Styles are wanting, which occurs in *Viburnum*. Such Orders are accordingly named

MONOGYNIA.	Style, or sessile Stigma,	1.
DIGYNIA.	Styles, or sessile Stigmas,	2.
TRIGYNIA.	———————	3.
TETRAGYNIA.	———————	4.
PENTAGYNIA.	———————	5.
HEXAGYNIA,	———————	6,
of very rare occurrence.		
HEPTAGYNIA,	———————	7,
still more unusual.		
OCTOGYNIA.	Styles, or sessile Stigmas,	8,
scarcely occurs at all.		
ENNEAGYNIA,	———————	9,
of which there is hardly an instance.		
DECAGYNIA.	———————	10.
DODECAGYNIA, &c.	———————	about 12.
POLYGYNIA.	———————	many.

The two Orders of the fourteenth Class, *Didynamia*, both nearly natural, are characterized by the fruit, as follows:

1. GYMNOSPERMIA. Seeds (apparently) naked, almost universally four, never more.

2. ANGIOSPERMIA. Seeds in a seed-vessel, numerous.

The two Orders of the fifteenth Class, *Tetradynamia*, both very natural, are distinguished by the form of the fruit, thus:

1. Siliculosa. Fruit a *Silicula*, Pouch, or roundish Pod.

2. Siliquosa. Fruit a *Siliqua*, or long Pod.

The Orders of the sixteenth, seventeenth, and eighteenth Classes, *Monadelphia*, *Diadelphia* and *Polyadelphia*, are founded on the number of the Stamens, that is, on the characters of the first thirteen Classes.

The Orders of the great natural nineteenth Class, *Syngenesia*, are marked by the united or separated, barren, fertile, or abortive, nature of the florets.

1. Polygamia Æqualis. Florets all perfect or united, that is, each furnished with perfect Stamens, a Pistil, and one Seed.

2. Polygamia Superflua. Florets of the disk with Stamens and Pistil; those of the radius with Pistil only, but each, of both kinds, forming perfect seed.

3. Polygamia frustranea. Florets of the disk as in the last; those of the radius with merely an abortive Pistil, or with not even the rudiments of any. This is a bad Order, for reasons hereafter to be explained.

4. Polygamia necessaria. Florets of the disk with Stamens only; those of the radius with Pistils only.

5. Polygamia segregata. Several flowers, either simple or compound, but with united anthers, and with a proper calyx, included in one common calyx.

Linnæus has a sixth Order in this Class, named *Monogamia*, consisting of simple flowers with united anthers; but this I have presumed to omit, because the union of the anthers is not constant throughout the species of each genus referred to it, witness *Lobelia* and *Viola*, while, on the contrary, several detached species in other Classes have united anthers, as in *Gentiana*. These reasons, which show the connexion of the anthers of a simple flower to be neither important in nature, nor constant as an artificial character, are confirmed by the plants of this whole Linnæan Order being natural allies of others in the fifth Class, and widely different in general from the compound syngenesious flowers.

The Orders of the twentieth, twenty-first and twenty-second Classes are distinguished by the characters of some of the Classes themselves which precede them, that is, almost entirely by the number of their Stamens; for the union of the anthers in some of them is, for the reasons just given, of no moment.

The Orders of the twenty-third Class, *Polygamia*, are, according to the beautiful uniformity of plan which runs through this ingenious system, distinguished upon the principles of the Classes immediately preceding.

1. Monoecia has flowers with Stamens and Pistils on the same plant with others that have only Pistils, or only Stamens; or perhaps all these three kinds of blossoms occur; but whatever the different kinds may be, they are confined to one plant.

2. Dioecia has the two or three kinds of flowers on two separate plants.

3. Trioecia has them on three separate plants, of which the Fig is the only real example, and in that the structure of the flowers is alike in all.

The Orders of the twenty-fourth Class, *Cryptogamia*, are professedly natural. They are four in Linnæus, but we now reckon five.*

1. Filices. Ferns, whose fructification is obscure, and grows either on the back, summit, or near the base of the leaf, thence denominated a frond. See *p.* 67.

2. Musci. Mosses, which have real separate leaves, and often a stem; a hood-like corolla, or *calyptra*, bearing the

* In this arrangement the *Hepaticæ* are intended to include the *Lichenes*, which are now universally considered a distinct Order. *Characeæ* likewise forms another Order of *Cryptogamia*. See the Chapter on Natural Orders.—*Ed.*

style, and concealing the capsule, which at length rises on a stalk with the *calyptra*, and opens by a lid.

3. Hepaticæ. Liverworts, whose herb is a frond, being leaf and stem united, and whose capsules do not open with a lid. Linnæus comprehends this Order under the following.

4. Algæ. Flags, whose herb is likewise a frond, and whose seeds are imbedded, either in its very substance, or in the disk of some appropriate receptacle.

5. Fungi. Mushrooms, destitute of herbage, bearing their fructification in a fleshy substance.

Such are the principles of the Linnæan Classes, and Orders, which have the advantage of all other systems in facility, if not conformity to the arrangement of nature; the latter merit they do not claim. They are happily founded on two organs, not only essential to a plant, but both necessarily present at the same time; for though the Orders of the fourteenth and fifteenth Classes are distinguished by the fruit, they can be clearly ascertained even in the earliest state of the germen.*

Tournefort founded his Orders on the fruit; and his countryman Adanson is charmed with the propriety of this measure, because the fruit comes after the flower, and thus precedence is given to the nobler part, which distinguishes the primary Divisions or Classes! But happily the laws of a drawing-room do not extend to philosophy, and we are allowed to prefer parts which we are sure to meet with at

* An instance apparently to the contrary occurs in the history of my *Hastingia coccinea*, *Exot. Bot. t.* 80, a plant most evidently, both by character and natural affinity, belonging to the *Didynamia Gymnospermia*, but as I could nowhere find it described in that Order, I concluded it to be unpublished; and was not a little surprised to be told sometime afterwards, that it was extant in the works of my friends Retzius and Willdenow, under *Didynamia Angiospermia*, by the name of *Holmskioldia*, after a meritorious botanist. This last name therefore, however unutterable, must remain; and I wish the Linnæan system, as well as myself, might be as free from blame in all other cases as in this.

one and the same moment, without waiting a month or two, after we have made out the Class of a plant, before we can settle its Order.

The Linnæan System, however, like all human inventions, has its imperfections and difficulties. If we meet in gardens with double or monstrous flowers, whose essential organs of fructification are deformed, multiplied, or changed to petals; or if we find a solitary barren or fertile blossom only; we must be at a loss, and in such cases could only guess at a new plant from its natural resemblance to some known one. But the principal imperfection of the System in question consists not merely in what arises from variations in number or structure among the parts of a flower, against which no system could provide, but in the differences which sometimes occur between the number of Stamens, Styles, &c., in different plants of the same natural genus. Thus, some species of *Cerastium* have only four, others five Stamens, though the greater part have ten. *Lychnis dioica* has the Stamens on one plant, the Pistils on another, though the rest of the genus has them united in the same flower; and there are several similar instances; for number in the parts of fructification is no more invariable than other characters, and even more uncertain than such as are founded on insertion, or the connexion of one part with another. Against these inconveniences the author of this System has provided an all-sufficient remedy. At the head of every Class and Order, after the genera that properly belong to them, he enumerates, in italics, all the anomalous species of genera stationed in other places, which, by their own peculiar number of Stamens or Styles, should belong to the Class or Order in question, but which are thus easily found with their brethren by means of the index.

It is further to be observed, that Linnæus, ever aware of the importance of keeping the natural affinities of plants in view, has in each of his artificial Orders, and sections of those Orders, arranged the genera according to those affinities;*

* At least such was his intention, though the more advanced state of philosophical botany might now enable us, with regard to some genera, to improve this arrangement.

while at the head of each Class, in his *Systema Vegetabilium*, he places the same genera according to their technical characters; thus combining, as far as art can keep pace with nature, the merits of a natural and an artificial system. His editors have seldom been aware of this; and Murray especially, in his fourteenth edition of the book just mentioned, has inserted new plants without any regard to this original plan of the work.

From the foregoing remarks it is easy to comprehend what is the real and highly important use of the *Genera Plantarum* of Jussieu arranged in Natural Orders, the most learned botanical work that has appeared since the *Species Plantarum* of Linnæus, and the most useful to those who study the philosophy of botanical arrangement. The aim of this excellent author is to bring the genera of plants together, as much as possible, according to their natural affinities; constructing his Classes and Orders, rather from an enlarged and general view of those affinities, than from technical characters, previously assumed, for each Class or Order; except great and primary divisions, derived chiefly from the Cotyledons, the Petals, and the insertion of the Stamens. But his Characters are so far from absolute, that at the end of almost every Order we find a number of genera merely related to it, and not properly belonging to it; and at the end of the system a very large assemblage of genera incapable of being referred to any order whatever.* Nor could a learner possibly use this system as a dictionary, so as to find out any unknown plant. The characters of the Orders are necessarily, in proportion as those orders are natural, so widely and loosely constructed, that a student has nowhere to fix; and in proportion as they are here and there more defined, this, or any other system, becomes artificial, and liable to the more exceptions. The way, therefore, to use this valuable work, so as to ascertain an unknown plant, is, after turning to the

* The reader, however, must be informed that when Jussieu wrote in the year 1789, this beautiful and important system was in its infancy. The Genera here alluded to are now almost entirely referred to their proper Orders. —*Ed.*

Order or Genus to which we conceive it most probably allied, to read and study the characters and observations there brought together, as well as all to which they may allude. We shall find we learn more from the doubts and queries of Jussieu than from the assertions of most other writers. We shall readily perceive whether our plant be known to him or not; and if at the same time we refer it, by its artificial characters, to the Linnæan System, we can hardly fail to ascertain, even under the most difficult circumstances, whether it be described by either of these authors. A student may acquire a competent knowledge of natural orders, with very great pleasure to himself, by repeatedly turning over the work of Jussieu with any known plants in his hand, and contemplating their essential generic characters in the first place, and then what regards their habit and affinities; proceeding afterwards to combine in his own mind their several points of agreement, till he is competent to form an idea of those assemblages which constitute natural Classes and Orders. This will gradually extend his ideas; whereas a contrary mode would only contract them, and his Jussieu would prove merely an artificial guide, without the advantages of facility or perspicuity. Such indeed it has proved in practice, and De Candolle, in his great universal System of Vegetables, now publishing, has been obliged to invent a new and professedly artificial distribution of his natural orders.—*Sic transit gloria—systematum!*

CHAP. XXIV.—*Illustrations of the Linnæan Classes and Orders.*

I PROCEED to a compendious view of the Linnæan Classes and Orders, which will serve to illustrate many things in the preceding pages.

CLASS 1. *Monandria.* Stamen 1.

This contains only two Orders.

1. *Monogynia.* Style 1. Here we find the beautiful exotic

natural order called *Scitamineæ*, consisting of Cardamoms, Ginger, Turmerick, &c., hitherto a chaos, till Mr. Roscoe, in a paper printed in the eighth volume of the *Linnæan Society's Transactions*, reduced them to very natural and distinct genera by the form of the filament. See *Suppl. f.* 1.

Salicornia and *Hippuris*, *Suppl. f.* 252, are British examples of *Monandria Monogynia*.

Valeriana (Class 3) has some species with one stamen.

2. *Digynia*. Styles 2. Contains *Corispermum*, *Blitum*, and a few plants besides.

CLASS 2. *Diandria*. Stamens 2. Orders 3.

1. *Monogynia*. This, the most natural and numerous Order, comprehends the elegant and fragrant *Jasmineæ*, the Jasmine, Lilac, Olive, *Suppl. f.* 173, &c.,—also *Veronica*, *Suppl. f.* 2, *Utricularia*, *Suppl. f.* 170;—and a few labiate flowers with naked seeds, as *Salvia*, Rosemary, &c., natural allies of the fourteenth class; but having only two stamens, they are necessarily ranged here in the artificial system. *Justicia*, *Suppl. f.* 172, bears the same relation to *Didynamia Angiospermia*.

2. *Digynia* consists only of *Anthoxanthum*, a grass, which, for the reason just given, is separated from its natural family in the third class.

3. *Trigynia*—has only *Piper*, the Pepper, a large tropical genus.

CLASS 3. *Triandria*. Stamens 3. Orders 3.

1. *Monogynia*. *Valeriana*, is placed here because most of its species have three stamens. See Class 1. Here also we find the sword-leaved plants, so amply illustrated in Curtis's Magazine, *Iris*, *Suppl. f.* 152, *Gladiolus*, *Ixia*, &c., also *Crocus*, and numerous grass-like plants, *Schœnus*, *Cyperus*, *Scirpus*, *Suppl. f.* 140. The genera of the latter

are now reformed, partly after the principles of Vahl and Brown, in *Engl. Fl. v.* 1, published in 1824. Such a reform was become indispensable.

2. *Digynia.* This important Order consists of the true Grasses; see *p.* 122, and *Suppl. f.* 3, 4. Their habit is more easily perceived than described; their value, as furnishing herbage for cattle, and grain for man, is sufficiently obvious. No poisonous plant is found among them, except the *Lolium temulentum*, said to be intoxicating and pernicious in bread. Their genera are not easily defined. Linnæus, Jussieu, and most botanists, pay regard to the number of florets in each spikelet; but in *Arundo* this is of no moment. Magnificent and valuable works on this family have been published in Germany by the celebrated Schreber and by Dr. Host. The *Flora Græca* also is rich in this department, to which the late Dr. Sibthorp paid great attention. Much is to be expected from scientific agriculturists; but nature so accommodates each grass to its own soil and station, that nothing is more difficult than to overcome their habits, insomuch that few grasses can be generally cultivated at pleasure. See Mr. Sinclair's excellent work, *Hortus Gramineus Woburnensis*, ed. 2. *octavo*, 1825.

3. *Trigynia* is chiefly composed of little pink-like plants, or *Caryophylleæ*, as *Holosteum*, *Suppl. f.* 239, and *Montia*, *f.* 247.

   Tillæa muscosa has the number proper to this order, but the rest of the genus bears every part of the fructification in fours. This, in Linnæan language is expressed by saying the flower of *Tillæa* is *quadrifidus*, four-cleft, and *T. muscosa* excludes, or lays aside, one-fourth of the fructification.

Class 4. *Tetrandria.* Stamens 4. Orders 3.

1. *Monogynia.* A very numerous and various Order, of which the *Proteaceæ* make a conspicuous part, consisting of *Protea*, *Suppl. f.* 159, *Banksia*, *Lambertia*, *Embothrium*,

Suppl. f. 160, &c., *Scabiosa, Suppl. f.* 5—7, *Plantago, Suppl. f.* 166, remarkable for its *capsula circumscissa*, a membranous capsule, separating by a complete circular fissure into two parts, as in the next genus, *Centunculus, Rubia*, and others of its Natural Order, of whose stipulation we have spoken, *p.* 107, are found here, and the curious *Epimedium, Suppl. f.* 234.

2. *Digynia. Buffonia.*

Cuscuta, placed here by Linnæus, is best removed to the next class.

3. *Tetragynia. Ilex*, a genus sometimes furnished with a few barren flowers, and therefore removed by Hudson to the twenty-third Class, of which this measure serves only to show the disadvantage; *Potamogeton, Suppl. f.* 135, and *Ruppia*, are examples of this Order. They all have sessile stigmas.

Class 5. *Pentandria.* Stamens 5. A very large class.

Orders 6.

1. *Monogynia.* One of the largest and most important Orders of the whole system. The genera are enumerated first artificially, according to the corolla being of one petal or more, or wanting; inferior or superior; with naked or covered seeds; but stand in the system according to their affinities, and compose some Natural Orders; as *Asperifoliæ, Suppl. f.* 178, rough-leaved plants, which have a monopetalous inferior corolla, and four naked seeds, with always more or less of spinous bristles, or callous asperities, on their foliage; as *Borago, Lycopsis*, and *Echium.* Next comes that most elegant tribe of spring-plants denominated *Preciæ* by Linnæus, *Suppl. f.* 169, *Primula, Cyclamen*, the charming alpine *Aretia*, and *Androsace.* These are followed by another Linnæan Order, nearly akin, called (by Linnæus, for the *Rotaceæ* and *Preciæ* both belong to one and the same Natural Order, *Primulaceæ, Juss.—Ed.*) *Rotaceæ*,

from the wheel-shaped corolla, *Hottonia*, *Lysimachia*—also by a new Order, *Epacris*, *Suppl. f.* 8, 9, and its numerous relations, the Heaths of New Holland as to habit, but very distinct from true *Ericæ*. *Convolvulus*, *Suppl. f.* 179, and *Campanula*, *Suppl. f.* 193, two large well-known genera, come afterwards; then *Lobelia*, *Suppl. f.* 195, *Impatiens*, and *Viola*, all three brought hither from the abolished Linnæan order *Syngenesia Monogamia*. The *Luridæ* (*Solaneæ*, *Juss.—Ed.*) follow, so called from their frequently dark, gloomy aspect, indicative of their narcotic and very dangerous qualities; as *Solanum*, *Suppl. f.* 177, *Datura*, *Hyoscyamus*, *Atropa*, and *Nicotiana*, or Tobacco. In a subsequent part we meet with the Vine, *Suppl. f.* 226, Currant, *Suppl. f.* 245, and Ivy, and the Order finishes with some of the natural family of *Contortæ*, (*Apocineæ*, *Juss.—Ed.*) *Suppl. f.* 185, 186, so called from their oblique or twisted corolla, and which are many of them very fine plants, as *Vinca*, the Periwinkle. They often abound with milky juice, generally highly acrid; but Dr. Afzelius met with a shrub of this order at Sierra Leone, the milk of whose fruit was so sweet, and so copious, as to be used instead of cream for tea. This is certainly what no one could have guessed from analogy. *Gardenia* is erroneously reckoned a *contorta* by Linnæus.

2. *Digynia* begins with the remainder of the *Contortæ;* then follow some incomplete flowers, as *Chenopodium*, *Beta*, and afterwards the fine alpine genus of *Gentiana*, *Suppl. f.* 182, famous for its extreme bitterness and consequent stomachic virtues.

The rest of the Order consists of the very natural Umbelliferous family, *Suppl. f.* 203—212, characterized by having five superior petals, and a pair of naked seeds, suspended vertically, when ripe, from the summit of a slender hair-like receptacle. Of the inflorescence of this tribe, and the difficulties attending their generic distinctions we have spoken, *p.* 156. In *Eryngium*, *Suppl. f.* 212, the umbel is condensed into a *capitulum*, or conical scaly head, showing an approach towards the compound flowers, and accompanied, as Jussieu observes, by the habit of a Thistle. *Lagoecia* is justly referred to this Natural Order by the same writer, though it has only a solitary seed and style.

The *Umbelliferæ* are mostly herbaceous; the qualities of such as grow on dry ground are aromatic, while the aquatic species are among the most deadly of poisons; according to the remark of Linnæus, who detected the cause of a dreadful disorder among horned cattle in Lapland,* in their eating young leaves of *Cicuta virosa*, under water.

Botanists in general shrink from the study of the *Umbelliferæ*, nor have these plants much beauty in the eyes of amateurs; but they will repay the trouble of a careful observation. The late M. Cusson of Montpellier bestowed more pains upon them than any other botanist has ever done; but the world has, as yet, been favoured with only a part of his remarks.† His labours met with a most ungrateful check, in the unkindness, and still more mortifying stupidity, of his wife, who, during his absence from home, is recorded to have destroyed his whole herbarium scraping off the dried specimens, for the sake of the paper on which they were pasted!

Professors Sprengel of Halle and Hoffmann of Moscow, have recently undertaken a revision of this Natural Order; but they have erred, as I conceive, in still taking generic characters from the bracteas. That the parts of the *flower* and *fruit* are all-sufficient, and lead to the establishment of far more natural and certain genera, will, I trust, be evident to the reader of the *English Flora*, *v.* 2, where these plants are so arranged. By such principles, the Linnæan umbelliferous genera, brought to the same test as those of other Natural Orders, are not overturned, but confirmed, and the very few new ones requisite to be introduced, prove as distinct in habit as in technical characters. This great object of systematical botany is most difficult to be attained in the most natural families. The present in-

* See his Tour in Lapland, v. 2. 136.

† The 4th vol. of De Candolle's *Prodromus*, contains a valuable arrangement of the Genera and species of this extensive Natural Order.—*Ed.*

stance, like the Grasses, and the *Calamariæ* (*Cyperaceæ*, *Juss.*) in *Triandria Monogynia*, see *Engl. Fl. v.* 1, proves the fructification to be our best guide.

3. *Trigynia* is illustrated by the Elder, the Sumach or *Rhus*, *Viburnum*, *Suppl. f.* 201, &c., also *Corrigiola*, and *Tamarix*, of which last, one species, *T. Germanica*, has ten stamens.

4 *Tetragynia* has only *Evolvulus*, nearly allied to *Convolvulus*, and the elegant and curious *Parnassia.*

5. *Pentagynia* contains *Statice*, a beautiful maritime genus, with a kind of everlasting calyx. The *Flora Græca* has many fine species. *Linum* or Flax follows ; also the curious exotic *Aldrovanda; Drosera;* the numerous succulent genus *Crassula;* and the alpine *Sibbaldia, Suppl. f.* 258, of the natural order of *Rosaceæ.*

6. *Polygynia. Myosurus*, a remarkable instance of few stamens (though they often exceed five) to a multitude of pistils.

Class 6. *Hexandria.* Stamens 6.

Orders 6.

1. *Monogynia.* This, as usual, is the most numerous. The Liliaceous family, *Suppl. f.* 10, 11, 146, 147—150, with or without a *spatha*, called by Linnæus the nobles of the vegetable kingdom, constitute its most splendid ornament. The beautiful White Lily is commonly chosen by popular writers to exemplify the stamens and pistils. The less ostentatious genera of *Juncus* and *Luciola*, *Sm. Suppl. f.* 145, which soon follow, are more nearly allied to the Lilies than a young botanist would suppose. Near these stand several genera which have little affinity to each other, *Frankenia*, *Suppl. f.* 241, &c., and of these *Capura* is a mistake, having been made out of a specimen of *Daphne Indica*, which chanced to have but six stamens.

2. *Digynia* has but few genera. The valuable *Oryza*, Rice, of which there now seems to be more than one species, is the most remarkable. It is a grass with six stamens.

3. *Trigynia.* See *Rumex*, some species of which have separated flowers; *Tofieldia*, and *Colchicum.*

4. *Tetragynia.* *Petiveria alliacea*, a plant the number of whose stamens is not very constant, and whose specific name is supposed to allude, not only to its garlic scent, but also to the caustic humour of the botanist whom it commemorates.

5. *Hexagynia.* An order in Schreber and Willdenow, contains *Wendlandia populifolia* of the latter; with *Damasonium* of the former, a genus consisting of the Linnæan *Stratiotes alismoides.*

6. *Polygynia.* *Alisma* only.

CLASS 7. *Heptandria.* Stamens 7.

Orders 4.

1. *Monogynia.* *Trientalis*, a favourite plant of Linnæus; and *Æsculus*, the Horse Chestnut, *Suppl. f.* 12. Several genera are removed to this order by late writers.

2. *Digynia.* *Limeum*, an African genus only.

3. *Tetragynia.* *Saururus*, a Virginian plant. *Aponogeton*, *Suppl. f.* 134, placed here by Linnæus, is now properly removed to *Dodecandria.* It is an East Indian and Cape aquatic genus, bearing above the water white fragrant flowers in a peculiar spike, which is either solitary or double.

4. *Heptagynia.* *Septas*, a Cape plant, very nearly akin to *Crassula*, to which Thunberg refers it. If its character in Linnæus be constant with respect to number, it is very remarkable, having the calyx in seven deep segments, seven petals, seven germens, and consequently seven capsules.

CLASS 8. *Octandria.* Stamens 8.

Orders 4.

1. *Monogynia.* A very various and rich order, consisting of the well known *Tropæolum* or Nasturtium, *Suppl. f.* 228, whose original Latin name, given from the flavour of the plant, like Garden Cresses, is now become its English one in every body's mouth. The elegant and fanciful Linnæan appellation, equivalent to a *trophy plant*, alludes to its use for decorating bowers, and the resemblance of its peltate leaves to shields, as well as of its flowers to golden helmets, pierced through and through, and stained with blood. *Epilobium*, *Suppl. f.* 249, with its allies, makes a beautiful part of this order; but above all are conspicuous the favourite *Fuchsia*, *Suppl. f.* 250, the chiefly American genus *Vaccinium*, *Suppl. f.* 192, the immense and most elegant genus *Erica*, *Suppl. f.* 191, so abundant in Southern Africa, but not known in America; and the fragrant *Daphne*, *Suppl. f.* 13, of which last the Levant possesses many charming species. *Acer*, the Maple, *Suppl. f.* 221, is removed hither in *Fl. Brit.* from the twenty-third Class.

2. *Digynia* has a few plants, but little known; among them are *Galenia Africana*, and *Moehringia muscosa*.

3. *Trigynia.* *Polygonum*, *Suppl. f.* 162, is a genus whose species differ in the number of their stamens and styles, and yet none can be more natural. Here therefore the Linnæan system claims our indulgence. *Paullinia* and *Cardiospermum* are more constant.

4. *Tetragynia.* Here we find the curious *Paris*, *Suppl. f.* 143, and *Adoxa.*

CLASS 9. *Enneandria.* Stamens 9.

Orders 3.

1. *Monogynia.* Of this the precious genus *Laurus*, *Suppl.*

f. 161, including the Cinnamon, Bay, Sassafras, Camphor, and many other noble plants, is an example.

2. *Trigynia* has only the *Rheum*, the Rhubarb, nearly related to *Rumex*.

3. *Hexagynia*. *Butomus umbellatus, Suppl. f.* 14, a great ornament to our rivers and pools.

Class 10. *Decandria*. Stamens 10.

Orders 5.

1. *Monogynia*. A numerous and fine assemblage, beginning with a tribe of flowers more or less correctly papilionaceous and leguminous, which differ very materially from the rest of that Natural Order, in having ten stout, firm, separate stamens. See *Cassia*, and *Sophora, Suppl. f.* 262.

   The *Ruta*, Rue, and its allies, now become very numerous, follow. See *Boronia, Suppl. f.* 237. *Dictamnus*, vulgraly called Fraxinella, is one of them. *Dionæa Muscipula*, see *p.* 85, stands in this artificial order, as do the beautiful *Kalmia, Rhododendron, Andromeda, Arbutus* and *Pyrola*.

2. *Digynia*. *Saxifraga, Suppl. f.* 243, remarkable for having the germen inferior, half inferior, and superior, in different species, a very rare example. *Dianthus, Suppl. f.* 15, 16, the Pink or Carnation tribe, and some of its very distinct Natural Order, *Caryophylleæ*, conclude the *Decandria Digynia*.

3. *Trigynia*. The *Caryophylleæ* are here continued, as *Cucubalus, Silene, Arenaria*, very prolific and intricate genera in the Levant, and *Stellaria, Suppl. f.* 240. *Malpighia, Suppl. f.* 222, and *Banisteria*, beautiful plants of (or allied to) the Maple family, which next occur, have no affinity to the foregoing.

4. *Pentagynia*. Abounds in more *Caryophylleæ*, as *Lychnis*, and *Cerastium, Cotyledon, Sedum*, and *Oxalis*, are placed here. Some of the last genus have the filaments united at

their base, and therefore should belong to the sixteenth class,—another defect in the artificial system.

5. *Decagynia.* Consists of only *Neurada*, with *Phytolacca;* the latter an irregular genus as to stamens and styles, which therefore afford good marks to discriminate the species.

CLASS 11. *Dodecandria.* Stamens 12 to 19.

Orders 6.

1. *Monogynia.* A rather numerous and very various order with scarcely any natural affinity between the genera. Some of them have twelve, others fifteen or more stamens, which should be mentioned in their characters. *Asarum, Suppl. f.* 157, and the handsome *Lythrum Salicaria, Suppl. f.* 255, also the American Snow-drop tree, *Halesia*, not rare in our gardens, may serve as examples of this order. *Sterculia* is very properly removed hither from *Gynandria*, by Schreber and Willdenow, as its stamens are not inserted above the germen.

2. *Digynia* consists of *Heliocarpus*, a very rare American tree, with a singularly fringed or radiated fruit; and *Agrimonia.* The latter might as well have been placed in the next class, with which it agrees in natural order.

3. *Trigynia* is chiefly occupied by *Reseda, Suppl. f.* 17, the Mignonette, and *Euphorbia, Suppl. f.* 268, one of the best defined and most natural genera, of which the *punicea, Sm. Ic. Pict. t.* 3, is a splendid exotic species; but *Euphorbia* is now better placed in *Monoecia Monandria.*

4. *Tetragynia*, in Schreber and Willdenow, consists of *Calligonum*, and *Aponogeton*, already mentioned, *p.* 213.

5. *Pentagynia* has *Glinus*, an insignificant genus; and *Blackwellia,* a doubtful one.

6. *Dodecagynia* is exemplified in *empervivum*, the House-

leek, *Suppl. f.* 242, whose styles vary from twelve to eighteen or twenty. *Sempervivum sediforme* is a *Sedum* with a superabundance of parts in the fructification. Linnæus confounded it with *S. rupestre.*

Class 12. *Icosandria.* Stamens 20 or more, inserted into the Calyx.

Orders 3.

1. *Monogynia*, consists of fine trees, bearing for the most part stone-fruits, as the Peach, Plum, Cherry, *Suppl. f.* 261, &c., though the leaves and other parts are bitter, acrid, and, as we have already mentioned, sometimes very dangerous, owing to a peculiar essential oil, known by its bitter almond flavour. The Myrtle tribe is another Natural Order, comprehended chiefly under *Icosandria Monogynia*, as *Eucalyptus*, *Suppl. f.* 253, abounding in a fragrant and wholesome aromatic oil. These are plentiful in New Holland. *Caryophyllus aromaticus*, the Clove, should on every account be removed hither. *Cactus*, *Suppl. f.* 246, is placed here.

2. *Pentagynia.* In this order it is most convenient to include such plants as have from two to five styles, and occasionally, from accidental luxuriance only, one or two more. An example of it is the very natural family of the *Pomaceæ*, as *Pyrus*, the Apple, Pear, &c., and *Mespilus*, *Suppl. f.* 18, 19. In this family, some species of the same genus have five, others three, two, or only one style, and a corresponding number of seeds. *Spiræa*, nearly allied to it, stands here, most of its species having five styles, though some have a much greater number, *Suppl. f.* 260; *Mesembryanthemum*, *Suppl. f.* 248, a vast and brilliant exotic genus, of a succulent habit, abounding in alkaline salt, and a few genera naturally allied to it, make up the rest of the order.

3. *Polygynia.* An entirely Natural Order of genuine Rosaceous flowers, except possibly *Calycanthus.* Here we find

Rosa, *Suppl. f.* 256, 257; *Rubus*, *Fragaria*, *Suppl. f.* 259, *Potentilla*, *Tormentilla*, *Geum*, *Dryas*, and *Comarum*; all elegant plants, agreeing in the astringent qualities of their roots, bark, and foliage, and in their generally eatable, always innocent, fruit. The vegetable kingdom does not afford a more satisfactory example of a Natural Order,* composed of natural genera, than this; and Linnæus has well illustrated it in the *Flora Lapponica*. His genus *Tormentilla*, differing from *Potentilla* in number of petals and segments of the calyx, though retained by Jussieu, may perhaps be scarcely distinct; yet there is a difference in their habit, which has induced me to leave it for further consideration. Haller united them both with *Fragaria* and *Comarum*, which the character and habit of the latter totally forbid, and Gærtner has well suggested a mark from the smoothness of the seeds in *Fragaria*, (as well as *Comarum*,) to strengthen that of its pulpy receptacle. Whatever difficulties may attend these genera, how admirably does the fruit serve us in *Rosa*, *Rubus*, *Dryas* and *Geum*, to discriminate those whose leaves, flowers and habit all stamp them as distinct! A student cannot do better than to study this order and these genera, as an introduction to the knowledge of more obscure ones; and the beautiful plants which compose it, mostly familiar to every body, are easily obtained.

Class 13. *Polyandria*. Stamens numerous, inserted into the Receptacle.

Orders 7.

1. *Monogynia*. The genera of this order are artificially distributed, according to the number of their petals, but not so arranged in the body of the system. They form a numerous and various assemblage of handsome plants, but many are of a suspected quality. Among them are

* Nor a better illustration of the superiority of the Natural over the Artificial Arrangement. For in the latter, other genera belonging to it are scattered through the Classes *Tetrandria* (*Alchemilla*, *Sanguisorba*), *Pentandria* (*Sibbaldia*), *Dodecandria* (*Agrimonia*), and *Monœcia* (*Poterium*).—*Ed.*

the *Actæa, Suppl. f.* 217, the Poppy, *f.* 218, the Caper-shrub, *Suppl. f.* 20, the *Sanguinaria Canadensis*, remarkable for its orange juice, like our Celandine; also the beautiful genus *Cistus, Suppl. f.* 236, with its copious but short-lived flowers, some of which have irritable stamens; the *Tilia, Suppl. f.* 235; the splendid aquatic tribe of *Nymphæa*, &c., *Suppl. f.* 219. But the precious Nutmeg and the Tea, (see *Monadelphia*), are perhaps erroneously placed here by Linnæus, as well as the Clove; while on the other hand *Cleome* more properly belongs to this part of the system than to the fifteenth Class.

2. *Digynia* has principally the *Pæonia*, variable in number of pistils, and *Fothergilla alnifolia*, an American shrub.

3. *Trigynia. Delphinium* the Larkspur, and *Aconitum* the Monk's hood, two variable and uncertain genera as to number of pistils.

4. *Tetragynia. Tetracera* ought, by its name, to have constantly four pistils, but the rest of this order are very doubtful. *Caryocar*, whose large rugged woody nuts contain the most exquisite kernel ever brought to our tables, and which is the same plant with Gærtner's and Schreber's *Rhizobolus*, as the excellent Willdenow rightly judged, is not certain in number; and still less the *Cimicifuga;* whilst *Wahlbomia* is probably a *Tetracera:* see Willdenow.

5. *Pentagynia* contains chiefly *Aquilegia* the Columbine, and *Nigella*—both strictly allied to genera in the third order. *Reaumuria* indeed is here well placed. Some *Nigellæ* have ten styles.

6. *Hexagynia* consists of *Stratiotes*, and *Brasenia*, a new genus of Schreber's with which I am not acquainted.

I would recommend an union of the last five orders, for the same reason that influenced me in the preceding class. They now only serve to keep natural genera asunder, the species of which not only differ among themselves as to number of pistils, but each species is often variable besides. The genera are so few that no inconvenience could arise on that account. I conceive such reforms, founded in experience, not in theory, serve to strengthen the system, by greatly facilitating its application to practice.

7. *Polygynia.* An order for the most part natural, comprehending some fine exotic trees, as *Dillenia, Suppl. f.* 230, 231; *Liriodendron*, the Tulip-tree; the noble *Magnolia, Suppl. f.* 229, &c.; a tribe concerning whose genera our periodical writers are falling into great mistakes. To these succeed a family of plants, either herbaceous or climbing, of great elegance, but of acrid and dangerous qualities, as *Anemone*, in a single state the most lovely, in a double one the most splendid, ornament of our parterres in the spring; *Atragene* and *Clematis, Suppl. f.* 213, so graceful for bowers; *Thalictrum, Adonis, Ranunculus, f.* 214, *Trollius, Helleborus, f.* 215, and *Caltha, f.* 216, all conspicuous in our gardens or meadows, which, with a few less familiar, close this class.

Nothing can be more injudicious than uniting these two last classes, as some inexperienced authors have done. They are immutably distinct in nature and characters, whether we call the part which immediately bears the stamens in the *Icosandria* a calyx, with most botanists, or a receptacle, with Mr. Salisbury in the eighth volume of the Linnæan Society's Transactions, where, among many things which I wish had been omitted, are some good remarks concerning the distinction between calyx and corolla. This the writer in question considers as decided in doubtful cases by the latter sometimes bearing the stamens, which the former, in his opinion, never really does.

CLASS 14. *Didynamia.* Stamens 2 long and 2 short.

Orders 2, each on the whole very natural.

1. *Gymnospermia.* Seeds naked, in the bottom of the calyx

four, (in other words four *Achenia*, or apparently naked seeds,) except in *Phryma*, which has a solitary seed.—Corolla monopetalous and irregular, a little inflated at the base, and holding honey, without any particular nectary. Stamens in two pairs, incurved, with the style between them, so that the impregnation rarely fails. The plants of this order are mostly aromatic, and none, I believe, poisonous. The calyx is either in five nearly equal segments, or two-lipped. Most of the genera afford excellent essential characters, taken frequently from the corolla, or from some other part. Thus,

Perilla has two styles, of which it is an unique example in this class.

Mentha, a corolla whose segments are nearly equal, and spreading stamens.

Lavandula, the Lavander, and *Westringia*, have a *corolla resupinata*, reversed, or laid on its back.

Teucrium, a deeply divided upper lip, allowing the stamens and style to project between its lobes.

Ajuga, scarcely any upper lip at all.

Lamium has the mouth toothed on each side, *Suppl. f.* 21, 22.

Prunella has forked filaments; *Cleonia*, four stigmas; *Prasium*, a pulpy coat to its seeds. These instances will suffice as clear examples of natural genera, distinguished by an essential technical character, in a most natural order.*

2. *Angiospermia.* Seeds in a seed-vessel, and generally very numerous, *Suppl. f.* 171, 181, 175, 176.—The plants of this order have the greatest possible affinity with some families in *Pentandria Monogynia.* Some species even vary from one class to the other, as *Bignonia radicans*, and *Antirrhinum Linaria*, in which the irregular corolla becomes regular, and the four unequal stamens are

* This Natural Order has been admirably illustrated by a most able Botanist, Mr. Bentham, in different pages of the Bot. Register, and in his "Labiatarum Genera et Species," Part I. London, 1832.—*Ed.*

changed to five equal ones; nor does this depend, as has been asserted, on the action of any extraneous pollen upon the stigmas of the parent plant, neither are the seeds always abortive. No method of arrangement, natural or artificial, could provide against such anomalies as these, and therefore imperfections must be expected in every system. The celebrated *Linnæa, Suppl. f.* 200, is one of this order, also *Verbena, f.* 174, and *Sibthorpia, f.* 176.

CLASS 15. *Tetradynamia.* Stamens 4 long and 2 short.

Orders 2, perfectly natural.* Flowers cruciform.

1. *Siliculosa.* Fruit a roundish pod, or pouch. In some genera it is entire, as *Draba*, and the Honesty or Satin-flower, *Lunaria:* in others notched, as *Thlaspi, Suppl. f.* 23, 24, and *Iberis;* which last genus is unique† in its Natural Order in having unequal petals. *Crambe, Isatis,* and *Bunias* certainly belong to this Order, though placed by Linnæus in the next.

2. *Siliquosa.* Fruit a very long pod. Some genera have a *calyx clausus*, its leaves slightly cohering by their sides, as *Raphanus, Cheiranthus, Hesperis, Brassica.* Others have a spreading or gaping calyx, as *Cardamine, Suppl. f.* 28—30; *Sisymbrium*, and especially *Sinapis.*

Cleome is a very irregular genus, allied in habit and even in the number of stamens of several species, to the *Polyandria Monogynia.* Its fruit, moreover, is a capsule of one cell, not the real two-celled pod of this Order. Most of its species are fœtid and very poisonous, whereas scarcely any plants properly belonging to this Class are remarkably noxious, for I have great doubts concerning

* Natural, but not perfectly distinct. Of some species of *Nasturtium* and *Draba*, and of several Exotic Genera, it is not easy to say to which of the Orders they should be referred. The fruits are certainly not always either a "roundish pod," or a "very long pod." The whole class is indeed a vast and extremely Natural family, exclusive of *Cleome.*—*Ed.*

† Except one species of *Teesdalia, Sm. Compend. ed.* 4. 110. *Suppl. f.* 25—27.

the disease called *Raphania*, attributed by Linnæus to the seeds of *Raphanus Raphanistrum*.

The Cruciform plants are vulgarly called antiscorbutic, and supposed to be of an alkalescent nature. Their essential oil, which is generally obtainable in very small quantities by distillation, smells like volatile alkali, and is of a very acrid quality. Hence the fœtid scent of water in which cabbages, or other plants of this tribe, have been boiled.

CLASS 16. *Monadelphia*. Stamens united by their filaments into one tube.

Orders 8, distinguished by the number of their stamens.

1. *Triandria* is exemplified by *Sisyrinchium*, *Suppl. f.* 151, and *Ferraria*, both erroneously placed by Linnæus in *Gynandria*. Also the singular Cape plant *Aphyteia*, consisting of a large flower and succulent fruit, springing immediately from the root, without stem or leaves. On this plant Linnæus published a dissertation in 1775. *Tamarindus* has lately been removed hither from the third Class, perhaps justly, (but most unnaturally, for it belongs to the Natural Order *Leguminosæ*.—*Ed.*)

2. *Pentandria*. *Erodium*, separated, with great propriety from *Geranium* by L'Héritier; *Hermannia*, a pretty Cape genus; and a few other plants, more or less akin to the Mallow tribe, compose this Order; to which also strictly belong some species of *Linum*, *Geranium*, &c. *Passiflora*, *Suppl. f.* 271, removed from *Gynandria*, belongs most unquestionably to *Pentandria Trigynia*, and by no means to this Class.

3. *Heptandria* consists only of *Pelargonium* of L'Héritier, *Suppl. f.* 227, an excellent genus, comprising most of the Cape Geraniums, and marked by its irregular flower, seven stamens, and tubular nectary.

4. *Octandria* contains *Aitonia*, named in honour of the excel-

lent and universally respected author of the *Hortus Kewensis*. *Pistia* is, I believe justly, placed here by Schreber and Willdenow.

5. *Decandria*. *Geranium*, properly so called, *Suppl. f.* 31—35, is the principal genus here. The late Professor Cavanilles, however, in his *Dissertationes Botanicæ*, referred to this Order a vast number of genera, never before suspected to belong to it, as *Banisteria*, *Malpighia*, *Suppl. f.* 222, *Turræa*, *f.* 225, *Melia*, &c., on account of some fancied union of their filaments, perhaps through the medium of a tubular nectary; which principle is absolutely inadmissible; for we might just as well refer to *Monadelphia* every plant whose filaments are connected by insertion into a tubular corolla. Some species of *Oxalis*, see *p.* 215, belong to this Order; as do several papilionaceous genera, of which we shall speak under the next Class.

6. *Endecandria* contains only the splendid South American genus *Brownea*, the number of whose stamens is different in different species.

7. *Dodecandria*, Stamens mostly fifteen, is composed of some fine plants allied to the Mallows, as *Pterospermum*, *Pentapetes*, &c.

8. *Polyandria*, a very numerous and magnificent Order, comprises, among other things, the true *Columniferæ* or *Malvaceæ*, as *Malva*, *Suppl. f.* 36, 37, *Hibiscus*, *Gossypium* the Cotton-tree, *Alcea* the Hollyhock, &c. Stately and beautiful plants of this Order though not *Malvaceæ*, are *Carolinea*, whose angular seeds are sold in our shops by the name of Brazil nuts;* *Gustavia*, named after the King of Sweden, a great patron of botany and of Linnæus; *Camellia*, *t.* 42, whose splendid varieties have of late become favourites with collectors; *Thea*, the Tea-tree, its near

* Surely not. Brazil-nuts are the seeds of the *Bertholletia excelsa*, of the Natural Order *Lecythideæ*, *Rich.* (*Myrtaceæ*, Tribe *Lecythideæ*, *De Cand.*) See Humboldt, " Plantes Equinoctiales." *Carolinea* is a totally different plant, really belonging to the *Malvaceæ*; or to a groupe of *Malvaceæ* called *Bombaceæ*.—*Ed.*

relation, placed by Linnæus in *Polyandria Monogynia; Stuartia, f.* 51, 52; and *Barringtonia*, the original *Commersonia.*

CLASS 17. *Diadelphia.* Stamens united by their filaments into two parcels, both sometimes cohering at the base, (thus truly monadelphous.—*Ed.*)

Orders 4, distinguished by the number of their Stamens. Flowers almost universally papilionaceous.

1. *Pentandria.* The only genus in this Order is *Monnieria*, a rare little South American plant, whose Natural Order is uncertain. It has a ringent corolla, ternate leaves, a simple bristly pubescence, and is besprinkled with resinous dots. (It belongs to the *Rutaceæ.—Ed.*)

2. *Hexandria.* *Saraca*, in this Order, is as little known as the *Monnieria*, except that it undoubtedly belongs to the leguminous family. It seems most allied to *Brownea, Jonesia, Afzelia*, &c. (It is indeed referred, upon the authority of Ventenat's Herbarium, to the beautiful *Jonesia Asoca.—Ed.*).—*Fumaria, Suppl. f.* 38, 39, the only genus besides, is remarkable for the great variety of forms in its seed-vessel, whence Botanists who make genera from technical characters, without regard to natural principles, have injudiciously subdivided it.

3. *Octandria.* *Polygala* is the principal genus here. America and the Cape of Good Hope abound in beautiful species of it, and New Holland affords some new genera, long confounded with this. *Dalbergia* is perhaps as well placed in the next Order.

4. *Decandria* is by far the most numerous, as well as natural, Order of this Class, consequently the genera are difficult to characterize. They compose the family of proper *Papilionaceæ* or *Leguminosæ*, the Pea, Vetch, Broom, &c. Their stamens are most usually nine in one set, with a single one separate.

The genera are arranged in sections variously characterized.

* *Stamens all united*, that is, all in one set. The plants of this section are really not *diadelphous* but *monadelphous*. See *Spartium, Suppl. f.* 40. Some of them, as *Lupinus*, and *Ulex, Suppl. f.* 41, have indeed the tenth stamen evidently distinguished from the rest, though incorporated with them by its lower part. Others have a longitudinal slit in the upper side of the tube, or the latter easily separates there, as *Ononis*, without any indication of a separate stamen. Here therefore the Linnæan System swerves from its strict artificial laws, in compliance with the decisive natural character which marks the plants in question. We easily perceive that character, and have only to ascertain whether any papilionaceous plant we may have to examine has ten stamens, all alike separate and distinct, in which case it belongs to the tenth Class, or whether they are in any way combined, which refers it to the seventeenth.

** *Stigma downy*, without the character of the preceding section, for this and all the following are truly diadelphous. Very nice, but accurate marks distinguish the genera, which are sufficiently natural. The style and stigma afford the discriminating characteristics of *Orobus, Pisum, Suppl. f.* 42—47; *Lathyrus, Vicia*, and no less decisively in *Ervum*, which last genus, notwithstanding the remark in Jussieu, 369, "*stigma non barbatum*," (taken probably from no genuine species,) most evidently belongs to this section, as was first remarked in the *Flora Britannica;* and it is clearly distinguished from all the other genera of the section by the *capitate stigma hairy all over;* nor is any genus in the whole Class more natural, when the hitherto mistaken species are removed to their proper places. See *Fl. Brit.*

*** *Legume imperfectly divided into two cells*, always, as in all the following, without the character of the preceding sections. This is composed of the singular *Biserrula*, known by its doubly serrated fruit, of which there is only one species; the *Phaca*, and the vast genus of *Astragalus, Suppl. f.* 263, long since illustrated in a splendid work by Professor De Candolle.

**** *Legume with scarcely more than one seed.* Of this section, *Psoralea;* the curious *Stylosanthes* of Swartz; the *Hallia* of Thunberg; and our own *Trifolium*, are examples. The last genus, one of the most natural as to habit and qualities, is extremely untractable with respect to botanical characters. Some species have many seeds in each pod; some have not even the capitate inflorescence, made a part of the generic definition. The difficulty is lessened by establishing *Melilotus* as a genus, with Jussieu; but the whole requires to be well reconsidered; for, if possible, so great a laxity of definition, with such glaring exceptions, should not disgrace any system.

***** *Legume composed of single-valved joints, which are rarely solitary.* *Hedysarum* is the most important genus of this section, and is known by its obtuse or rectangular keel. *Hippocrepis, Ornithopus,* and *Scorpiurus,* known in gardens by the name of Caterpillar, from its worm-like pod, are further examples. *Smithia, Ait. Hort. Kew. t.* 13, is remarkable for having the joints of the legume connected by means of the style, as by a thread; the stamens in two equal divisions, with five anthers to each; and a two-lipped calyx. *Hedysarum vespertilionis* in some points approaches this genus, and more certain species are possibly latent among the numerous unsettled papilionaceous plants of India.

****** *Legume of one cell, with several seeds.* To this belong the genus *Melilotus*, if separated from *Trifolium;* the *Indigofera*, several species of which are so valuable for dyeing blue; the handsome *Robinia, Cytisus,* &c., and *Clitoria,** also *Lotus,* and *Medicago,* which last is justly transferred by Willdenow from the foregoing section to this.

Papilionaceous plants are rarely noxious to the larger tribes of animals, though some species of *Galega* intoxicate fish. The seeds of *Cytisus Laburnum* have of late been found violently emetic, and those of *Lathyrus sativus* have been supposed at Florence to soften the bones, and cause death;

* From κλειω, *to close* or *shut up*, in allusion to the situation of the wings and keel.

we know of no other similar instances in this Class, which is one of the most abundant in valuable esculent plants. The Negroes have a notion that the beautiful little scarlet and black seeds of *Abrus precatorius*, so frequently used for necklaces, are extremely poisonous, insomuch that half of one is sufficient to kill a man. This is totally incredible. Linnæus however asserts rather too absolutely, that "among all the leguminous or papilionaceous tribe there is no deleterious plant to be found."

Class 18. *Polyadelphia.* Stamens united by their filaments into more than two parcels.

Orders 3, distinguished by the number or insertion of their stamens, which last particular Linnæus here overlooked.

No part of the Linnæan system has been less accurately defined or understood than the Orders of the eighteenth Class. Willdenow, aware of this, has made some improvements, but they appear to me not sufficient, and I venture to propose the following arrangement.

1. *Dodecandria.* Stamens, or rather Anthers, from twelve to twenty, or twenty-five, their filaments unconnected with the calyx. Of this, the first example that presents itself is *Theobroma*, the Chocolate tree. The flowers have not been seen fresh in Europe, and we only know them from drawings made in the West Indies, one of which, preserved in the Linnæan herbarium, is my authority for the following descriptions. The filaments are inserted between the long tapering segments of a five-cleft nectary, on its outside, and each bears at its summit four sessile, obtuse, spreading anthers. Aublet's figure of this genus, which Schreber and Willdenow seem to have followed, represents but two. The fruit is perhaps most properly a berry with a hard coat, whose seeds, when roasted, make chocolate. *Bubroma* of Schreber, *Guazuma* of Lamarck, *t.* 637, confounded by Linnæus with the preceding genus, has similar

filaments, but each bears five anthers; Jussieu and Cavanilles say three. The fruit is a woody capsule, with ten rows of perforations. *Abroma* has five parcels of anthers, nearly sessile, on the outside of the nectary, between its obtuse, reflexed, notched lobes. It is difficult to say how many anthers compose each parcel, for the different accounts on record are totally irreconcilable. I have found three; the drawing sent to Linnæus represents six; and Miller has a much greater number. Perhaps they may vary. In this uncertainty the genus in question is best placed with its natural allies in this Order, with a reference to it in italics at the end of *Polyadelphia Polyandria*. Its fruit is a membranous winged capsule, opening at the top. *Monsonia*, removed by Schreber and Willdenow to *Monadelphia*, rather, I think, belongs to this class, where Linnæus placed it. The five filaments, bearing each three long-stalked anthers, are merely inserted into a short membranous cup, or nectary, for so the analogy of the three preceding genera induces me to call it; and if we refer *Monsonia* to *Monadelphia*, we fall into the error of Cavanilles mentioned *p.* 224. Lastly, *Citrus*, *Suppl. f.* 224, the Orange, Lemon, &c., most unquestionably belongs to this Order. Its stamens are about nineteen or twenty, combined variously and unequally in several distinct parcels; but those parcels are inserted into a proper receptacle, by no means into the calyx, as the character of the Class *Icosandria* indispensably requires. Even the number of the anthers of *Citrus* accords better with most plants in *Dodecandria* than in *Icosandria*, notwithstanding the title of the latter.

2. *Icosandria.* Stamens numerous, their filaments inserted (in several parcels) into the calyx.—To this Order Professor Willdenow properly refers *Melaleuca*, *Suppl. f.* 53—56, which had previously stood in *Polyandria*, botanists having only considered *number* and not *insertion* in the Orders of *Polyadelphia*, whence a double mistake has arisen, concerning *Citrus* on the one hand, and *Melaleuca* on the other.

3. *Polyandria.* Stamens very numerous, unconnected with

the calyx. This Order consists of several genera. The most remarkable is *Hypericum*, *Suppl. f.* 48—50, whose stamens are united into three or five parcels, corresponding with the number of its styles. *Munchhausia* is a *Lagerströmia*, nor does it appear to be polyadelphous at all. Linnæus seems to have intended bringing *Thea* into this Order; see *Monadelphia Polyandria.*

Class 19. *Syngenesia.* Anthers united into a tube. Flowers compound.

Orders 5.

This being truly a natural Class, its Orders are most of them equally so, though some are liable to exceptions, as will presently be explained.

1. *Polygamia æqualis.* In this each floret, taken separately, is perfect or united, being furnished with its own perfect stamens and pistil, and capable of bringing its seed to maturity without the assistance of any other floret. The Order consists of three sections.

* *Florets all ligulate*, or *strap-shaped*, *Suppl. f.* 57—60, called by Tournefort *semiflosculous.* These flowers are generally yellow, sometimes blue, very rarely reddish. They expand in a morning, and close towards noon, or in cloudy weather. Their herbage is commonly milky and bitter. *Leontodon*, *Tragopogon*, *Hieracium*, and *Cichorium*, exemplify this very natural section.

** *Flowers globose, generally uniform and regular, their florets all tubular, five-cleft, and spreading, Suppl. f.* 61—63. —*Carduus*, *Onopordum*, and *Arctium*, well exemplify this. *Carlina* does not so exactly agree with the above definition, having a flat disk; but its affinity to the other genera is indubitable. Its flattened disk and radiating coloured calyx seem contrived to imitate the radiated flowers of the following Order.

*** *Flowers discoid, their florets all tubular, regular, crowded and parallel, forming a surface nearly flat, or exactly conical.* Their colour is most generally yellow, in some cases pink. *Santolina,* and *Bidens* are genuine examples of this section; *Eupatorium,* and the exotic *Stæhelina,* approach to the preceding one. There is however the most absolute difference between these two sections, collectively, and the first; while, on the other hand, they have considerable affinity with some of the following Orders, as will be hereafter explained.

2. *Polygamia superflua.* Florets of the disk perfect or united; those of the margin furnished with pistils only; but all producing perfect seed.

* *Discoid,* the florets of the margin being obsolete or inconspicuous, from the smallness or peculiar form of the corolla; as *Artemisia, Tanacetum, Conyza,* and *Gnaphalium.* In the last the marginal florets are mostly five-cleft and tubular like the rest, only wanting stamens. Caution is requisite to detect the difference between this section and the preceding Order.

** *Ligulate, two-lipped,* of which *Perdicium,* a rare exotic genus, is an instance.

*** *Radiant,* the marginal florets ligulate, forming spreading conspicuous rays; as *Bellis,* the Daisy, *Aster,* or Michaelmas Daisy, a very numerous genus in America; *Chrysanthemum, Inula, Suppl. f.* 66—69, &c. This section seems, at first sight, a combination of the first and third sections of the former Order, but this is chiefly in the form of its corollas. It is rather an approach of that third section towards what is equivalent to becoming double in other tribes. Accordingly, the Chamomile, *Anthemis nobilis, Chrysanthemum Leucanthemum,* and some others, occasionally have their whole disk changed to ligulate white florets, destitute of stamens, and consequently abortive. Such are actually called double flowers in this Class, and very properly. Many exotic species so circumstanced are met with in gardens. A few very strange anomalies occur in this section, as already mentioned; see *p.*155, one *Siegesbeckia* having but three stamens, instead of five, the otherwise universal number in the Class; and *Tussilago Petasites*, *Br. Fl.*) *hybrida*,* as well as *paradoxa* of Retzius, having distinct anthers. Nature therefore, even in this most natural Class, is not quite without exceptions.

3. *Polygamia frustranea.* Florets of the disk, as in the preceding, perfect or united, *Suppl. f.* 65; those of the margin neuter, *Suppl. f.* 64, or destitute of pistils as well as of stamens; only some few genera having the rudiments of pistils in their radiant florets.

This Order is, still more evidently than the last, analogous to double flowers of other Classes. Accordingly, *Coreopsis* is the very same genus as *Bidens*, only furnished with unproductive radiant florets. *C. bidens* of Linnæus is the same species as his *B. cernua; C. coronata* is his *B. frondosa;* and *C. leucantha*, *B. pilosa.* Some species of *Coreopsis*, indeed, have never been found without rays. Linnæus expresses his difficulties on this subject in *Phil. Bot. sect.* 209, but seems inclined to unite the two genera. A similar ambiguity occurs between *Gorteria* and *Atractylis*, *Relhania* (of the last Order) and *Athanasia*, and in some degree between *Centaurea* and *Carduus*, or *Serratula;* only the scales of the calyx of *Centaurea* generally keep that genus distinct.

I should be much inclined to abolish this Order. Those of its genera which have rudiments of pistils in their radiant florets, as *Rudbeckia* and *Helianthus*, would very commodiously range with their near relations in *Polygamia superflua*, nor are we sure that such radiant florets are in all circumstances abortive, neither can a student often know whether they are so or not. It does not follow, from what has just been observed, that the presence of radiant florets, whether abortive or not, can never afford

* This is now universally acknowledged to be the pistilliferous state of *Tussilago Petasites* (*Petasites vulgaris*, *Br. Fl.*), that plant being in a great measure diœcious.—*Ed.*

a generic character, provided there be no corresponding genus without them. This must be determined by experience and observation. They are indeed to be considered as a very secondary mark, the most essential in this Class being derived from the receptacle, crown of the seed, and calyx. These Gærtner has illustrated with the greatest accuracy and skill, but even these must not be blindly followed to the destruction of natural genera.

4. *Polygamia necessaria.* Florets of the disk furnished with stamens only; those of the margin, or radius, only with pistils; so that both are necessary to each other. This is well seen in the common Garden Marigold, *Calendula*, in whose calyx, when ripening seed, the naked and barren disk is conspicuous. *Othonna*, *Arctotis*, *Osteospermum* and *Silphium*, not rare in gardens, are further examples of this Order, which I believe is constant and founded in nature. We have no British specimens either of it or the following. *Filago*, at least as far as our *Flora* is concerned, belongs to *Gnaphalium*.

5. *Polygamia segregata.* Several flowers, either simple or compound, but with united tubular anthers, and with a partial calyx, all included in one general calyx. Of these the Globe-thistle, *Echinops*, and *Stoebe*, with *Seriphium* and *Corymbium*, (which two last require to be removed hither from the abolished Linnæan Order, *Syngenesia Monogamia*,) have only one floret in each partial calyx; *Jungia* has three, *Elephantopus*, four, others more. In every case the partial calyx is distinguished from the chaffy seed-crown, observable in several genera of the other Orders, (though the latter is indeed analogous to a calyx,) either by being inferior, or by the presence of a seed-crown, or feathery down, besides. See *Lamarck*, *t.* 718—723, where the plants in question are well represented.

Class 20. *Gynandria.* Stamens inserted either upon the style or germen.

Orders 9 in Linnæus, but some alterations concerning them are necessary.

This is one of those Classes abolished by the celebrated Thunberg, and by several less intelligent writers who have followed him. The reasons which led to this measure appear to have been, that Linnæus has erroneously placed in *Gynandria* several plants which have not the requisite character; hence that character itself has been judged ambiguous, or not founded in nature, and the system has been supposed to be simplified by overlooking it. This appears to me a great mistake. The character of the Class, taken as above, is as evident, constant, and genuine as that of any other in the system. No doubt can arise, if we be careful to observe that the stamens actually grow out of the germen or style, and not merely out of any part that supports the germen; as will appear by examples.

1. *Monandria.* Stamen, or sessile Anther, one only. This contains all the beautiful and curious natural family of the *Orchideæ*, or Orchis tribe, except only *Cypripedium*, which belongs to the next Order. I am induced to consider the bulk of this family as *monandrous*, upon a careful review of Professor Swartz's representation of the subject, in his excellent treatise, long ago published in English. See *Tracts relative to Botany translated from different Languages* (by Mr. König), printed for Phillips and Fardon, 1805. I have already, *p.* 133, mentioned the glutinous nature of the pollen of these plants. This forms yellow elastic masses, often stalked, in each cell of the anther, and the cells are either parallel and close together, or removed from each other to the opposite sides of the style; which serves to connect them, just as the filament does in many Scitamineous plants, alike therefore decided to be monandrous. Such a decision, with regard to those also, is justified by the analogy of other species, whose cells being approximated or conjoined, properly constitute but one anther. The grand and absolute subdivision of the *Orchideæ* is justly founded by Dr. Swartz, after Haller, on the structure of the anther, whether it be, as just described, *parallel*,

like that of *Orchis*, *Ophrys*, *Suppl. f.* 70—72; and *Diuris*, *Exot. Bot. t.* 9, &c.; or *vertical*, consisting of a moveable lid on the top of the style, like *Dendrobium*, *Suppl. f.* 77, 78; or *Malaxis*. The style of the *Orchideæ* has been called a column, but I think that term now altogether superfluous. It is really a style, and the stigma is a moist shining space, generally concave, and situated, for the most part, in front of the style beneath the anther. In *Orchis* (*Habenaria*, *Br. Fl.*) *bifolia*, and others, it is just above the orifice of the spur. Concerning the nectary of these plants there has been much diversity of opinion. The *calcar*, spur, in *Orchis*, and some other genera, is acknowledged to be such, and holds abundance of honey. This spur is judged by Swartz, as well as Linnæus, a decisive generic mark of distinction, and it commonly is so: but some Indian species brought by Dr. Hamilton prove it not to be absolute. The remarkable and often highly ornamented lip, considered by Swartz as the only corolla, for he takes all the other leaves of the flower for a calyx, has, by Linnæus and others, been thought either a part of the nectary, or, where no spur is present, the only nectary. Nor is this opinion so ill-founded as many botanists suppose; for the front of the lip evidently secretes honey in *Ophrys* (or *Listera*) *ovata*, and probably in others not yet attended to. Nevertheless, this lip might, like the petals of lilies, be deemed a nectariferous corolla, were it certain that all the other leaves were truly a calyx. But the two inner are so remarkably different from the three outer ones in *Ophrys*, and above all in *Stelis*, *Exot. Bot. t.* 75, that I am most inclined to take the former for the corolla, the latter being, according to all appearance, a calyx. An insensible gradation from one to the other, of which we have pointed out other instances in treating of this subject already, occurs in *Diuris*, while in some *Orchideæ* the leaves all partake more of the habit of a calyx, and in others of a corolla. Even the lip in *Thelymitra*, assumes the exact form, colour, and texture, of the rest of the flower; which proves that a dissimilarity between any of these parts is not always to be expected in the family under consideration. *Vahl* appears by the preface to his *Enumeratio Plantarum* to have removed the *Scitamineæ* to *Gynandria*, because the stamen of *Canna* adheres to the style. This, if constant, could only concern that genus, for the rest of the Order are in no sense gynandrous.

2. *Diandria.* To this Order *Cypripedium* must be referred, having a pair of very distinct double-celled anthers. Here we find *Forstera*, so well illustrated by Professor Swartz in Sims and König's *Annals of Botany, v.* 1. 291, *t.* 6; of which genus *Phyllachne, t.* 5 of the same volume, is justly there reckoned a species. Of the same natural order with *Forstera* is *Stylidium;* but that having, I think, four anthers, belongs to the fourth Order of the present Class. *Gunnera*, placed by Linnæus in *Gynandria Diandria*, is not yet sufficiently well understood.

3. *Triandria.* *Salacia*, if Linnæus' description be right, is properly placed here; but Jussieu doubts it, nor does my dried specimen serve to remove the uncertainty. *Stilago* proves to be merely the barren plant of *Antidesma alexiteria*, and belongs to *Dioecia;* as *Sisyrinchium, Suppl. f.* 151, and *Ferraria*, do to *Monadelphia*, the tubular united stamens of the two last having been mistaken for a solid style. *Rhopium* of Schreber (*Meborea* of *Aublet, t.* 323,) seems therefore the only certain genus of the Order under consideration; unless Lamarck be right in referring to it Jacquin's *Strumpfia*, upon which I have not materials to form any opinion. The original discoverer attributes to this plant five stamens with united anthers; hence it found a place in the *Syngenesia Monogamia* of Linnæus. Lamarck merits attention, as he appears to have had an authentic specimen. See his *t.* 731.

4. *Tetrandria.* *Nepenthes*, of whose extraordinary kind of leaf mention is made, *p.* 95, is the only genus of this Order in Linnæus, but very erroneously placed here, for it belongs to *Dioecia Monadelphia*. The Order however

must be retained for the sake of *Stylidium*, *Suppl. f.* 73—76, a New Holland genus, related, as above-mentioned, to *Forstera*. This is my *Ventenatia*, *Exot. Bot. t.* 66, 67; but another genus having previously, without my knowledge, received the latter denomination, that of *Stylidium*, under which I had, some time ago, communicated this genus to the French botanists,* and which they have adopted, becomes established. See Labillardière's excellent work on New Holland plants, where several species of it are figured.

5. *Pentandria*. The original genera of this Order, *Ayenia*, *Gluta*, and *Passiflora*, *Suppl. f.* 271, most unquestionably have nothing to do with it, their stamens being inserted below the germen, merely on a columnar receptacle. The learned Schreber therefore removed them to the fifth Class.

It has been thought that this Order might receive a reinforcement from the Linnæan *Pentandria Digynia*. Several of the *Contortæ* have long been suspected to belong to *Gynandria*; see *Pergularia*, *Ic. Pict. t.* 16, *Suppl. f.* 185, and *Andr. Repos. t.* 184. In this genus, as well as *Cynanchum* and *Asclepias*, the pollen appears in five pair of glutinous masses, exactly like the pollen of *Orchideæ*, sticking upon the stigma. Each mass of pollen is received into a bag, or cell, formed by a valvular apparatus that encircles the organs of impregnation, like the generality of stamens. The pollen however is, in the above genera, not found attached to these cells or valves, but to five glands, each of which is double, and all of them seated on that thick abrupt angular body which acts as a stigma.†

* I was not aware of Loureiro's *Stylidium*, a plant, according to his description, of the seventh Class: *Fl. Cochinch. v.* 1. 221; but this can scarcely interfere with ours, being probably, as it grows about Canton, some well known shrub that happened to have a seven-cleft flower. It should seem to belong to the *Rubiaceæ*, notwithstanding some points in the description.

† Mr. R. Brown believes the cells secrete the pollen, and deposit it on the stigma, as the pollen of some *Orchideæ* sticks to any part of the plant. I now readily assent to this, and therefore these plants must remain in *Pentandria*.

Nor is it worth while to dispute whether this whole body be a stigma or not, with regard to the question under consideration; for it is borne by the styles, above the germen. I humbly conceive, however, with Linnæus and Jacquin, that as part of it, at least, receives the pollen, stigma is full as good a name for this body as Haller's term *dolium*, a tub! Still less is it worth while to controvert with Kölreuter the propriety of the term pollen, because the substance in question is not actually a dry powder, any more than in the Orchis tribe, or in *Mirabilis*, *Suppl. f.* 167. That term is technically used for the matter which renders the seeds fertile, including its vehicle, whether the latter be capsular or glutinous; in short, whatever the appearance or texture of the whole may be. Another question remains, more immediately to our present purpose, whether these plants have five stamens or ten? Jacquin, who has well illustrated several of them in his *Miscell. Austr. v.* 1. *t.* 1—4, and Röttboll in a dissertation on the subject, contend for the latter. Röttboll wrote to Haller, "that finding Linnæus deaf to all that had been said, he sent him his treatise, to see whether he would persist in falsifying nature." Thus sordid underlings foment the animosities and flatter the failings of their superiors! Linnæus judiciously suspended his opinion, and, after all, proves to be most correct. The analogies of the *Orchideæ* and *Scitamineæ*, very clearly decide that the two cells, or the double masses of naked pollen, can only be considered as one anther of two lobes. *Periploca Græca* confirms this. Each lobe of its anthers stands, as in many *Scitamineæ*, on the outermost edge of the filament; thus meeting that on the adjoining filament, and in appearance constituting with it a two-lobed anther, as the lobe of the *Scitamineæ*, where there is but one filament, meets its corresponding lobe by embracing the style.

6. *Hexandria*. *Aristolochia*, a curious genus, of which there are many exotic species, is the only example of this, *Pistia* being removed to *Monadelphia Octandria*.

7. *Octandria.* The *Scopolia* of Linnæus, which originally constituted this Order, proves to be a *Daphne.* *Cytinus* however, a singular parasitical plant on the roots of *Cistus* in the south of Europe, has properly been brought hither from the Order *Dodecandria*, of which it originally formed the only example. The observations of Dr. Sibthorp and Mr. Ferd. Bauer confirm those of other botanists, that the anthers are eight, not sixteen, and that they are truly inserted upon the style.

8. *Decandria* is now abolished. Of the two genera which constituted it, *Kleinhovia* belongs to the Class *Dodecandria*, having fifteen stamens, see *Cavan. Monadelph. t.* 146; and *Helicteres* to *Decandria Monogynia.*

9. *Dodecandria* is likewise abolished.

10. *Polyandria* is in a similar predicament, for I am not aware of any genus that can be admitted into it. *Xylopia* goes with the greatest propriety to its natural allies *Annona*, &c., in *Polyandria Polygynia*, its short stamens being inserted into the receptacle below the germen. *Grewia*, as well as Schreber's *Microcos*, a good genus, belong to *Polyandria Monogynia*, the organs of impregnation being merely elevated on a common stalk, like those of *Passiflora* and *Ayenia. Ambrosinia*, *Arum*, and *Calla*, are all justly removed by Schreber to *Monoecia*, though I think, for reasons hereafter given, they are more commodiously and naturally placed in the Order *Polyandria* of that Class, than in the Order *Monandria. Dracontium* and *Pothos*, of the same natural family, having perfect or united flowers, the former with seven stamens to each, the latter with four, are undoubtedly to be referred to their corresponding Classes, *Heptandria* and *Tetrandria. Zostera*, the only remaining genus of *Gynandria Polyandria* in Linnæus, I have long ago ventured to remove to *Monandria Monogynia;* see *Engl. Bot. t.* 467.

Class 21. *Monoecia.* Stamens and Pistils in separate flowers, but both growing on the same individual plant.

Orders 9 or 10.

Several reformers of the Linnæan system have also abolished this Class and the two following, by way of rendering that system more simple. Thirty years' additional experience since the preface to the seventh volume of *English Botany* was written, have but confirmed my opinion, there given, on this subject. If any plants ought to be removed from these Classes, they must be such as have the structure of all the accessory parts of the flower exactly alike, (the essential parts, or stamens and pistils only, differing,) in both barren and fertile flowers; and especially such as have in one flower perfect organs of one kind, accompanied by rudiments of the other kind, for these rudiments are liable occasionally to become perfect. By this means dioecious species of a genus, as in *Lychnis*, *Valeriana*, *Rumex*, &c., would no longer be a reproach or inconvenience to the system. But, on the other hand, some difficulty would occasionally arise to a student, in deciding whether there were any real difference of structure between these accessory parts or not, and it might puzzle an adept to determine the question. For instance, whether the nectary in *Salix*, different in the barren and fertile flowers of some species, should lead us to keep that genus in *Dioecia*, though in other species the nectary is precisely alike in both the kinds, and occasionally an abortive germen occurs in the barren flowers, as stamens do, more rarely, in some fertile ones. Considering all this, I might refer *Salix*, *Suppl. f.* 85—87, to *Diandria Monogynia*.

With respect to those Monoecious or Dioecious genera whose barren flowers are decidedly unlike the fertile ones, the former being in a catkin, the latter not, as *Corylus*, *Quercus*, *Suppl. f.* 80—82, &c., I conceive nothing more pernicious or troublesome can be attempted than to remove them to the Classes of united flowers. They meet with no allies there, but, on the contrary, form so natural an assemblage by themselves, as to be unanimously kept separate by the authors of every natural system that has appeared. But even if this were not the case, there is a most important reason for keeping them as they are, which regards the artificial system more particularly, and of which its author was well aware; they are of all plants most uncertain in the number of their stamens. Now this uncertainty is of little moment, when we have them primarily distinguished and set apart from other plants by their Monoecious or Dioecious character; because the genera being few, and the Orders constructed widely as to number of Stamens, we find little difficulty in determining any genus, which would by no means be the case if we had them confounded with the mass of the system. Even the species of the same genus, as well as individuals of each species, differ among themselves. How unwise and unscientific then is it, to take as a primary mark of discrimination what nature has evidently made of less consequence here than in any other case! It is somewhat like attempting a natural system, and founding its primary divisions on the artificial circumstance of number of stamens.

I proceed to give some illustrations of the Orders in *Monoecia.*

1. *Monandria. Zannichellia* and *Aegopricon, Plant. Ic. ex Herb. Linn. t.* 42, are genuine examples of this Class and Order, having a different structure in the accessory parts of their barren and fertile flowers. *Artocarpus,* the celebrated Bread-fruit, may likewise be esteemed so, on account of a partial calyx in the barren flowers. The other amentaceous genera may most intelligibly perhaps be referred to the Order *Polyandria. Chara* is now removed to the first Class in the System; * *Euphorbia, Suppl. f.* 268, is brought hither from the eleventh Class, at the suggestion of Mr. Brown.

2. *Diandria. Anguria* can remain here only till the proposed reformation takes place, having no difference of structure in its flowers. *Lemna,* so imperfectly known when Linnæus wrote, is now well understood, and, having frequently united flowers, belongs to the second Class, *Suppl. f.* 136.

* By some; by others, and I think with the greatest propriety, to the Class *Cryptogamia.—Ed.*

3. *Triandria.* The great genus of *Carex*, *Suppl. f.* 79 and 139, and some other grassy plants, *f.* 141, are found here. *Typha*, *Suppl. f.* 138, is less clear in its structure; *Sparganium* is sufficiently so. *Tragia*, *Hernandia* and *Phyllanthus* are properly placed in this Class and Order.

4. *Tetrandria.* *Littorella*, the valuable genera *Betula*, and *Buxus*, *Suppl. f.* 269; also the Nettle, *Urtica*, *f.* 273, are good examples of this. *Morus*, the Mulberry, of the same natural order as the Nettle, has scarcely any difference of structure in the accessory organs of the flowers. This tree, however, is remarkable for being often inclined to become even dioecious in its constitution, one individual bearing most fruit when accompanied by another whose barren flowers are more effective than its own. *Empleurum* is one of those ambiguous genera which are but imperfectly monoecious.

5. *Pentandria.* *Xanthium*, *Ambrosia*, *Nephelium*, *Parthenium*, *Iva*, and *Clibadium*, all partake, more or less accurately, of the nature of compound flowers; but their anthers not being united, they could hardly be referred to the class *Syngenesia*;* particularly *Xanthium* and *Nephelium*, whose fertile flowers have no resemblance to that Class. *Amaranthus*, *Suppl. f.* 165, an extensive dunghill genus in warm countries, analogous to our *Chenopodium*, follows next. *Leea* is the same with *Aquilicia*, and belongs to *Pentandria Monogynia*, the former name being retained for the sake of the highly meritorious botanist and cultivator whom it commemorates. The Gourd tribe, *Cucurbita*, *Cucumis*, *Bryonia*, *Suppl. f.* 270, might be brought hither from the abolished Order *Syngenesia*, unless it should be thought better to consider them as polyadelphous, to which I am most inclined.

6. *Hexandria.* *Zizania*, and *Pharus*, both grasses, compose

* Willdenow however has removed *Iva* and *Parthenium* thither, according to the original ideas of Linnæus, in *Gen. Pl. ed.* 1.

this Order, to which Schreber has added *Epibaterium* and *Pometia* of Forster, as well as the splendid *Guettarda*. The latter varies from six to nine in the parts of the flower, and constitutes the Order *Heptandria* in Linnæus, according to his usual principle of placing such irregular plants, as much as possible, in small Classes or Orders, that they might be the more easily found.

7. *Polyandria*. Stamens more than seven. *Ceratophyllum*, *Myriophyllum*, *Suppl. f.* 251, and the handsome *Sagittaria* stand here at present, but the accessory parts in their two kinds of flowers are alike. *Begonia* has the number of its petals, though various in several species, always sufficiently different in the barren and fertile flowers to fix it here.—The most indubitable plants of this Order are amentaceous, *Quercus*, *Suppl. f.* 80—84, *Fagus*, *Corylus*, *Carpinus*, *Juglans*, *Platanus*, &c.—*Arum*, *Calla* and *Ambrosinia*, all brought hither from the twentieth Class, seem to me perfectly intelligible as simple monoecious flowers, the barren one, with many stamens, being *superior*, or *interior*, with respect to the fertile, like the generality of monoecious, as well as all compound flowers, and not *inferior*, or, as in every simple one, *exterior*.

8. *Monadelphia*. The Fir, *Pinus*, *Suppl. f.* 276, so magnificently illustrated by Mr. Lambert, is very distinct in its two kinds of flowers. Each barren one consists of a naked tuft of monadelphous stamens, accompanied only by a few bracteas at the base. The fertile ones are catkins, with similar bracteas, each scale bearing on its upper side a pair of winged seeds, and on its under a leaf-like style and acute stigma; as Jussieu first suggested, though some botanists have understood these parts otherwise; see *Engl. Fl. v.* 4. *Acalypha*, *Croton*, *Jatropha*, *Ricinus*, and several others of the Natural Order of *Euphorbiaceæ*, acrid milky plants, form a conspicuous and legitimate part of *Monoecia Monadelphia*. *Omphalea* is justly associated with them by Schreber, though placed by Linnæus in the Order *Triandria*, and this alteration is the more fortunate, as one of its species is

diandrous. *Sterculia* is best removed to the eleventh Class, next to *Kleinhovia*.

9. *Polyadelphia*. If the system should be preserved in its present state, without regard to agreement or difference in the accessory parts of the barren and fertile flowers, I conceive this Order might be established for the reception of the Gourd tribe, as already hinted under the fifth Order. Their filaments are united, in three sets, a character much more intelligible and constant than the casual and irregular connexion of their anthers which led Linnæus to reckon them syngenesious; for they only afford an additional proof that union of anthers is, in simple flowers, neither a good natural nor artificial guide. If the monoecious and dioecious Classes be reformed according to the plan to which I have so often adverted, these plants should go to the Class *Polyadelphia*.

10. *Gynandria* is scarcely tenable, being paradoxical in its character, and the two Linnæan genera which compose it, *Andrachne* and *Agyneia*, seem most properly, even as the system stands at present, to belong to the eighth Order, to great part of which they are, moreover, naturally related.

CLASS 22. *Dioecia*. Stamens and pistils in separate flowers, situated on two separate plants.

Orders 8.

The foregoing remarks on the Orders of *Monoecia* apply also to those of this Class. I shall therefore only briefly mention some genera properly illustrative of each Order, more particularly specifying such as require to be placed elsewhere.

1. *Monandria*. *Brosimum* of Swartz, and *Ascarina* of Forster, seem, by their descriptions, to be well placed here. *Pandanus* (*Athrodactylis* of Forster) is more doubtful, not having any partial calyx or corolla to divide the stamens into

separate blossoms, so that the whole may be taken either for a polyandrous or a monadelphous flower, as well as for an assemblage of monandrous ones. *Najas* is a good and immutable example of this Order. Of Thunberg's *Phelypæa* I have not materials to form a judgment.

2. *Diandria.* The wonderful *Valisneria* already described, *p.* 168, is a decisive example of this. *Cecropia* also seems unexceptionable. Of *Salix*, see *Suppl. f.* 85—87, I have already spoken, *p.* 240. The scales of its barren and fertile catkins are alike; its nectaries various.

3. *Triandria.* *Elegia* and *Restio*, hard rushy plants, chiefly of the Cape of Good Hope and New Holland, appear to be without any difference in the accessory parts of their flowers, which is certainly the case with *Empetrum*, *Ruscus*, brought hither from *Dioecia Syngenesia*, *Osyris*, *Excœcaria*, and *Maba* ; *Caturus* only seeming differently constructed in this particular; but I have not been able to examine the three last.

4. *Tetrandria.* *Trophis*, *Batis*, and *Hippophäe*, are good examples of this, though Mr. Viborg is recorded by Schreber to have occasionally found united flowers, intermixed with the barren ones, in the last-mentioned genus. If this be usual, *Hippophäe* must be removed to *Polygamia Dioecia*. The rest of the order appear to have the accessory parts alike in both flowers, as *Viscum*.

5. *Pentandria.* *Humulus*, *Suppl. f.* 274, is almost the only certain instance here. *Spinacia*, *Acnida*, and *Cannabis* would be unexceptionable, but they are less absolutely dioecious, being sometimes monoecious; see *p.* 166. The rest of the Order is at best doubtful; nor can the pretended *amentum* of the barren-flowered *Pistacia* entitle it to a permanent place in this Class, for its fructification is truly a panicle. *Clutia*, more properly *Cluytia*, may possibly remain here. It has no right to a place in the Order *Gynandria*.

6. *Hexandria.* No difference of structure is discernible between the barren and fertile flowers of any genus in this Order; witness *Tamus*, though something to the contrary is mentioned in the *Genera Plantarum* of Linnæus.

7. *Polyandria.* Under this Order I would certainly comprehend all dioecious plants that have from eight to any greater number of stamens, according to the example set by Linnæus himself in the last Class. The genera are exceedingly variable in this respect; and if all those, the accessory parts of whose flowers are uniform, were taken away, the remainder would be so few, that it is hard to say whether any would remain at all. Instances of the Order as it now stands are *Populus, Suppl. f.* 88—91, *Hydrocharis, Suppl. f.* 156, and *Mercurialis.* The fertile flowers of the latter have, in some cases, a nectary or corolla of two slender leaves, not found in the barren ones, which may entitle it to a permanent place here. *Carica* will also probably remain. *Rhodiola* is scarcely perhaps distinct from *Sedum. Coriaria* and *Ailanthus*, having often united flowers, are best in the tenth Class, as *Euclea* is in the eleventh. I find no genera truly icosandrous here, though Schreber esteems *Flacourtia* and *Hedycarya* to be so.

8. *Monadelphia. Taxus, Suppl. f.* 275, and perhaps *Juniperus*, also the exotic *Ephedra*, are legitimate examples of this Order. Spurious ones are *Nepenthes, Myristica* the Nutmeg, and Schreber's *Xanthe*, all placed by him in the now abolished Order *Syngenesia*, and which can only take shelter here while the Class remains as it is, for they have no difference of structure in the accessory parts of their flowers.

Class 23. *Polygamia.* Stamens and Pistils separate in some flowers, united in others, either on the same plant or on two or three distinct ones; such difference in the essential organs being moreover accompanied with a diversity in the accessory parts of the flowers.

Orders 3.

1. *Monoecia.* United flowers accompanied with barren or fertile, or both, all on one plant. *Atriplex, Suppl. f.* 163, is an instance of this, having the barren flowers of five regular spreading segments; the united ones of two compressed valves, which becoming greatly enlarged, protect the seed. In several species however the flowers are none of them united, each having only stamens or only pistils. Throughout the rest of the Order, as it stands in Linnæus and Schreber, I can find no genus that possesses the requisite character. Some of the grasses indeed have awns to one kind of flower only, but that part is too uncertain to establish a character upon; and this family is so natural in itself and so liable to variations in the perfecting of its flowers or florets, that there can be no doubt of the propriety of classing its genera simply by the number of their stamens and styles, which are very constant.

2. *Dioecia.* The different flowers on two different plants. I can scarcely find a certain instance of this, except *Hippophäe*, already mentioned under *Monoecia Tetrandria.*

3. *Trioecia.* Of the only two genera which have ever been placed here, *Ceratonia* belongs to *Pentandria Monogynia*, *Ficus, Suppl. f.* 92—95, is so celebrated for the diversity of its flowers, as connected with the history of vegetable impregnation, see *p.* 169, that we are glad to take advantage of a trifling difference in the calyx of the two florets, (the barren one being *most frequently* three-cleft, the fertile five-cleft,) to keep it here.

All things being considered, this Class may be thought scarcely worth retaining. Yet as we know two or three genera entitled to a place in it, upon principles which the analogy of the two preceding Classes shows to be sound, we cannot tell but others may exist in the unexplored parts of the globe. For this reason, and for the uniformity of the system, I would venture to preserve it. If the twenty-first and twenty-second Classes should hereafter be reformed by some judicious and experienced hand, according to the principle I have suggested of retaining in them such genera only as have a permanent difference in the accessory, as well as the essential, parts of their flowers, their bulk being by such a reformation much diminished, it might be advisable to reduce them to one Class, in which the slender remains of *Polygamia* might commodiously be included, and the title of such a Class should be *Diclinia*, expressing the two distinct seats, or stations, of the organs. Mr. Pursh has adopted this.

Class 24. *Cryptogamia.* Stamens and Pistils either not well ascertained, or not to be numbered with any certainty.

Orders 5.

1. *Filices.* Ferns. The parts of their flowers are almost entirely unknown. The fructification, taken collectively, and proved to be such by the production of prolific seeds, grows either on the back, summit, or near the base of the frond. Some are called *annulatæ*, annulated, their capsules being bound with an elastic transverse ring; others *thecatæ*, or more properly *exannulatæ*, from the want of such an appendage, of which some of these last have, nevertheless, a spurious vestige. All the former, and some of the latter, are dorsiferous, bearing fruit on the back of the frond, and of these the fructification is either naked, or else covered with a membranous involucrum. The genera are distinguished by Linnæus according to the shape and situation of the spots, or assemblages of capsules, besides which I have first found it necessary to take into consideration the absence or presence of the involucrum, and especially the direction in which it bursts. *See Tracts relating to Nat. Hist.* 215, *t.* 1.

Polypodium has no involucrum; *Aspidium*, *Suppl. f.* 99—101, has a single, and *Scolopendrium*, *f.* 102—104, a double one. *Osmunda* has been remarked by Professor Swartz to have a spurious ring. It is one of those ferns the lobes of whose frond are metamorphosed, as it were, into spikes of capsules. *Botrychium* of Swartz, more distinctly spiked, and having no vestige of a ring, is separated by him from *Osmunda*. See one species of it in *Engl. Bot. t.* 318. *Ophioglossum*, and *Equisetum*, *Suppl. f.* 96—98, are other examples of spiked ferns. Each seed of the latter is embraced by four filaments, judged by Hedwig to be the stamens. Supposed ferns with radical fructifications, are *Pilularia*, and *Isöetes*, but the former might possibly be referred to *Monoecia Polyandria*, and the latter to *Monoecia Monandria*, as the system at present stands. *Lycopodium* is a fern, at least in my opinion, with axillary fructification.

2. *Musci.* Mosses. These are really herbs* with distinct leaves and frequently as distinct a stem, *Suppl. f.* 105—113. Their conical membranous corolla is called a *calyptra*, *Suppl. f.* 151, or veil, its summit being the stigma. This veil clothes the capsule, which, before the seed ripens, is elevated on a fruit-stalk. The capsule is of one cell and one valve, opening by a vertical lid, *Suppl. f.* 213.† Seeds very numerous and minute. The barren flowers of mosses consist of an indefinite number of nearly cylindrical, almost sessile, anthers, *Suppl. f.* 190; the fertile flowers of one (rarely more) perfect pistil, accompanied by several barren pistils, *Suppl. f.* 192. Both stamens and pistils are intermixed with numerous succulent jointed threads, *Suppl. f.* 191, which perhaps answer the purpose of a calyx or corolla, so far as protection is concerned. Some few species of moss have the stamens and pistils associated in the same flower, but they are generally separate. *Hypnum* has a scaly sheath, or *perichætium*, *Suppl. f.* 150, at the base of its fruit-stalk, composed of leaves very different from the foliage of the plant. This is considered as a sort of calyx, see *p.* 123, and as such is allowed to enter into the generic character; but there is some reason to esteem it rather of the nature of bracteas. The capsule of *Splachnum* stands on a peculiar fleshy base, called *apophysis*, *Suppl. f.* 189, *a*.

Micheli, in his *Genera Plantarum*, published in 1729,

* Hedwig's term *musci frondosi* is incorrect.

† This part in *Phascum* only does not separate from the capsule.

tab. 59, has well represented the parts above described, though he mistook their use, being quite ignorant of the fecundation of plants. Dillenius took the one flower precisely for the other, and yet absurdly called *capsula* what he believed to be *anthera*. Linnæus, who had previously formed just ideas on the subject, as appears from his Tour to Lapland, too implicitly submitted his own judgment to that of Dillenius, and adopted his hypothesis, at the same time correcting, as he thought, his phraseology. Hence the whole glare of the blunder of Dillenius has fallen on Linnæus; for while we read, in the Linnæan definitions of mosses, every where the word *anthera*, and in those of Dillenius, usually accompanying them, *capsula;* few persons, who have lately been instructed by Hedwig that the part in question is really a capsule, take the trouble to recollect that Dillenius so grossly misused that word. Various ideas have been started on this subject by Haller, Necker, and others, which could only claim attention while it remained in great obscurity. The excellent Hedwig has entirely the merit of an original discoverer in this branch of physiology. He examined all that had been done before his time, detected the truth, raised mosses from seed, *Suppl. f.* 193—196, and established their characters on the principles we have already explained.

The Linnæan genera of Mosses are chiefly founded on the situation of the capsule, whether lateral or terminal, with some other circumstances. They are too few, and not strictly natural. Hedwig first brought into notice the structure of the fringe, *peristomium*, which in most mosses borders the orifice of the capsule. This is either simple, *Suppl. f.* 189, *b*, or double, *f.* 213, 214, and consists either of separate teeth, or of a plaited and jagged membrane. The external fringe is mostly of the former kind, the inner, when present, of the latter. The number of teeth, remarkably constant in each genus and species, is either four, eight, sixteen, thirty-two or sixty-four. On these, therefore, Hedwig and his followers have placed great dependence, only perhaps going into too great refinements relative to the internal fringe, which is more difficult to examine, and less certain than the outer. Their great error has been laying down certain principles as absolute in forming genera, without observing whether all such genera were natural. Such mistakes are very excusable in persons not conversant with botany on a general scale, and whose minute and indefatigable attention to the detail of their subject, more than compensates the want of what is easily supplied by more experienced systematists. Thus *Barbula* of Hedwig is separated from *Tortula*, and *Fissidens* from *Dicranum*, *Suppl. f.* 105—108, on account of a difference of form or situation in the barren flowers, which is evidently of no moment, and merely divides genera that ought to be united. The same may be said of genera founded on the union of the stamens and pistils in one flower. On this subject I have been more diffuse in a paper on *Mnium*, in *Tr. of Linn. Soc. v.* 7. 254, to which I beg leave to refer those who are desirous of studying it further. Various and abundant specimens of this tribe of plants, showing the different structures of the fringe, lid, and other parts, may be seen in the latter volumes of *English Botany* more especially.

Mosses are found in the hottest and coldest climates. They are extremely tenacious of life, and, after being long dried, easily recover their health and vigour by moisture. Their beautiful structure cannot be too much admired. Their species are numerous, and in some cases difficult to determine, particularly in the genera *Tortula* and *Orthotrichum;* nor is the generic character of the latter so easy or certain as most others. Schreber, Dickson, Swartz, Bridel, Weber, Mohr, Turner, Schwaegrichen and Hooker, are great names in this department of Botany, besides those of whom I have already spoken.

3. *Hepaticæ.* Liverworts. Of these the herbage is commonly frondose, the fructification originating from what is at the same time both leaf and stem. This character, however, proves less absolute than one founded on their capsules, which differ essentially from those of the preceding Order in having nothing like a lid or *operculum.* The *corolla,* or veil, of some of the genera is like that of Mosses, but

usually bursts at the top. The barren flowers in some are similar to the stamens of the last-mentioned plants, as in *Jungermannia*, *Suppl. f.* 114, 115, see Hedwig's *Theoria*, *t.* 16;* in others they are of some peculiar conformation, as in *Marchantia*, *Engl. Bot. t.* 210, where they are imbedded in a disk like the seeds of Lichens, in a manner so contrary to all analogy, that botanists can scarcely agree which are the barren and which the fertile flowers of this genus. The four-valved capsule of *Jungermannia*, with the veil bursting at its summit to let the fruit-stalk pass, may be seen in *Engl. Bot. t.* 185, 186, which are both frondose species, like *J. epiphylla*, *t.* 771, whose calyx as well as corolla is evident; and *t.* 605—608, which have apparently distinct leaves, like Mosses. *Anthoceros*, *t.* 1537, 1538, is a curious genus of the *Hepaticæ*. Linnæus comprehended this Order under the following one, to which it is, most assuredly, far less akin than to the foregoing.

4. *Algæ.* Flags. In this Order the herbage is frondose, sometimes a mere crust, sometimes of a leathery or gelatinous texture. The seeds are imbedded, either in the frond itself, or in some peculiar receptacle. The barren flowers are but imperfectly known. Here we find that great Natural Order, comprehended by Linnæus under one genus by the name of *Lichen*, *Suppl. f.* 116—122, the fructification of which, for the most part, consists of a smooth round disk, *f.* 198, 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. The barren flowers are supposed to be powdery also, *f.* 197, very much like those of *Jungermannia*. See *Engl. Bot. t.* 126, and various other parts of that work, where a great number of species are figured. The whole tribe has been much investigated, and attempted to be divided into natural genera founded on habit, by Dr. Hoffmann, late of Goettingen, whose figures are perfect in their kind. But a more complete

* See also Prof. Hooker's valuable Monograph on *Jungermannia*, *t.* 13, where the anthers are ascertained to be membranous, discharging the pollen at the apex.

scheme for reducing this family to systematic order has been made known to the world by Dr. Acharius, a learned Swede, who in his *Prodromus* and *Methodus Lichenum*, has divided it into genera founded on the receptacle of the seeds alone. Hence those genera, though more technical, are less natural than Hoffmann's; but they will, most likely, prove the foundation of all that can in future be done on the subject, and the works of Acharius form a new era in cryptogamic botany. It is only perhaps to be regretted that he has been somewhat too prodigal of new terms, which when not wanted are always a burthen to science, and rather obscure than illustrate it. Thus Hedwig used the term *sporangium* for a seed-vessel, *pericarpium*, in which the learner would seek in vain for any distinction, or new idea. A student might very justly complain if, in a science so necessarily overburthened with words, he were required to call the same part by a different name in every different family. I would gladly therefore retain the word *frons* in preference to the *thallus* of Acharius, *receptaculum* for his *apothecium*, *pedicellus* for his *bacillum* or *podetium*, and *semina* for his *sporæ*, because I see no improvement in the change. When this or any other writer strikes out new ideas, and discriminates parts hitherto mistaken or unknown, we thankfully receive from him new terms to express his discoveries. Thus the *cyphella* of Acharius is a peculiar sort of pit or pore, on the under side of the frond, in that section of Lichens called *Sticta;* his *lirellæ* are the black letter-like receptacles of the genus *Opegrapha*, *Suppl. f.* 116, 117; his *tricæ* are the analogous parts, resembling a coiled horse-hair, in *Gyrophora*, the *Umbilicaria* of Hoffmann. These terms are necessary and instructive, and are chosen with that accuracy and taste for which Dr. Acharius is conspicuous.

The aquatic or submerged *Algæ* form a distinct and peculiar tribe. Some of these abound in fresh-water, others in the sea, whence the latter are commonly denominated seaweeds. The chief genera are *Ulva*, well defined by its seeds being dispersed under the cuticle throughout the membranous or gelatinous substance of the frond; *Fucus*, *Suppl. f.* 123—126, whose seeds are collected together in tubercles or swellings, of various forms and sizes; and *Conferva*, *Suppl. f.* 127, 128, of which the twenty-fourth and twenty-fifth volumes of *Engl. Bot.*, more especially, show various specimens. This last genus is commonly known by its capillary, and, for the most part, jointed frond. The seeds of some species are lodged in external capsules or tubercles; of others in the joints of the frond; and hence the ingenious Dr. Roth has formed a genus of the former, called *Ceramium*. His *Rivularia*, *Engl. Bot. t.* 1797—1799, is perhaps more satisfactorily separated from *Conferva*, as we trust is *Vaucheria*, a fresh-water genus named after *M. Vaucher* of Geneva, who has published an elaborate and faithful microscopical work on Fresh-water Confervas. The submerged *Algæ* in general are merely fixed by the roots, their nourishment being imbibed by their surface. Many of them float without being attached to any thing. The genus *Fucus* has received more botanical attention than the rest of this tribe; and the works of Gmelin, Esper, Stackhouse, and Velley have ascertained many species, which the labours of the Bishop of Carlisle, Mr. Woodward, and Mr. Turner, have reduced to systematic order. Still a more perfect combination of the skill of the painter and the botanist has long been desired, which is now supplied by the *Historia Fucorum* of the writer last-mentioned, and Dr. Hooker.*

5. *Fungi.* Mushrooms. These cannot properly be said to have any herbage. Their substance is fleshy, generally of quick growth and short duration, differing in firmness from a watery pulp to a leathery or even woody texture. By some naturalists they have been thought of an animal nature, chiefly because of their fetid scent in decay, and because little white bodies like eggs are found in them at that period. But these are truly the eggs of flies, laid there by the parent insect, and destined to produce a brood of maggots, to feed on the decaying *fungus*, as on a dead carcase.

* Prof. Agardh now takes the lead in this department.

Ellis' beautiful discoveries, relative to corals and their inhabiting polypes, led to the strange analogical hypothesis that these insects formed the *fungus*, which Munchausen and others have asserted. Some have thought *fungi* were composed of the sap of corrupted wood, transmuted into a new sort of being; an idea as unphilosophical as the former, and unsupported by any semblance of truth.

Dryander, Schæffer and Hedwig have, on much better grounds, asserted their vegetable nature, detected their seeds, and in many cases explained their parts of fructification. In fact, they propagate their species as regularly as any other organized beings, though, like others, subject to varieties. Their sequestered and obscure habitations, their short duration, their mutability of form and substance, render them indeed more difficult of investigation than common plants, but there is no reason to suppose them less perfect, or less accurately defined. Splendid and accurate works, illustrative of this Order, have been given to the world by Schæffer, Bulliard and Sowerby, which are the more useful, as the generality of *fungi* cannot well be preserved. The most distinguished writer upon them, indeed the only good systematic one,* is Persoon, who has moreover supplied us with some exquisite figures. His *Synopsis Methodica Fungorum* helps us to the following arrangement.

1. *Angiocarpi*, such as bear seeds internally. These are either hard like *Sphæria*, *Sowerb. Fung. t.* 159, 160; or membranous, *Suppl. f.* 133; or tough and leathery, like *Lycoperdon*, *Cyathus* (*Nidularia*,) *Suppl. f.* 131, 132; or *Batarrea* (*Lycoperdon*,) *Sowerb. t.* 390.

2. *Gymnocarpi*, such as bear seeds imbedded in an appropriate, dilated, exposed membrane, denominated *hymenium*, *Suppl. f.* 130, like *Helvella*, *Sowerb. t.* 39, in which that part is smooth and even; *Boletus*, in which it is porous; and the vast genus *Agaricus*, *Suppl.*

* Except the learned Fries.

f. 129, in which it consists of parallel plates called *lamellæ*, or gills.

Persoon has been commendably sparing of new terms. Besides *hymenium* above explained, he has scarcely introduced any other than *peridium*, for the round membranous dry case of the seeds in some of the first section. The term *pileus*, a hat, is used by all authors for the head of those *fungi* that compose the second section.

Appendix. *Palmæ.* The Natural Order of Palms, *Suppl. f.* 142, was so little understood when Linnæus formed his systematical arrangement of plants, and so few of their flowers had been scientifically examined, that he was under the necessity of leaving this Order as an Appendix to his system, till it could be better investigated. To its peculiar habit and physiology we have adverted in several of the foregoing pages.

Late observations show Palms to have for the most part six stamens, rarely three or nine, with three or six petals, and one or three styles; which last are sometimes in the same flower with the stamens, sometimes in a separate one, but both flowers always agree in general structure. Their fruit is generally a *drupa*. They are akin to the *liliaceous* tribe, and Linnæus happily terms them the princes of the vegetable kingdom. His most numerous remarks concerning them occur in his *Prælectiones in Ordines Naturales Plantarum*, published by Professor Gieseke at Hamburgh in 1792, from private lectures and conversations of Linnæus. This work, however, is necessarily full of errors and mistakes, not only from its mode of compilation and the intricacy of the subject, but because Linnæus had only partially studied certain parts of that subject, and was undecided in his sentiments upon those parts. It was a singular instance of indulgent liberality in him to allow his disciples Fabricius and Gieseke to make notes, for their own use, of what he considered himself as scarcely competent to lay, in a finished form, before the public. We are obliged to the editor for preserving these valuable, though crude, materials, and he has shown ability in digesting and elucidating them. I should scarcely, for my own part, have thought it right to furnish still more crude and imperfect guesses and opinions, from manuscripts which their illustrious author had purposely, as it appears, withheld from his auditors, lest he should lead them into error. This will explain a note in Professor Gieseke's preface, *p.* 19, which, however, was printed before his request came to my knowledge; for two very intelligent friends, the late Sir Joseph Banks and Mr. Dryander, through whom it was meant to be conveyed, judged it unreasonable to be made, as well as improper to be complied with, and therefore suppressed the message.

CHAP. XXV.—*Illustrations of the Natural Method.**

A MORE admirable illustration of the Linnæan, or Artificial Arrangement, than that given by Sir J. E. Smith in the last chapter, it is perhaps impossible to expect from the pen of any Botanist. It may truly be called the perfection of the System. Its merits are faithfully portrayed, its defects candidly stated, and notwithstanding the many exceptions to the general rules, which the reader cannot fail to discover, it must be allowed to be of infinite service to the beginner, in consequence of the great facility with which he is enabled, by its means, and by an acquaintance with the nomenclature of Botany, to arrive at the *name* of any given species of plant. But this is not enough. The Philosophical inquirer will be anxious to make himself familiar with the natural affinities of plants; the physician with the properties of vegetables, and the various remedies to be obtained from them for healing the numerous diseases to which mankind is heir. This can only be accomplished by the aid of another System, another method, only briefly noticed here in the 22d Chapter, on the "Natural and Artificial Methods," but which is happily becoming daily more and more popular in this

* By the Editor.

country, and which is almost the only Arrangement used in many parts of the Continent, especially in France. There, the System to which I allude, namely the *Natural System*, may be said to have taken its rise, and to be carried to a very high degree of perfection. Magnol, in 1689, published at Montpellier, his *Prodromus Historiæ Generalis Plantarum*, in which he for the first time, attempted to arrange Plants, according to Families. "I have thought," said he, "that it was possible to establish families among plants, such as exist among animals; and the characters of these families ought not to be taken solely from the organs of fructification, but also from all the other parts of a vegetable; yet we acknowledge that the most important are those which are derived from the flower and the seed" (or fruit) &c. Linnæus, notwithstanding that he was the founder of the System which so justly bears his name, was not ignorant of, nor blind to, the merits of a Natural Arrangement. "This," says he, "is the first, and will be the final aim of Botany. The habitual employment of the most eminent botanists is, and must be, to labour at it. It is certain that the Artificial Method is but secondary to the Natural one, and must yield the precedence to it, whenever this latter shall be disclosed. Long have I, like others, endeavoured to establish it, I have made some discoveries, but have hitherto been unable to complete it, and I shall continue to direct my attention to it so long as I live." In 1759, the celebrated Bernard de Jussieu arranged the plants of the Botanic Garden of Trianon near Paris, according to their Natural Affinities; and his nephew, the no less eminent Antoine Laurent de Jussieu, published his Method at the head of the *Genera Plantarum secundum Ordines Naturales disposita*, at Paris, in 1789, of which he makes it the basis. The appearance of this work constituted, it may truly be said, a new era in the Botanical world: taking this for their guide, the most learned and philosophical Botanists of the latter end of the foregoing, and beginning of the present century, have devoted their time and their talents to the improvement of this Method. Still, it must never be forgotten that the two Jussieus, Bernard and Antoine, have the merit of rendering the System accessible to the student, so that the Natural

Method, and the Method of Jussieu, are synonymous terms. It is this, which it was the professed object of Sir J. E. Smith to explain in the "Grammar of Botany," the subject having been omitted, or only very slightly touched upon, as just stated, in the present Introduction; and this a translation of the Natural Orders, of Jussieu, with some original remarks, which was the only elementary work of the kind that had appeared for a long time in our country. Professor De Candolle furthered the cause of this beautiful System, by the publication of his "*Théorie Elémentaire de Botanique*," Mirbel by that of his "*Elémens de Physiologie Végétale et de Botanique*," and Achille Richard by that of his "*Nouveaux Elémens de Botanique*," of which there have been translations into English, by Mr. M'Gillivray of Edinburgh, and Dr. Clinton of Dublin; while in this country, with the exception of the immortal *Prodromus Floræ Novæ Hollandiæ* of Dr. Brown, no work had appeared which could materially advance our knowledge of the Natural Orders of Plants, until the publication of Professor Lindley's valuable "Introduction to the Natural System of Botany," and subsequently his "Introduction to Botany." These two volumes contain a mine of important information, collected with great judgment, to which is added a mass of original observations. Posterior to the former, but anterior to the latter, Mr. Arnott wrote with much clearness and perspicuity an excellent Introduction to a knowledge of Vegetables, especially in connexion with the Natural Arrangement, under the Article "Botany," in the 5th volume of the 7th edition of the *Encyclopædia Britannica;* so that it can now, though at a late period, justly be said, that we are behind no country in these Elementary Treatises. Still the study of the Natural Affinities of Plants can hardly be expected to come into general use, and to be so highly esteemed as it deserves, until we shall have a complete Flora so arranged. Both Professor Lindley, in the first of his works, above alluded to, and Dr. Bartling (in his *Ordines Naturales Plantarum eorumque Characteres et Affinitates*, Gottingen, 1830), have greatly enlarged our knowledge of the genera so arranged; but one only of the many botanical luminaries of the present day has ventured upon the arduous task of preparing a "*Regni Vegetabilium Systema Naturale sive Ordines Genera et Species Plantarum secundum Methodi Naturalis normas digestarum et descriptarum*," and he of all men the most competent, Professor De Candolle. Of this work, two volumes appeared in 1818, and 1821; with specific characters, descriptions, and ample synonyms. Upon this enlarged scale, however, the accomplished author found it would be impossible to complete the work in any reasonable space of time; and was hence led to publish a new book, a "*Prodromus Systematis Naturalis Regni Vegetabilis*," which has now, April, 1833, extended to four closely printed volumes, including one hundred of the Natural Orders, and which deserves to be in the hands of every botanical student throughout the world.

It will be the object of the Editor now to present this method to his readers, in as simple a point of view, and in language as free from technicalities, as possible. It must, however, be acknowledged that a more full glossary of terms is necessary for the student of the Natural Orders, than for one who only aims at a knowledge of the artificial system. The real structure of the different parts of a plant is here investigated with more accuracy, and terms must be invented to express these variations in the organs, without the necessity of employing a whole sentence to distinguish them. But if, on the one hand, the more popular Botanical Introductions of our country are not sufficient to explain the various terms necessarily used in defining the characters of the Natural Orders; so, on the other hand, have our Continental brethren increased the Terminology or Glossology, as they now often call it, to such an unwarrantable length, that it would demand more time than the subject deserved, to become master of it; and the most learned and accurate writers of the present day have wisely rejected a large portion of these new words, as useless or worse than useless. In confirmation of the remark, that a more extended terminology than the student of British Botany has been accustomed to, is necessary, I may observe, that it will be at once seen, by those who examine the structure, for instance, of such fruits as Sir J. E. Smith has considered "naked seeds," (*achenia*,) that these words cannot consistently with the fact, be applied to them; they are furnished with a true pericarp, and not unfrequently, in addition, with the adherent floral covering. In the germen so called "inferior," and "superior," the real situation of the germen or ovary is the same relatively to the calyx; but, in the former case, the tubular portion is firmly attached to the germen, and is termed, in the language now employed in treating of the Natural Orders, "a germen adherent with the calyx;" while the latter structure is said to be a "free germen," (*germen liberum*) that is not adherent with the calyx. These and other terms, not fully explained in the Introduction of Sir J. E. Smith, will be rendered intelligible by incidental remarks in the succeeding observations, or by an alphabetical list at the close of the work.

Later botanists having, as is already stated, and none perhaps more than the learned Antoine de Jussieu himself in the various volumes of the *Mémoires du Muséum*, made considerable improvements upon the *Genera Plantarum* of Bernard de Jussieu, it will be desirable to give a general outline of the system of that author, as it appeared in his work, published in 1789.

He divides all Plants into three primary groupes, I. ACOTYLEDONES (those whose seeds have no cotyledon); II. MONOCOTYLEDONES, *p.* 50; and III. DICOTYLEDONES, *p.* 50; and these are entirely founded in nature. For let it not be supposed that an examination of the Embryo is necessary, to ascertain to which of the above groupes any given plant may belong: those structures in the Embryo are accompanied by peculiarities in the vegetable itself, some internal, and some external, but in both cases sufficiently evident to a close observer, and to a practised eye. Who does not recognise in the Mosses, Hepaticæ, Lichens, and Fungi, a peculiarity of appearance which at once distinguishes them from all the rest of the vegetable kingdom? Thus are the ACOTYLEDONES synonymous indeed with the 24th Class, CRYPTOGAMIA, in the Linnæan system. They have no real flowers, that is, none that can justly be compared with the organs, so called in other plants; they are wholly formed of the cellular texture, excepting the Ferns, which approach the *Monocotyledones* in the presence of tubular vessels. The differences between the MONOCOTYLEDONES and DICOTYLEDONES are not, at once, so evident to the senses, nor so easy of description, as in the instance just mentioned; nor can any one character be given by which they may be defined in words: both have evident flowers. The following characters will however be found to prevail. In the *Monocotyledones* the Root is generally fibrous, bulbous or tuberous; the stem is furnished with tubular vessels, placed without any order, and there is no distinction into pith, wood, and bark; there exist no reservoirs of proper juices, the stem is generally inert, and such peculiar properties as the plants do possess are commonly locked up in the tubers, or bulbs, or seeds; the leaves have, mostly parallel, rarely branched, nerves, the base or petiole is often sheathing; the flowers have generally only a single floral covering (not distinguishable into calyx and corolla), and the parts of the flower exhibit, most commonly, a ternary arrangement; hence in the artificial system so many of them are found in the Classes *Triandria* and *Hexandria*. The Grasses, Rushes, the Lily tribe, the Palms, &c., may be cited as familiar examples of Monocotyledonous Plants. The *Dicotyledones* have, for the most part, a fibrous or tap root, never really bulbous; the stem is divided into pith, wood, and bark; the wood and inner bark contain the tubular vessels, and both are composed of concentric layers, the former being also marked with medullary rays; the latter frequently containing reservoirs of proper juices, in which reside the various properties, with which so many Dicotyledonous Plants are endowed; the flowers have, very commonly, a double perianth, a calyx and a corolla, and the arrangements of the parts is frequently quinary. Among this groupe may be reckoned, as familiar examples, the Rose, Honeysuckle, Oak, Pinks, and indeed the greater proportion of our Phænogamous, flowering, or cotyledonous plants.

The three primary groupes, now mentioned, include 15 Classes, not distinguished by any particular appellations,* of which one is *Acotyledonous*, 3 are *Monocotyledonous*, and

* These were afterwards invented by Antoine de Jussieu, and given in Richard's "*Elémens de Botanique*," (ed. 4.) p. 397; though it does not appear that they have been generally adopted by Botanists.

the remaining 11 are *Dicotyledonous.* In order to comprehend the terms by which these are characterized, it is only necessary to say, that by

Hypogynous Stamens, *stamina hypogyna,* is meant that they are inserted beneath the germen or ovary, as in the Flowering-Rush, *Suppl. f.* 18, and the Pink, *Suppl. f.* 16.

Epigynous Stamens, *stamina epigyna,* are inserted above the germen,* as in the umbelliferous plants, and the Snowdrop, *Suppl. f.* 11.

Perigynous Stamens, *stamina perigyna,* are inserted upon the calyx or single floral covering, more or less remote from the germen, as in the Spurge-Laurel, *Daphne Laureola, Suppl. f.* 13, *Mespilus, Suppl. f.* 19.

Apetalous, without petals or corolla.

Monopetalous, corolla of one petal, or petal of one piece.

Polypetalous, corolla of many pieces or petals.

Diclines, separated flowers, the stamens being upon one flower, the pistil or pistils upon another, on the same or on different plants.

INDEX TO JUSSIEU'S CLASSES.

ACOTYLEDONES				Class 1.
MONOCOTYLEDONES		Stamens hypogynous		2.
		perigynous		3.
		epigynous		4.
DICOTYLEDONES	apetalous	Stamens epigynous		5.
		perigynous		6.
		hypogynous		7.
	monopetalous	Corolla hypogynous		8.
		perigynous		9.
		epigynous	anthers combined	10.
			anthers distinct	11.
	polypetalous	Stamens epigynous		12.
		hypogynous		13.
		perigynous		14.
	diclines	irregular		15.

* More so indeed, apparently than in reality, for at all times the real insertion may be considered as below the germen; but the filaments are sometimes

The Orders are 100, distributed in Natural Series, under every Class, and each explained by rather full definitions, taken, in the first place, from the parts of fructification, and illustrated by secondary characters, founded on any other circumstance.

Series of the Orders.

Class 1.

1. *Fungi.*
2. *Algæ.*
3. *Hepaticæ.*
4. *Musci.*
5. *Filices.*
6. *Naiades.*

Class 2.

7. *Aroideæ.*
8. *Typhæ.*
9. *Cyperoideæ.*
10. *Gramineæ.*

Class 3.

11. *Palmæ.*
12. *Asparagi.*
13. *Junci.*
14. *Lilia.*
15. *Bromeliæ.*
16. *Asphodeli.*
17. *Narcissi.*
18. *Irides.*

Class 4.

19. *Musæ.*
20. *Cannæ.*
21. *Orchideæ.*
22. *Hydrocharides.*

Class 5.

23. *Aristolochiæ.*

Class 6.

24. *Eleagni.*
25. *Thymeleæ.*
26. *Proteæ.*
27. *Lauri.*
28. *Polygoneæ.*
29. *Atriplices.*

Class 7.

30. *Amaranthi.*
31. *Plantagines.*
32. *Nyctagines.*
33. *Plumbagines.*

Class 8.

34. *Lysimachiæ.*
35. *Pediculares.*
36. *Acanthi.*
37. *Jasmineæ.*
38. *Vitices.*
39. *Labiatæ.*
40. *Scrophularinæ.*
41. *Solaneæ.*
42. *Boragineæ.*
43. *Convolvuli.*
44. *Polemonia.*
45. *Bignoniæ.*
46. *Gentianeæ.*
47. *Apocineæ.*
48. *Sapotæ.*

Class 9.

49. *Guaiacanæ.*
50. *Rhododendra.*
51. *Ericæ.*
52. *Campanulaceæ.*

more or less combined with the germen or calyx, and the free portion indicates the apparent insertion. Where the calyx, as well as a portion of the filaments, is united to the germen, it would seem doubtful whether they should be called epigynous, or perigynous, as in the *Umbelliferæ*, in which Jussieu calls them epigynous, De Candolle perigynous. The attachment is as much to the one part as to the other.

CLASS 10.

53. *Cichoraceæ.*
54. *Cinarocephalæ.*
55. *Corymbiferæ.*

CLASS 11.

56. *Dipsaceæ.*
57. *Rubiaceæ.*
58. *Caprifolia.*

CLASS. 12.

59. *Araliæ.*
60. *Umbelliferæ.*

CLASS. 13.

61. *Ranunculaceæ.*
62. *Papaveraceæ.*
63. *Cruciferæ.*
64. *Capparides.*
65. *Sapindi.*
66. *Acera.*
67. *Malpighiæ.*
68. *Hyperica.*
69. *Guttiferæ.*
70. *Aurantia.*
71. *Meliæ.*
72. *Vites.*
73. *Gerania.*
74. *Malvaceæ.*
75. *Magnoliæ.*
76. *Anonæ.*
77. *Menisperma.*
78. *Berberides.*
79. *Tiliaceæ.*
80. *Cisti.*
81. *Rutaceæ.*
82. *Caryophylleæ.*

CLASS 14.

83. *Sempervivæ.*
84. *Saxifragæ.*
85. *Cacti.*
86. *Portulaceæ.*
87. *Ficoideæ.*
88. *Onagræ.*
89. *Myrti.*
90. *Melastomæ.*
91. *Salicariæ.*
92. *Rosaceæ.*
93. *Leguminosæ.*
94. *Terebinthaceæ.*
95. *Rhamni.*

CLASS 15.

96. *Euphorbiæ.*
97. *Cucurbitaceæ.*
98. *Urticæ.*
99. *Amentaceæ.*
100. *Coniferæ.*

The Genera, in the work under consideration, stand in one or more sections, according to their respective affinities, and with their essential characters under each Order, to which are usually added many valuable critical remarks. There is, at the end, a Table of *Plantæ incertæ sedis*, Genera not reducible to any of these Orders. These, for convenience, are artificially arranged by the corolla, (whether monopetalous, polypetalous or wanting,) the situation of the germen, inferior or superior, (adherent with the calyx or free,) and by the number of Styles and Stamens. This list comprises 137 genera, the greater number of which have been subsequently reduced to the proper Orders; and when we consider how many of those genera were known to Jussieu, only through imperfect descriptions, incorrect figures, or by inadequate specimens, the wonder is that there should not have been many more.

Such is an outline of the contents of this little volume; the offspring of the united studies of Bernard and Antoine Laurent de Jussieu, which has been received, as Sir J. E. Smith assures us it was, and as its merits entitled it to be, "by acclamation throughout Europe, and hailed as the most learned botanical work that had appeared, since the *Species Plantarum* of Linnæus."

It will be seen that Jussieu commences his arrangement by the most simple of vegetable beings, namely, the Acotyledonous or Cryptogamic plants. To this, Professor De Candolle objects, they being, he justly says, the least understood, and it being inconsistent with the principles of logic to begin with the least known objects, and to proceed onward to those that are better ascertained; hence this excellent author, in his "Sketch," published in his *Théorie Elémentaire de la Botanique*, commences with the Dicotyledonous plants, and the most perfect of them, namely, those with a double floral covering. For all practical purposes, indeed, the one arrangement is as good as the other, a botanist not being bound to commence his studies either with the *Acotyledonous* or with the *Dicotyledonous* groupe. De Candolle there augments the number of Orders to 161, adopts several alterations and improvements, and has given an uniform termination, except in some very rare cases where the words would scarcely admit of it, to the names of the Orders. He divides all vegetables into two great primary groupes. I. Vascular or Cotyledonous, and II. Cellular or Acotyledonous:—the first of these again into I. Exogenous, (εξω, without, on the outside, and γενναω, to increase, in allusion to the new portion of wood being around or external, with regard to the old portion) or Dicotyledonous:—and Endogenous,* (ενδον, within, and γενναω, from the circumstance of the increase taking place in the centre,) or Monocotyledonous. These he calls Classes, as follows:

* These two terms Exogenous and Endogenous, very nearly correspond with the *Exorhizæ* and *Endorhizæ* of Richard, as applied to the Radicle of these two divisions. (See p. 148.)

SKETCH (from the *Théorie Elémentaire, ed.* 2.) of a linear and consequently artificial Series, for the arrangement of the natural families in the Vegetable Kingdom.

I. VASCULAR or COTYLEDONOUS VEGETABLES, *that is, such as are furnished with a cellular substance and tubular vessels, and of which the embryo has one or more cotyledons.*

1. EXOGENOUS or DICOTYLEDONOUS, *where the vessels are arranged in concentric layers, the youngest of which are external, and the cotyledons of the embryo are opposite or verticillate.*

A. DICHLAMYDEÆ.

The Perigonium (or Perianth) double, that is, the calyx and corolla distinct.

* Thalamifloræ, *or with distinct petals, inserted upon the receptacle.*

1st. Groupe. *Carpels numerous. Stamens, if definite, opposite to the petals.*

1. Ranunculaceæ, *Juss.*
2. Dilleniaceæ, *DC.*
3. Magnoliaceæ, *DC.*
4. Anonaceæ, *Juss.*
5. Menispermeæ, *Juss.*
6. Berberideæ, *Juss.*
7. Podophylleæ, *DC.*
8. Nympheaceæ, *Salisb.*

2d. Groupe. *Carpels solitary or conjoined, placentæ parietal.*

9. Papaveraceæ, *Juss.*
10. Fumariæ.
11. Cruciferæ, *Juss.*
12. Capparideæ, *Juss.*
13. Flacourtianeæ, *Rich.*
14. Passifloreæ, *Juss.*
15. Violaceæ, *Vent.*
16. Polygaleæ, *Juss.*
17. Resedaceæ, *DC.*
18. Droseraceæ, *DC.*
19. Frankeniaceæ, *St. Hil.*
20. Cistineæ, *DC.*

3d. Groupe. *Ovary solitary, placenta central.*

21. Caryophylleæ, *Juss.*
22. Lineæ, *DC.*
23. Malvaceæ, *Juss.*
24. Chlenaceæ, *Pet. Th.*
25. Byttneriaceæ, *Br.*
26. Sterculiaceæ, *Vent.*
27. Tiliaceæ, *Juss.*
28. Elæocarpeæ, *Juss.*
29. Sapindaceæ.
30. Hippocastaneæ.
31. Acereæ, *Juss.*
32. Malpighiaceæ, *Juss.*
33. Hippocraticeæ, *Juss.*
34. Hypericineæ, *Juss.*
35. Guttiferæ, *Juss.*
36. Marcgraviaceæ, *Juss.*
37. Sarmentaceæ, *Juss.*
38. Geraneæ, *Juss.*
39. Cedreleæ, *Br.*
40. Meliaceæ, *Juss.*
41. Hesperideæ, *Cor.*
42. Camelliæ, *DC.*
43. ? Olacineæ, *Mirb.*
44. Rutaceæ, *Juss.*

Groupe 4th. *Gynobasic fruit.*

45. Simaroubeæ, *DC.*
46. Ochnaceæ, *DC.*

** CALYCIFLORÆ.

Petals free, or more or less combined, always perigynous or inserted upon the calyx.

47. Frangulaceæ, *DC.* (Rhamni, *Juss.*)
48. Samydeæ, *Vent.*
49. Xanthoxyleæ, *DC.*
50. Juglandeæ, *DC.*
51. Terebinthaceæ, *Juss.*
52. Leguminosæ, *Juss.*
53. Rosaceæ, *Juss.*
54. Salicariæ, *Juss.*
55. Tamariscineæ, *Desv.*
56. Melastomeæ, *Juss.*
57. Myrtineæ, *Juss.*
58. Combretaceæ, *Br.*
59. Cucurbitaceæ, *Juss.*
60. Loaseæ, *Juss.*
61. Onagrariæ, *Juss.*
62. Ficoideæ, *Juss.*
63. Paronychiæ, *St. Hil.*
64. Portulaceæ, *Juss.*
65. Nopaleæ, *Juss.*
66. Grossularieæ, *DC.*
67. Crassulaceæ, *Juss.*
68. Saxifrageæ, *Juss.*
69. Cunoniaceæ, *Br.*
70. Umbelliferæ, *Juss.*
71. Araliaceæ, *Juss.*
72. Caprifolieæ, *Juss.*
73. Lorantheæ, *Rich.*
74. Rubiaceæ, *Juss.*
75. Operculariéæ, *Juss.*
76. Valerianeæ, *DC.*
77. Dipsaceæ, *Juss.*
78. Calyceræ, *Br.*—Boopideæ, *Cass.*
79. Compositæ, *Adans.*
80. Campanulaceæ, *Juss.*
81. Lobeliaceæ, *Juss.*
82. Gessnerieæ, *Rich.*
83. Vacciniæ, *DC.*
84. Ericineæ, *Desv.*

*** COROLLIFLORÆ.

Petals united into a hypogynous corolla, not attached to the calyx.

85. Myrsineæ, *Br.* (Ophiospermæ, *Vent.* — Ardisiaceæ, *Juss.*)
86. Sapoteæ, *Juss.*
87. Ternstrœmiaceæ, *Mirb.*
88. Ebenaceæ, *Juss.*
89. Oleineæ, *Hoffm.*
90. Jasmineæ, *Br.*
91. Strychneæ, *DC.*
92. Apocyneæ, *Juss.*
93. Gentianeæ, *Juss.*
94. Bignoniaceæ, *Juss.*
95. Sesameæ, *Br.*
96. Polemonideæ, *Juss.*
97. Convolvulaceæ, *Juss.*
98. Boragineæ, *Juss.*
99. Solaneæ, *Juss.*
100. Antirrhineæ, *Juss.*
101. Rhinanthaceæ, *Juss.*
102. Labiatæ, *Juss.*
103. Myoporineæ, *Br.*
104. Pyrenaceæ, *Juss.*
105. Acanthaceæ, *Juss.*
106. Lentibulariæ, *Rich.*—Utriculinæ, *Link.*
107. Primulaceæ, *Juss.*
108. Globulariæ, *Lam.*

B. MONOCHLAMYDEÆ.

Perigonium simple, or calyx and corolla forming but a single covering.

109. Plumbagineæ, *Juss.*
110. Plantagineæ, *Juss.*
111. Nyctagineæ, *Juss.*
112. Amaranthaceæ, *Juss.*
113. Chenopodeæ, *Juss.*
114. Begoniaceæ, *Bonpl.*
115. Polygoneæ, *Juss.*
116. Laurineæ, *Juss.*
117. Myristiceæ, *Br.*
118. Proteaceæ, *Juss.*
119. Thymeleæ, *Juss.*
120 Santalaceæ, *Br.*
121. Eleagneæ, *Juss.*

122. Aristolochiæ, *Juss.*
123. Euphorbiaceæ, *Juss.*
124. Monimiæ, *Juss.*
125. Urticeæ, *Juss.*
126. Piperiteæ, *Humb.*
127. Amentaceæ, *Juss.*
128. Coniferæ, *Juss.*

2. ENDOGENOUS, or MONOCOTYLEDONOUS, *that is, where the tubular vessels are situated in bundles, the youngest in the centre of the stem, and the embryo furnished with solitary or alternate cotyledons.*

A. Phanerogamous. *The fructifications visible and regular.*

129. Cycadeæ, *Pers.*
130. Hydrocharideæ, *Juss.*
131. Alismaceæ, *DC.*
132. Orchideæ, *Juss.*
133 Drymyrhizæ, *Juss.*
134. Musaceæ, *Juss.*
135. Irideæ, *Juss.*
136. Hæmodoraceæ, *Br.*
137. Amaryllideæ, *Br.*
138. Hemerocallideæ, *Br.*
139.? Dioscoreæ, *Br.*
140. Smilaceæ, *Br.*
141. Liliaceæ, *DC.*
142. Colchicaceæ, *DC.*
143. Junceæ, *DC.*
144. Commelineæ, *Mirb.*
145. Palmæ, *Juss.*
146. Pandaneæ, *Br.*
147. Typhaceæ, *Juss.*
148. Aroideæ, *Juss.*
149. Cyperaceæ, *Juss.*
150. Gramineæ, *Juss.*

B. CRYPTOGAMOUS. *Fructification concealed, unknown or irregular.*

151. Naiadeæ, *Juss.*
152. Equisetaceæ, *DC.*
153. Marsileaceæ, *Br.* (Rhizospermeæ, *DC.*)
154. Lycopodineæ, *DC.*
155. Filices, *Juss.*

II. CELLULAR OR ACOTYLEDONOUS PLANTS; *composed of a cellular substance, destitute of vessels, and the embryo without cotyledons.*

A. FOLIACEOUS, *having apparently leafy expansions and distinct sexes.*

156. Musci, *Juss.*
157. Hepaticæ, *Juss.*

B. LEAFLESS; *having no foliaceous expansion, and no evident sexes.*

158. Lichenes, *DC.*
159. Hypoxyla, *DC.*
160. Fungi, *DC.*
161. Algæ, *DC.*

Still greater application to the subject, and the minute attention requisite for publishing the "*Prodromus Systematis Vegetabilium Regni vegetabilis*" were productive of further alterations and improvements; and as this work, so far as it goes, is not only the most popular and important of botanical writings, but the only one* that gives an arrangement of all the

* One has recently been commenced in this country in English, by Mr. George Don, under the title of "a General System of Gardening and Botany," of which two volumes have appeared in 4to.

species according to a natural method, it is that which will, with few exceptions, be followed in the subjoined list of orders. Many changes, and, I need not say, among them many improvements, have been made by Professor Lindley in his Introduction to the Natural System; but unless such changes are imperiously called for, in consequence of striking inaccuracy in the present system, it is quite evident that they only lead to confusion; every different writer on this subject (and they are many now, and daily increasing,) having a different arrangement; so that a Tyro, not knowing to which to give the preference, will be disposed to throw up the study in disgust. The *Prodromus* of De Candolle will remain a lasting monument to the abilities, the research, and the candour of its illustrious author; it is such as few living Botanists could equal, and none, perhaps, excel.

With much justice De Candolle denominates his arrangement a "linear," and hence an artificial series, for the affinity of an order or genus is not alone with that which precedes or follows it; but with others also remote from it, as it stands in our books. Linnæus, with his accustomed sagacity, compared the vegetable kingdom to a geographical map, and such botanical charts have been published, first by Gieseke, a distinguished pupil of Linnæus, afterwards by Batsch, Bernardin de St. Pierre, L'Héritier, Petit Thouars, Agardh and others, in which it may be said that the classes correspond to the quarters or primary divisions of the globe; the families or orders to kingdoms; the tribes to provinces or cantons; the genera to districts or parishes; and the species to towns or villages; one genus or tribe being connected with another, in the same way as one kingdom or province borders on many others. Let it not therefore be held out as a reproach to our science, that it is unnatural, because the disposition of the orders in our Floras is necessarily linear and artificial.

Arrangement and Characters of the Natural Orders.

I. Vasculares seu Cotyledononeæ. Vascular or Cotyledonous Plants (including the Dicotyledonous and Monocotyledonous Classes).

Class I. DICOTYLEDONES* seu Exogenæ.

Dicotyledonous or Exogenous Plants. *Trunk* formed of 2 distinct portions, the woody and the central body, increasing in two opposite directions; the former containing pith in the centre, from which diverge the medullary rays, and increasing by new layers on its outside; the latter by new layers within. *Leaves* with the nerves much branched and anastomosing. *Flowers* usually with a double perianth, the parts often arranged in a quinary manner. *Embryo* with two opposite *cotyledons*, rarely more, and then verticillate.

Subclass I. Thalamifloræ.† *Calyx* of many sepals or pieces (sometimes combined at the base). *Petals* many, distinct, and as well as the stamens, inserted upon the receptacle, not upon the calyx; hence hypogynous, (from ὑπω, *beneath*, and γυνη, the *pistil*). The exceptions are very rare.

Ord. I. RANUNCULACEÆ. *Juss.* Ranunculus, or Crowfoot Family. *Suppl. f.* 213—217.

Perianth double, free, hypogynous (inserted below the Germens or Ovaries). Sepals 3—6, usually 5. Petals equal in number to the sepals, or double or triple, free, with an imbricated æstivation, rarely none, sometimes formed of the dilated filaments, and then plane, sometimes from the transformed anthers, and then cucullate. Stamens free, in-

* From δις, *two*, and κοτυληδων, *cotyledon*.

† From *thalamus*, a bed, and *flos*, a flower, in allusion to the parts of the flower being inserted on the receptacle.

definite: anthers adnate in the true species of *Ranunculus* and reversed. Pistils many, inserted upon the receptacle, rarely, by imperfection, or by their union, solitary. Carpels (small clustered pericarps) either achenia, berries, capsules or follicles, one-or many-seeded. *Seeds* sometimes solitary and erect or pendulous, sometimes many arranged on each side in series, along the margins of the carpels. Albumen horny, large. Embryo very minute.—*Herbs, undershrubs, or climbing shrubs. Roots fasciculate, granulated or fibrous. Leaves alternate or in the* Clematideæ *opposite, often variously divided, their bases dilated into a semiamplexicaul sheath, simple. Hairs none or simple.*

The properties of this extensive Order are in general acrid and more or less poisonous, some of the species powerfully so. *Clematis recta* and *flammula* are said to be used by beggars for forming artificial ulcers: the same qualities exist in the leaves of the Cape *Knowltonia,* thence called *vesicatoria,* and several species of *Ranunculus. R. flammula* is esteemed a powerful sudorific. The roots of the *Hellebores* are a drastic purgative; those of *Coptis trifolia* and *Hydrastis Canadensis* strong bitters; in the *Aconites* they are peculiarly acrid, and those of the Indian species called *Bikh,* or *Bish,* (*Aconitum ferox, Wall. Pl. Asiat. Rar. v.* 1. *p.* 33. *f.* 41,) contain a virulent poison. The species are chiefly European and North American: several have been found in the southern hemisphere, but generally in the temperate districts.

This Order includes 5 Tribes or Suborders.

TRIBE I. CLEMATIDEÆ. Clematis Tribe.—Examples of the Genera. *Clematis,* Suppl. f.* 213. *Naravelia.*

TRIBE II. ANEMONEÆ. Anemone Tribe.—Ex. *Thalictrum.* Tetractis. Anemone.* Hepatica. Hydrastis. Knowltonia. Adonis.* Hamadryas.*

TRIBE III. RANUNCULACEÆ. Ranunculus Tribe.—Ex. *Myosurus.* Ceratocephalus. Ranunculus,* Suppl. f.* 214. *Ficaria** (*Ranunculus Ficaria,* L.).

TRIBE IV. HELLEBOREÆ. Hellebore Tribe.—Ex. *Caltha,* Suppl. f.* 216. *Trollius.* Eranthis. Helleborus,* Suppl. f.* 215, *Nigella. Aquilegia.* Delphinium. Aconitum,* &c.*

TRIBE V.? PÆONIACEÆ. Piony Tribe.—Ex. *Actæa,* Suppl. f.* 217. *Pæonia,** &c.

* Those marked with an asterisk are British Genera.

Ord. II. DILLENIACEÆ. *DC.* Dillenia Family, *Suppl. f.* 230, 231.

Perianth with an imbricated æstivation. Sepals 5, persistent; 2 exterior, 3 interior. Petals 5, deciduous, in a single series, hypogynous. Stamens numerous: filaments filiform, plane, dilated at the base or at the extremity, distinct or polyadelphous, either inserted around the carpels or on one side; anthers adnate, the cells generally opening longitudinally and internally. Carpels several (often 2—5), sometimes solitary or combined into one, 1-styled with simple stigmas, 1-celled, membranaceous, baccate or 2-valved, acuminated with the style. Seeds ovate, arranged in a double series at the angle of the carpels or cells, 2 or many, sometimes solitary, naked or enclosed in a pulpy arillus. Testa crustaceous. Albumen fleshy, subcartilaginous, shaped like the seed. Embryo minute, erect, inferior, at the base of the albumen.—*Trees, shrubs, or undershrubs. Leaves almost always alternate, rarely opposite, simple, entire or toothed, often coriaceous and persistent. Flowers solitary, racemose or panicled, terminal, frequently yellow.*

Exotics; of which a large proportion is found in New Holland. They are astringent, but possess no remarkable properties.—Ex. *Delima*, of which one species, *D. sarmentosa*, has the leaves so rough, that they are employed in China in lieu of a file. *Dillenia*, *Suppl. f.* 230, 231: *D. speciosa* is a splendid tree of Malabar, with beautiful flowers, larger than those of the white Water Lily, and a pulpy, esculent but highly acid fruit, of the size of a very large apple.

Ord. III. MAGNOLIACEÆ. *DC.* Magnolia Family, *Suppl. f.* 229.

Parts of the flower ternary. Sepals 3—6, deciduous. Petals 3—27, in many series. Stamens numerous, distinct; anthers adnate, elongated. Ovaries numerous, inserted upon the receptacle above the stamens, often spicate, 1-styled. Styles short; stigmas simple. Carpels as many as ovaries, 1-celled, 1-or many-seeded, capsular, opening with a superior cleft; or capsular and 2-valved, opening below: sometimes follicular, or somewhat fleshy and indehiscent, or samariform, aggregated, or combined into a lax or dense cone. Seeds adnate with the internal angle of the carpel. Albumen fleshy. Embryo straight, small, inferior.—*Exotic trees or handsome shrubs. Leaves alternate, often coriaceous and ample. Flowers showy and very fragrant.*

This fine Order has 2 Tribes.

TRIBE I. ILLICIEÆ. Aniseed Tribe.—Ex. *Illicium*, of which the *I. Floridanum* or Red-flowered Aniseed-tree possesses fragrant wood and leaves, and the *I. Anisatum* yields in its seeds a fragrant volatile oil, which the Chinese burn in their temples. *Drimys ;* the *D. Winteri* affording the Winter's bark, a drug now superseded in its use by the *Canella alba*, which was for some time confounded with it.

TRIBE II. MAGNOLIEÆ. Magnolia Tribe.—Ex. *Michelia ; M. Champaca* is cultivated all over India, on account of the delicious fragrance of its blossoms. *Magnolia, Suppl. f.* 229, a genus of which the N. American species are pre-eminent for the size and beauty both of their flowers and foliage. Bartram describes one kind as rising to the height of 100 feet, bearing blossoms " so large, as to be distinctly visible a mile or more ;" seen in the mass, we presume. *Liriodendron*, or the Tulip-tree, one of the most stately of forest-trees, no less remarkable for the beauty of its blossoms, which in shape and size are like those of a tulip, than for the curious form of its leaves. The bark is very astringent.

ORD. IV. ANONACEÆ. *Juss.* Custard-apple Family.

Sepals 3—4, short, persistent, more or less combined. Petals 6, in two series, often coriaceous, with an imbricated æstivation. Stamens numerous, appressed, often covering an hemispherical disk (or expansion of the receptacle) : filaments very short ; cells of the anthers with a large *connectivum* (or point of union), opening outwards. Carpels numerous, crowded, shortly 1-styled, sometimes combined, rarely solitary, baccate or capsular, 1-or many-seeded, sessile or stalked. Seeds in 1 or 2 series in the inner angle of the carpels. Testa crustaceous. Embryo minute, at the base of the fleshy furrowed albumen.—*Tropical trees or shrubs. Leaves alternate, entire, without stipules.*

Ex. *Anona*, the Custard-apples ; among which are the Sour-sop and the delicious Cherimoly of Peru. *Unona.*

Ord. V. MENISPERMACEÆ. *Juss.* Cocculus Family, *Suppl. f.* 233.

Flowers small, often diœcious. Perianth in one or many series; sepals 3 or 4 in each series. Petals often none.—♂. Stamens monadelphous, or distinct, sometimes equal in number to the petals, and opposite to them, sometimes 3—4 times their number; anthers usually adnate, opening outwards. —♀. Ovaries many, 1-styled, somewhat combined at the base, or solitary with several stigmas, many-celled, rarely 1-celled. Drupes 1-seeded, oblique or lunulate and compressed. Embryo curved. Albumen none, or small and fleshy. Cotyledons plane. Radicle superior.—*Climbing, exotic, and mostly tropical shrubs. Leaves alternate, usually simple. Flowers small, generally racemose. The roots are bitter and tonic.*

Menispermum palmatum, (*Bot. Mag. t.* 2970,) affords the famous Columbo root. Pareira brava, a powerful diuretic, is the *Cissampelos Pareira:* a poison is afforded by the seeds of *Menispermum Cocculus.*—Ex. *Cocculus. Cissampelos. Menispermum, Suppl. f.* 233.

Ord. VI. BERBERIDEÆ. *Vent.* Barberry Family, *Suppl. f.* 234.

Sepals 3—4—6, deciduous, in a double series, accompanied by scales. Petals equal in number with the sepals and opposite to them, rarely twice as many, often furnished with a gland or scale within. Stamens as many as there are petals, and opposite to them: filaments short; anthers oblong, adnate, 2-celled, opening by valves. Ovary solitary, 1-celled; style very short, oblique; stigma suborbicular. Fruit baccate or capsular; seeds 1—3. Albumen fleshy or somewhat horny; embryo straight, in the axis of the albumen. Radicle inferior. Cotyledons plane.—*Shrubs or herbs, with perennial roots, mostly glabrous. Inhabitants of temperate or cold climates, in both hemispheres.*

Ex. *Berberis.** The fruit of *B. vulgaris* is used as a preserve, on account of its agreeable and acid flavour. *Mahonia*, scarcely differing from *Berberis* except in its pinnated leaves. *Nandina. Leontice. Epimedium,** *Suppl. f.* 234.

Ord. VII. PODOPHYLLEÆ. *DC.* May-apple Family.

Sepals 3—4, often petaloid. Petals in 2—3—4 series, each equal in number to the sepals. Stamens equal in number with, and opposite to, the petals, or 2, 3 or many times that number, arranged in as many series: filaments filiform; anthers terminal, opening outwards, and longitudinally, the receptacle small. Ovaries many, or two or solitary. Stigma nearly sessile, subpeltate. Carpels 1-celled, fleshy and indehiscent, or opening transversely below the extremity. Seeds indefinite, rarely solitary, attached to a lateral placenta. Albumen fleshy. Embryo small, at the base of the seed.—*Exotic* (*chiefly N. American*) *herbs, growing in shady places or aquatic. Richard and other authors unite this order with* Papaveraceæ, *from which however it differs in habit and in properties.*

Tribe I. Podophylleæ. May-apple Tribe.—Ovary 1. Stigma thick, subpeltate, seeds numerous. Terrestrial.—Ex. *Podophyllum;* the *P. peltatum,* or May-apple, is a safe and powerful purgative. *Jeffersonia,* a cathartic. *Achlys,* I would rather refer to *Berberideæ,* on account of the valvular dehiscence of its anthers.

Tribe II. Hydropeltideæ. Hydropeltis Tribe.—Ovaries 2 or many. Seeds few or solitary. Floating.—Ex. *Cabomba. Hydropeltis.* The first of these, Prof. De Candolle suggests, may be placed with the *Nymphaaceæ,* whither Mr. Brown refers it. M. Richard maintains that both belong to the *Monocotyledones,* and form a distinct Order, "Cabombeæ."

Ord. VIII. NYMPHÆACEÆ. *DC.* Water-Lily Family, *Suppl. f.* 219.

Sepals 4—6, coloured within, often passing into the petals, which are numerous, and arranged in several series. Stamens numerous, in many series, inserted, as well as the perianth, on a more or less enlarged portion of the receptacle; filaments often petaloid; anthers adnate, 2-celled, opening longitudinally. Ovaries, or carpels, 8—24, half immersed in the enlarged foveolated receptacle, (*Nelumbi-*

um), or entirely included in an urceolate one (resembling a solitary ovarium or carpel), 1-styled, membranaceous, indehiscent, 1-, 2- or many-seeded. Styles, in the free ovaries, distinct with a simple stigma; in the included carpels combined with the stigmas, adnate at their base, and radiating (as in *Papaver*); Seeds in the former 2 or 1, in the latter very numerous, fixed to the sides of the carpels, covered by a gelatinous arillus; the cells filled with gelatine in maturity. Albumen farinaceous, none in *Nelumbium*. Embryo minute, somewhat turbinate, on the outside of the albumen, and included in a membranous bag.—*Aquatic herbs, with peltate or cordate leaves, and splendid flowers.*

TRIBE I. NELUMBONEÆ. Nelumbium Tribe.—Carpels many, distinct, 1—2-seeded, immersed in a remarkably large, foveolated, obconical, elevated receptacle. Seeds solitary in each carpel, without arillus and albumen.—Ex. *Nelumbium*, of which one species, *N. speciosum*, (*Cyamus*, *Sm.*, κυαμος, or the Sacred Bean of the ancients,) displays its magnificent rose-coloured blossoms in the tanks of India; while its prototype, *N. luteum*, adorns the lakes of the southern United States with its scarcely less splendid yellow flowers. The roots of *Nymphæa Lotus* and of *Nelumbium speciosum*, are used as food.

TRIBE II. NYMPHÆEÆ. Water-Lily Tribe.—Carpels several, many-seeded, included within the enlarged receptacle, with the stigmas radiating above the berry-formed fruit. Seeds with an arillus, and a farinaceous albumen.—Ex. *Nymphæa*.* *Nuphar*,* *Suppl. f.* 219.

ORD. IX. SARRACENIEÆ. *De La Pyl.* Sarracenia Family.

Sepals 5, persistent, concave at the base, and having a 3-leaved involucre. Petals 5, contracted and unguiculated at the base. Stamens numerous, compact: filaments short; anthers fixed by the back, 2-celled, opening internally with longitudinal fissures, scarcely reaching to the extremity. Ovary solitary, globose, 5-celled: style solitary: stigma very large, foliaceous, peltate, 5-angled. Capsule globose, crowned with the persistent style and stigma, 5-lobed, 5-celled, 5-valved, many-seeded, opening between the dissepiments. Placentæ at the inner angle of the cells, covered with numerous, minute seeds. Albumen copious. Embryo cylindrical, at the base of the seed, with the radicle pointing to the hilum.—*Marsh herbs. Root fibrous. Leaves all radical, tubular, with a somewhat helmet-shaped appendage at the extremity. Scape single-flowered. Flower large, drooping, green, yellow or purple.*

Ex. *Sarracenia.* A most remarkable North American genus, now well known in our collections. The affinity of this Order is doubtful. Mr. Lindley places it near to *Droseraceæ*, on account of its resemblance to *Dionæa.* The leaves, by their structure and the fluid they contain, entrap and destroy a great number of insects.

Ord. X. PAPAVERACEÆ. *Juss.* Poppy Family, *Suppl. f.* 218.

Sepals 2, deciduous. Petals 4, rarely 8—12 or wanting, irregularly plaited before expansion. Stamens distinct, usually numerous: filaments filiform; anthers 2-celled, opening longitudinally. Ovary 1, free. Style short or none, bearing as many stigmas as there are placentæ, alternate with them and arranged, when many, in a stellated manner. Fruit 1-celled, siliquiform, with 2 placentæ, or a capsule with several parietal placentæ, and often opening by pores beneath the stigma. Albumen fleshy and oily. Embryo minute, at the base of the albumen, with plano-convex cotyledons.—*Annual or perennial herbs or undershrubs, abounding in narcotic juice. Root fibrous. Leaves alternate, simple or lobed. Peduncles elongated, single-flowered. Flowers white, yellow or red, never blue.*

Ex. *Papaver*,* *Suppl. f.* 218, of which the *P. somniferum* yields opium. *Argemone. Meconopsis.** *Glaucium.** *Chelidonium.** *Roemeria*,* and the beautiful *Eschscholtzia*, &c.

Ord. XI. FUMARIACEÆ. *DC.* Fumitory Family, *Suppl. f.* 38—39.

Sepals 2, small, deciduous. Petals 4, irregular, more or less united below; 2 exterior, alternating with the sepals; one, the upper, or both, gibbous, or prolonged at the base into a spur; 2 inner somewhat callous at the extremity, where they cohere and enclose the anthers and stigma. Stamens 6: filaments diadelphous, opposite the outer petals; anthers 6, small, the middle one of each bundle 2-celled, the lateral ones 1-celled. Ovary one, free; style filiform; stigma bilamellate. Fruit siliquiform, 2-valved, many-seeded, somewhat indehiscent, 1—2-seeded. Seeds affixed to lateral placentæ, with an arillus or caruncle. Albumen fleshy, including the embryo in its base. Cotyledons plane. —*Delicate herbs, of temperate latitudes, slightly bitter and diaphoretic, containing a watery, not milky, juice. Flowers purple, white or yellow.*

Ex. *Dielytra. Corydalis,* Suppl. f.* 38, 39. *Fumaria.**

Ord. XII. CRUCIFERÆ. *Juss.* Cruciferous Family, *Suppl. f.* 23—30.

Sepals 4, deciduous, 2 often gibbous at the base. Petals 4, cruciate, alternate with the sepals, unguiculate, rarely unequal. Stamens 6, tetradynamous, 2 solitary, shorter, opposite the lateral sepals, 4 longer in pairs, alternating with them, distinct, rarely combined at the base, sometimes with a tooth. Ovary 2-celled and style single: green glands at the base of the germen and stamens. Stigmas 2, opposite the placentæ. Fruit a siliqua or silicula, 2,-rarely 1-celled, 2-valved, the valves separating from the placentæ, rarely valveless, 1-or many-seeded. Seeds pendulous, without albumen. Embryo curved upwards towards the margins of the Cotyledons (o=), or against the back of one of them (o‖), opposite to the hilum.—*Herbaceous, rarely suffruticose plants. Leaves alternate. Flowers in corymbs or racemes.*

A most extensive and important Natural Order, many of the plants which it includes being cultivated as esculents, as the Cabbage, Turnep, Mustard and Cress of various kinds, Horse-radish, &c.; and they are antiscorbutic. Many yield an essential oil which renders them stimulating, while their seeds afford a fine mild and oleaginous fluid, as Rape. Several kinds contain sulphur and the basis of Ammonia, Nitrogen, and they have been employed instead of animal substances, as the horns and hoofs of animals, in the manufactory of Prussian Blue. The Order is chiefly European, but some examples are found in every part of the world. The ancient division, according to the relative length and breadth of the fruit, liable as it is to many objections, is perhaps the most simple. The nature and the foldings of the cotyledons, and the direction of the radicle in respect to them, is the foundation of the arrangement of more modern authors; but, independently of its difficulty in a practical point of view, it is found not to be accompanied by any natural habit. I shall confine myself to an enumeration of the British Genera.

TRIBE I. SILICULOSÆ.—A short pod or pouch.—Ex. *Cakile.** *Crambe.** *Coronopus.** *Isatis.** *Vella.** *Thlaspi.** *Capsella,** *Suppl. f.* 23, 24. *Hutchinsia.** *Teesdalia,** *Suppl. f.* 25, 26, 27. *Iberis.** *Lepidium.** *Cochlearia.** *Subularia.** *Draba.** *Camelina.** *Koniga.**

TRIBE II. SILIQUOSÆ.—An elongated pod.—Ex. *Dentaria.** *Cardamine,** *Suppl. f.* 28—30. *Arabis.** *Turritis.** *Barbarea.** *Nasturtium.** *Sisymbrium.** *Erysimum.** *Cheiranthus.** *Mathiola.** *Hesperis.** *Brassica.** *Sinapis.** *Raphanus.**

ORD. XIII. CAPPARIDEÆ. *Juss.* Caper Family, *Suppl. f.* 20.

Sepals 4. Petals 4, cruciate, often unguiculate and unequal. Stamens almost perigynous, rarely tetradynamous, definite or indefinite and arranged in fours in several series. Torus hemisphærical or elongated, often glandular. Ovary stipitate. Style none or filiform. Fruit siliquiform or baccate, 1-celled, rarely 1-seeded, usually with two polyspermous placentæ between the valves. Seeds often reniform, without albumen. Embryo incurved. Cotyledons foliaceous, plane, subincumbent.—*Herbs, shrubs, or trees. Leaves alternate, petiolate, simple or palmate. Stipules none or spinescent.*

De Candolle considers this order as intermediate between the *Thalamifloræ* and *Calycifloræ*.

TRIBE I. CLEOMEÆ. Cleome Tribe.—Fruit capsular. *Herbs or undershrubs.*—Ex. *Cleome. Polanisia.*

TRIBE II. CAPPAREÆ. Caper Tribe.—Ex. *Cratæva. Capparis;* the buds of *C. spinosa, Suppl. f.* 20, yield the Capers of commerce.

ORD. XIV. RESEDACEÆ. *DC.* Mignonnette Family, *Suppl. f.* 17.

Calyx in 4—6 deep divisions, persistent. Petals 4—6, alternating with the divisions of the calyx, of two kinds; lower ones entire, upper ones cleft into many segments. Stamens generally indefinite, distinct and hypogynous: anthers 2-celled, opening longitudinally. Between the petals and filaments there is an annular gland, most elevated at its upper side; thus forming a remarkable hypogynous disk. The slightly stipitate Ovary appears to be formed by the union of 3 carpels and terminates in 3 horns or styles, each with its stigma, 1-celled, *open* at the summit. Ovules many, attached to 3 parietal placentæ, alternating with the stigmas. Fruit resembling the ovary, only more open. Seeds generally reniform. Testa thick. Albumen thin. Embryo curved.—*Herbs with alternate leaves and minute gland-like stipules.*

There are many to whom the Wild Mignonnette, *Reseda lutea*, and Dyer's Rocket (or Yellow-weed or Weld), *R. Luteola*, and still more the true Mignonnette, *R. odorata*, are very familiar, yet who are ignorant of the curious structure of their flowers: so curious indeed, that botanists are not agreed as to the affinities of the Order. Many place it next to *Capparideæ* (as is here done,) with which Jussieu united it. But Prof. Lindley takes a different view of the structure of the flowers; with him the calyx is a general involucre, each petal a sterile flower, and the hypogynous disk a perianth surrounding an hermaphrodite flower, composed of several stamens and a pistil. Hence he places it between *Euphorbiaceæ* and *Datisceæ*.—Ex. *Reseda*,* *Suppl. f.* 17. *Ochradenus.*

Ord. XV. FLACOURTIANEÆ. *Rich.* Flacourtia Family.

Sepals 4—7, slightly cohering at the base. Petals 4—7, alternating with the sepals, rarely none. Stamens equal in number to the petals, or double or many times that number, sometimes changed into nectariferous scales. Ovary subglobose, free, sessile or slightly stipitate. Styles none or filiform; stigmas as many as there are valves to the ovaries, more or less distinct. Fruit 1-celled, indehiscent and fleshy, or capsular and 4—5-valved, including a thin pulp. Seeds few, thick, covered with a pellicle, fixed to the valves, not to the margin (as in *Capparideæ*,) nor to a longitudinal line (as in *Violarieæ* and *Passifloreæ*,) but attached to branched placentæ which cover the inner surface. Albumen fleshy, somewhat oily. Embryo straight, in the axis, with the radicle directed to the hilum: cotyledons plane, oval, foliaceous.—*Shrubs, or small, mostly æquatorial trees. Leaves alternate, petiolate, simple. Stipules none.*

Ex. *Ryanæa. Flacourtia. Kiggelaria. Erythrospermum.*

Ord. XVI. BIXINEÆ. *Kunth.* Arnotto Family.

Sepals 4—7, with an imbricated æstivation. Petals 5, like the sepals, or none. Stamens indefinite, inserted upon a disk: filaments distinct; anthers 2-celled. Ovary superior, sessile, 1-celled. Ovules attached to from 1—7 parietal placentæ. Style 1, undivided or 2—4-fid. Fruit capsular or baccate, 1-celled, many-seeded. Seeds fixed to the parietal placentæ, and enveloped in pulp. Albumen fleshy or very thin. Embryo included, nearly erect or curved. Cotyledons foliaceous. Radicle directed to the hilum.—*Trees or shrubs, generally glabrous. Leaves alternate, simple, entire, sometimes pellucido-punctate. Stipules caducous.*

An Exotic and mostly Tropical Order, approaching the preceding and *Cistineæ* in its fruit, also *Malvaceæ, Flacourtianeæ,* and *Rosaceæ.* The red pulp which covers the fruit of *Bixa Orellana* yields *Arnotto*, which is slightly purgative and stomachic, and used in staining red cheeses.—Ex. *Bixa. Prockia. Ludia.*

Ord. XVII. CISTINEÆ. *Juss.* Cistus Family, *Suppl. f.* 236.

Sepals 5, generally unequal, the 2 outer smaller, the 3 inner with a twisted æstivation. Petals 5, caducous, equal, wrinkled in æstivation and twisted in a direction opposite to that of the sepals. Stamens indefinite, erect, distinct: anthers ovate, 2-celled, inserted by their base. Style 1, filiform. Stigma simple, capsule 3—5-rarely 10-valved, 1-celled, with the valves bearing a single longitudinal placenta, or 3—5-celled, the dissepiments from the centre of the valves, extending to the axis, and bearing the numerous seeds. Albumen nearly including a spiral or curved Embryo.—*Shrubs or herbs. Leaves simple, lower ones generally opposite, the rest alternate. Stipules 2 and foliaceous, or none. Flowers racemose, very fugacious, white, yellow, or purple.*

An Order chiefly confined to the south of Europe and north of Africa. *Cistus Creticus,* and other species probably, afford the Balsam of Labdanum. The stamens of *Helianthemum* are irritable when smartly and suddenly compressed.—Ex. *Cistus. Helianthemum,** *Suppl. f.* 236, *Hudsonia* and *Lechea,* which two latter are exclusively North American Genera.

Ord. XVIII. VIOLARIEÆ. *DC.* Violet Family.

Sepals 5, persistent, with an imbricated æstivation, often produced at the base. Petals 5, generally unequal, with an oblique convolute æstivation. Stamens 5, on an hypogynous disk, often unequal: filaments dilated beyond the anthers, two often with an appendage: anthers opening inwards, 2 celled. Ovary 1-celled, mostly with many ovules: placentæ 3, parietal: style 1, persistent, often curved, with an oblique and frequently perforated stigma. Capsule of 3 valves which bear the placentæ. Seeds often caruncalated at the base. Embryo straight, in the axis of a fleshy albumen.—*Herbs or small shrubs. Leaves simple, stipuled.*

Plants, of which a considerable proportion inhabit the temperate parts of the northern hemisphere, both in the new and the old world. Those with regular petals (*Alsodineæ, DC.*) are chiefly South American. Those with irregular petals possess, in many instances, powerfully emetic qualities; and Ipecacuanha is afforded by the roots of several species of *Ionidium,* as well as by other plants belonging to very different Families. Our common *Dog Violet* has been used, and it is said successfully, in cutaneous affections. *Sauvagesia* is mucilaginous.—Ex. *Viola,** (of which 105 species are described by De Candolle). *Ionidium. Hybanthus.* (with irregular petals). *Conohoria. Alsodeia. Sauvagesia.* (with regular petals).

Ord. XIX. DROSERACEÆ. *DC.* Sun-dew Family.

Sepals 5, persistent, equal, with an imbricated æstivation. Petals 5. Stamens distinct, marcescent, equal in number to the petals and alternate with them, or 2, 3 or 4 times that number. Anthers 2-celled, opening longitudinally. Ovary 1, sessile. Styles 3—5, more or less combined. Capsule 1—3-celled, 3—5-valved, bearing the seeds along the middle, or at the base of the valves. Seeds sometimes furnished with an arillus. Embryo straight, in the centre of a fleshy or cartilaginous albumen. Radicle directed to the hilum.—*Delicate herbaceous plants, frequently clothed with glandular hairs, and in the* Droseræ *the leaves and peduncles have a circinnate vernation.*

Ex. *Drosera,** remarkable for its viscid glandular hairs which detain and destroy insects. *Dionæa,* which destroys insects by a contrivance almost similar to that of a rat-trap. *Parnassia.**

Ord. XX. POLYGALEÆ. *Juss.* Milk-wort Family.

Sepals 5, with an imbricated æstivation, 2 interior ones often petaliform, 3 exterior smaller, of which the two anterior are sometimes combined, and the third is posterior. Petals 3—4, more or less connected by means of the staminal tube. Filaments of the stamens combined with the petals, monadelphous, but divided into 2 equal portions: anthers 8, 1-celled, opening by a pore at the extremity: ovary 1, distinct, 2-rarely 1—3-celled: style 1, incurved: stigma funnel-shaped or two-lobed. Fruit capsular or drupaceous, 2- or 1-celled, the valves bearing the dissepiments. Seeds solitary in each cell, pendulous, often carunculated, sometimes hairy or comate. Embryo straight, in the axis of a fleshy albumen; the latter sometimes wanting.—*Herbs or Shrubs. Leaves mostly alternate, entire. Flowers racemose.*

The bark and roots are bitter, the latter yielding a milky juice. *Polygala Senega* possesses very powerful medicinal properties. *Krameria* is said to be tonic and very astringent, and that, together with Gum Kino, it is used in England for adulterating Port Wine.—Ex. *Polygala.** *Comesperma,* (a New Holland Genus.) *Muraltia* and *Mundia* are exclusively from the Cape. *Krameria.*

Ord. XXI. TREMANDREÆ. *Br.* Tremandra Family.

Sepals 4—5, unequal, with a valvate æstivation, deciduous. Petals 4—5, equal, alternate with the sepals, with an involute æstivation, deciduous. Stamens distinct, 8—10, 2 opposite each petal: filaments erect: anthers 2—4-celled, opening with a tube or pore at the extremity. Ovary ovate, compressed, 2-celled cells with 1—3 ovules: style 1: stigmas 1—2. Capsule ovate, compressed, 2-celled, 2-valved, valves bearing the dissepiment in the middle. Seeds from the extremity of the dissepiment, pendulous, ovate, carunculated at the extremity. Embryo cylindrical, straight, in the axis of a fleshy albumen : Radicle directed to the hilum.—*Slender, erect, New Holland shrubs, with the habit of Heaths, often clothed with glandular hairs. Leaves alternate or verticillate, without stipules. Pedicels axillary, solitary, 1-flowered.*

Ex. *Tetratheca. Tremandra.*

Ord. XXII. PITTOSPOREÆ. *Br.* Pittosporum Family.

Sepals 5, deciduous, distinct or partially combined, with an imbricated æstivation. Petals 5, the claws connivent, sometimes slightly cohering; the border spreading. Stamens 5, hypogynous, distinct, alternate with the petals. Ovary 1; cells and placentæ 2—5, many-seeded. Style 1. There are as many stigmas as there are placentæ. Fruit capsular or baccate, the cells polyspermous, sometimes incomplete. Seeds often enveloped in a gelatinous pulp. Embryo minute, within the fleshy albumen and near the hilum. Cotyledons very short.—*African, Asiatic, or generally Australian shrubs. Leaves simple, alternate, often entire, without stipules. Flowers terminal or axillary, sometimes polygamous.*

Ex. *Billardiera,* a new Holland Genus, with eatable fruit. *Pittosporum. Bursaria.*

Ord. XXIII. FRANKENIACEÆ. *St. Hil.* Frankenia Family, *Suppl. f.* 241.

Sepals 4—5, erect, united below into a sulcated tube, persistent. Petals 4—5, alternate, unguiculate. Stamens 5—7: filaments filiform: anthers roundish. Ovary 1: style filiform 2—3-fid. Capsule enclosed in the persistent calyx, ovato-oblong, subtrigonous, 2—3—4-valved, 1-celled: valves placentiferous along each margin, polyspermous. Seeds minute. Embryo straight, in a fleshy albumen. Radicle directed to the hilum.—*Herbs or shrubs. Stems rounded, branched. Leaves opposite or verticillate, without stipules, ob-*

long, entire, with the margins revolute. Flowers at the apices and in the dichotomies of the branches, sessile, surrounded by floral leaves, rose or violet-coloured.

Allied to *Caryophylleæ,* but differing in the placentation.—Ex. *Frankenia,* Suppl. f.* 241. *Beatsonia. Luxemburgia.*

ORD. XXIV. ELATINEÆ. *Camb.* Elatine Family.

Sepals 3—5, persistent. Petals 3—5, alternate with the sepals. Stamens equal in number with, or twice as many as, the petals. Ovary 3—5-celled. Styles 3—5; stigmas small, capitate. Capsule 3—5-celled, 3—5-valved; valves separating from the dissepiments which alternate with them. Seeds numerous, cylindrical and generally curved. Albumen none. Radicle next the hilum.—*Annual herbs. Leaves opposite, with small stipules.*

Ex. *Elatine.* Bergia.*

ORD. XXV. CARYOPHYLLEÆ. *Juss.* Chickweed Family, *Suppl. f.* 15, 16, and 239, 240.

Sepals 4—5, continuous with the peduncle, distinct or cohering into a tube, persistent. Petals 4—5, hypogynous, in some (especially *Stellaria uliginosa*) almost perigynous, at other times, along with the stamens, inserted upon the receptacle, sometimes wanting. Stamens as many as, or twice the number of the petals, distinct or slightly united at the base: anthers 2-celled, opening longitudinally. Ovary inserted on a more or less evident torus. Styles 2—5. Capsule 1—5-celled, 2—5-valved, valves often dentiform. Placentæ central, in the 2—5-celled capsules, adhering to the edge of the dissepiments. Seeds indefinite. Albumen mealy, around which the embryo is generally more or less curved. Radicle directed to the hilum.—*Herbaceous plants, of the temperate and colder regions, rarely suffrutescent. Leaves opposite, often connate, entire, in* Arenaria rubra *and its allies having membranaceous stipules.*

TRIBE I. SILENEÆ.—Sepals united into a tube.—Ex. *Dianthus,* Suppl. f.* 15—16. *Saponaria,** which has, as its name implies, a saponaceous property. *Silene,** (a Genus of 217 species.) *Lychnis.** *Agrostemma.**

TRIBE II. ALSINEÆ.—Sepals distinct or only cohering at the base. —Ex. *Buffonia.** *Sagina.** *Mœnchia.** *Holosteum,** *Suppl. f.* 239. *Spergula,** *Suppl. f.* 240. *Arenaria.** *Cerastium.** *Cherleria.** The curious Genus *Vivania* is by some referred to this Order: but it seems to have a greater resemblance to *Geraniaceæ* or *Oxalideæ*.

ORD. XXVI. LINEÆ. *DC.* Flax Family.

Sepals 3—5, with an imbricated æstivation. Petals 3—5, unguiculate, alternate with the sepals and with a twisted æstivation. Stamens as many as there are petals, united at their base, alternate with the petals, with intermediate teeth or abortive filaments: anthers ovate, 2-celled. Ovary subglobose, generally with as many cells and capitate styles as there are sepals, rarely fewer. Capsule globose, often apiculated with the base of the persistent styles, each cell imperfectly separated into two by a spurious dissepiment and opening with two valves at the extremity. Albumen scarcely any. Embryo straight, fleshy and oily. Radicle towards the hilum.—*Herbs or undershrubs. Leaves entire, without stipules. Flowers pedunculated. Petals very fugacious.*

A small but valuable Order on account of the flax yielded by the fibres of *L. usitatissimum*, the mucilage of the seeds and the oil extracted from them. The little *L. catharticum* is purgative.—Ex. *Linum.** *Radiola.**

ORD. XXVII. MALVACEÆ. *Br.* Mallow Family, *Suppl. f.* 36, 37.

Sepals 5, rarely 3 or 4, more or less combined at the base, with a valvate æstivation, often bearing bracteas forming an involucre and resembling an outer calyx. Petals 5, equal, alternate with the sepals, with a twisted æstivation, often adnate at their base with the base of the staminal tube. Stamens 5 or indefinite: filaments united into a tube, unequal; anthers 1-celled, reniform, opening transversely. Ovary composed of many carpels or combined, placed around a common axis, distinct: styles as many as there are carpels, distinct or united; stigmas equal in number with the carpels, distinct or united. Carpels distinct or united into a many-celled capsule, each 1—2-or many-seeded, opening opposite the dissepiments or between them. Seeds sometimes villous; embryo curved; cotyledons folded.—*Herbs, shrubs or trees, mostly inhabiting warm and hot regions. Leaves alternate, petiolate, toothed or lobed, often clothed with a stellated pubescence. Stipules two to each leaf, often deciduous. Peduncles usually axillary.*

An extensive Order, remarkable for its mucilaginous properties; for the strong fibre of the inner bark, whence cordage is extensively manufactured from it, and for the villous covering of the seeds which fills the capsules of the *Gossypium*, and which constitutes Cotton.—Ex. *Malva.** *Althæa,** *Suppl. f.* 36, 37. *Lavatera.** *Hibiscus. Gossypium. Sida.*

Ord. XXVIII. BOMBACEÆ. *Kunth.* Cotton-tree Family.

Sepals 5, united into a truncated, or often irregularly cleft tube, rarely bracteated. Petals 5, regular, or none, and then the inside of the calyx is coloured. Stamens 5—10—15 or more, united below into a tube which is adnate with the base of the petals, dividing at the apex into 5 bundles each with 1 or more anthers, some of them sterile. Anthers 1-celled. Ovary of 5 (or rarely 10) carpels, somewhat distinct or firmly united: styles as many, more or less combined. Fruit variable, indehiscent, or capsular, generally with 5 valves, bearing the dissepiments in the middle. Seeds generally invested with wool or pulp, without albumen and with the cotyledons corrugated or convolute, or with albumen and the cotyledons plane.—*Shrubs or large tropical trees. Leaves alternate, stipuled. Pubescence stellate.*

Mucilaginous, like the last Order, from which it chiefly differs in the calyx not being truly valvate, and in the tube of the stamens being divided into 5 bundles. From the *Byttneriaceæ* and *Chlenaceæ* it differs in the 1-celled anther. The Cotton-tree, *Bombax pentandrum*, yields a medicinal gum and a fine kind of cotton. To this Family belong the Baobab, the largest known tree in the world, whose trunk measures 90 feet in circumference, and the Durion of the Indian Archipelago, the most delicious of all fruits.—Ex. *Helicteres,* (with its curious spiral capsules.)

Adansonia. Carolinea. Bombax. Durio. Cheirostemon, the famous Hand-plant of the Mexicans.

Ord. XXIX. BYTTNERIACEÆ. *Br.* Byttneria Family, *Suppl. f.* 267.

Sepals 5, more or less combined, with a valvate æstivation, sometimes bracteated. Petals 5, alternate with the sepals, variously formed, with a convolute æstivation. Stamens 5, or indefinite; the filaments variously monadelphous, some of them occasionally sterile; anthers opening behind, 2-celled. Carpels 5, rarely 3, distinct or combined into 1 ovary. Styles equal in number to the capsules, distinct or combined. Seeds with a strophiolated apex, often winged. Albumen oily or fleshy, rarely wanting. Embryo straight. Radicle inferior. Cotyledons foliaceous, plane or plaited, or folded round the plumule, sometimes (in those destitute of albumen) very thick.—*Exotic trees or shrubs, with stellated pubescence. Leaves alternate, simple, often toothed or lobed, stipuled. Peduncles frequently cymose.*

This Order also, like the 2 preceding, possesses mucilaginous properties. It affords chocolate, and cacao, in the seed and fruit of *Theobroma Cacao.* The Gum Tragacanth of Sierra Leone, Mr. Lindley informs us, is produced by a species of *Sterculia,* (*S. tragacantha, Lindl.*) Professor De Candolle has the following groupes, which some consider as distinct Orders.

Tribe I. Sterculieæ.—Ex. *Sterculia.*

Tribe II. Byttnerieæ.—Ex. *Theobroma. Byttneria.*

Tribe III. Lasiopetaleæ.—Ex. *Lasiopetalum, Suppl. f.* 267.

Tribe IV. Hermannieæ.—Ex. *Melochia. Hermannia,* a numerous Cape genus, as is *Mahernia.*

Tribe V. Dombeyaceæ.—Ex. *Pentapetes. Dombeya. Astrapæa.*

Tribe VI. Wallichieæ.—Ex. Wallichia.

Ord. XXX. TILIACEÆ. *Juss.* Linden Family, *Suppl. f.* 235.

Sepals 4—5, with a valvate æstivation, without bracteas. Petals 4—5, alternate with the sepals, entire, with a little hollow at the base. Stamens distinct, generally indefinite: anthers oval or roundish, 2-celled, opening longitudinally. Glands on the stalk of the ovary, as many as there are petals, and opposite to them. Ovary 1, composed of 4—10 combined carpels: styles as many, united into one: stigmas often free. Capsule of several cells. Seeds numerous. Albumen fleshy. Embryo straight: cotyledons plane, foliaceous.—*Trees or shrubs, rarely herbs, of which one Genus alone is European. Leaves simple, stipuled, often toothed. Flowers axillary.*

Mucilaginous plants, the bark abounding in tough fibre, used for a variety of economical purposes. Russian mats are made of the bark of the Lime. *Corchorus olitorius* is a potherb.—Ex. *Sparmannia. Corchorus. Triumfetta. Grewia. Tilia,* Suppl. f.* 235. *Sloanea.*

Ord. XXXI. ELÆOCARPEÆ. *Juss.* Elæocarpus Family.

Sepals 4—5, without bracteas, their æstivation valvate. Petals 4—5, alternate with the sepals, lobed or fimbriated at the extremity. Receptacle glandular. Stamens 15—20; filaments short, free; anthers elongated, 4-sided, 2-celled, opening by pores at the extremity. Ovary many-celled. Styles 1. Seeds 2 or more in each cell. Albumen fleshy. Embryo erect: cotyledons plane, foliaceous.—*Exotic shrubs or trees. Leaves alternate, simple.*

An Order differing from *Tiliaceæ* in the lobed petals, and the anthers opening by pores. The hard and wrinkled seeds of *Elæocarpus* are made into necklaces in the East Indies; and set in gold, are sold in our shops.—Ex. *Elæocarpus. Aceratium.*

Ord. XXXII. DIPTEROCARPEÆ. *Blume.* Camphor-tree Family.

Calyx tubular, 5-lobed, unequal, without bracteas, imbricated in æstivation. Petals sessile, combined at the base, with a twisted æstivation. Stamens indefinite, distinct or imperfectly polyadelphous; filaments dilated at the base; anthers subulate, 2-celled, opening longitudinally, towards the extremity. Ovary few-celled. Ovules in pairs, pendulous. Style and stigma simple. Fruit coriaceous, 1-celled, indehiscent, or 3-valved, surrounded by the enlarged foliaceous calyx. Seed single, without albumen; cotyledons twisted and folded, or unequal and obliquely incumbent. Radicle superior.—*Large Forest-trees of the Indian Archipelago. Leaves alternate, involute in vernation, with numerous parallel veins running from the midrib to the margin. Stipules oblong, convolute, terminating the branches with a taper point, deciduous. Peduncles in racemes or panicles. Flowers generally large.*

A small but important family, abounding in resinous juice. —Ex. *Dryobalanops,* of which *D. Camphora* yields the camphor of Sumatra. *Dipterocarpus. Shorea; S. robusta* affording a balsamic resin used in the Indian temples. *Vateria;* from *V. Indica* is obtained a kind of tallow.

Ord. XXXIII. CHLENACEÆ. *P. Th.* Chlenaceous Family.

Involucre 1—2-flowered, persistent. Sepals 3, small. Petals 5—6, broader and sometimes slightly combined at the base. Stamens indefinite, rarely 10; filaments somewhat combined into a tube, or adnate with the tube of the petals; anthers roundish, adnate or free, 2-celled. Style 1, filiform: stigma 3-fid. Capsule 3-celled, or, by imperfection, 1-celled. Seeds solitary, or many in each cell, fixed to the centre, suspended. Albumen fleshy (*Juss.*), or horny (*P. Th.*). Embryo green, central. Cotyledons foliaceous, waved.—*Small trees or shrubs of Madagascar, with alternate stipuled entire leaves. Flowers paniculate, or racemose.*

Ex. *Sarcolæna. Leptolena. Rhodolæna.*—To these De Candolle has added, as allied to them, the East Indian and Mauritian genus *Hugonia,* but remarking that it has much affinity with the *Malvaceæ* and *Byttneriaceæ,* differing in the imbricated, not valvate, calyx.

Ord. XXXIV. TERNSTRŒMIACEÆ. *Mirb.* Ternstrœmia Family, *Suppl. f.* 51, 52.

Sepals 5, concave, unequal, coriaceous, imbricated, obtuse, persistent, often with 2 small bracteas. Petals 5, on an hypogynous disk, free or partially combined. Stamens indefinite, somewhat coherent with the combined petals; filaments subulate, short; anthers erect, 2-celled. Ovary ovate. Styles 2—5, distinct or more or less united. Fruit ovato-globose, with as many cells as there are styles; sometimes a dry indehiscent berry, sometimes a capsule. Seeds numerous, on a central placenta, curved or ovate, or angled; in the first Tribe having a thin albumen, or none. Embryo rounded, in the axis, curved or folded. Cotyledons oblong. Radicle opposite the hilum;—in some species not well known. —*Tropical trees or shrubs. Leaves alternate, without stipules, coriaceous.*

This Family, to which Cambessedes has united the following one *Camelliaceæ*, Prof. De Candolle separates into 5 Tribes.

TRIBE I. TERNSTRŒMIACEÆ.—Ex. *Ternstrœmia.*

TRIBE II. FREZIEREÆ.—Ex. *Cleyera. Freziera. Eurya*, &c.

TRIBE III. SAURAUJEÆ.—Ex. *Saurauja.*

TRIBE IV. LAPLACEÆ.—Ex. *Cochlospermum. Laplacea.*

TRIBE V.? GORDONIEÆ.—Ex. *Stuartia, Suppl. f.* 51, 52. *Gordonia.*

ORD. XXXV. CAMELLIACEÆ. *DC.* Camellia Family.

Sepals 5—9, with an imbricated æstivation; the interior generally larger, somewhat concave, coriaceous, deciduous. Petals 5—9, alternate with the sepals, often slightly cohering at the base. Stamens indefinite: filaments filiform, at their base polyadelphous or monadelphous: anthers roundish, versatile. Ovary 1. Styles 3—6, filiform, more or less combined; capsule 3-celled, 3-valved, by the imperfection of many of the ovules 3-seeded; valves bearing the dissepiments in the middle, sometimes with the margins introflexed. Seeds fixed to the central margin of the dissepiments, large. Albumen none: embryo with large thick cotyledons, filled with a fat oil, plano-convex, as it were jointed at the base; radicle very short, obtuse, directed to the hilum.—*Glabrous, evergreen shrubs or trees of China, Japan, Cochin-China or India. Flowers axillary.*

This Order, restricted as it is by De Candolle, is confined to *Camellia* and *Thea;* two genera scarcely to be distinguished from each other; of which the former yields the most favoured ornaments of our Greenhouses and Conservatories; the latter a highly important article of Commerce with the Chinese, and a favourite beverage in every part of the civilized world.

Ord. XXXVI. OLACINEÆ. *Mirb.* Olax Family.

Calyx (involucre?) small, of one piece, slightly toothed, at length often enlarged and fleshy. Petals (or sepals?) 4—6, somewhat coriaceous, with a valvate æstivation, distinct or cohering in pairs. Stamens 3—10; filaments subulate, compressed; anthers cordato-oblong, erect, 2-celled. Ovary free, 3—4 (1- *Br.*) -celled. Cells with 2 ovules. Style 1, filiform. Fruit somewhat drupaceous, indehiscent, often surrounded by the enlarged and fleshy calyx, 1-celled, 1-seeded. Seed pendulous, umbilicated at the base. Albumen fleshy, large. Embryo oval, included within the base of the albumen. Radicle directed to the hilum, continuous with the cotyledons.—*Exotic, glabrous trees or shrubs, with simple petiolated entire leaves, rarely wanting, without stipules. Flowers small, axillary.*

The Genus *Olax,* the type of this Order, Dr. Brown refers as an appendix to *Santalaceæ* in the *Monochlamydeæ.*—Ex. *Olax. Heisteria,* (the Partridge-wood of the Cabinet-makers.) *Ximenia.*

Ord. XXXVII. AURANTIACEÆ. *Corr.* Orange Family, *Suppl. f.* 224.

Calyx urceolate or campanulate, short, 3—5-toothed, marcescent. Petals 3—5, broad at the base, distinct or more or less combined, æstivation slightly imbricated. Stamens equal in number with the petals, or double or triple or more, and as well as the petals, inserted upon an hypogynous disk; filaments compressed below, distinct, polyadelphous or monadelphous; anthers distinct, terminal, inserted by their base, erect. Ovary ovate, many-celled. Style 1, rounded. Stigma somewhat lobed, thickish. Fruit (*Aurantium* of De Cand., *Hesperidium* of others) many-celled; the cells filled with pulp, enclosed in little bags, and surrounded by a thickish indehiscent pericarp or rind, abounding in glands of volatile oil. Seeds fixed to the inner angles of the cells, numerous or solitary, generally pendent, without albumen, sometimes including more than one embryo. Embryo generally distinctly marked with the chalaza and raphe. Cotyledons large, thick, biauriculate at the base. Plumule conspicuous. Radicle directed to the hilum.—*Trees and shrubs of Eastern India, abounding in receptacles of essential oil. Leaves alternate, often compound, articulated with the petiole which is frequently winged. Spines, if any, axillary.*

This favourite family is remarkable for the fragrant bitter essential oil which is afforded by almost every part of the plant (contained in pellucid dots in the foliage,) for the odorous flowers and the delicious fruit; the latter being the Lime, Lemon, Citron, Orange, and other kinds less known in Europe.—Ex. *Limonia. Cookia. Citrus, Suppl. f.* 224.

Ord. XXXVIII. HYPERICINEÆ. *Juss.* Tutsan Family, *Suppl. f.* 48—50.

Calyx 4—5-cleft, or of 4—5 sepals, persistent, often unequal, with an imbricated æstivation and dotted or glandular. Petals 4—5, alternate with the divisions of the calyx, often with oblique veins, sometimes with black glands, the æstivation contorted. Stamens indefinite, usually polyadelphous at the base ; filaments long ; anthers small, versatile. Ovary 1. Styles several, often combined ; stigmas simple or capitate. Fruit a many- or 1-celled capsule or berry. Placenta entire, central, or several at the margins of the valves. Seeds numerous. Albumen none (*De Cand.*), fleshy in *Sarothra.* Embryo straight. Radicle inferior.—*Herbaceous or shrubby plants, variously and copiously glandular, the leaves (which are entire and mostly opposite) often with pellucid dots. Flowers generally yellow.*

A small but very extensively distributed family, yielding a resinous and slightly purgative and febrifugal juice analogous to Gamboge, in the *Vismias.* The Tutsan (tout-sain, or all-heal) is the *Hypericum Androsæmum.*—Ex. *Vismia,* (a tropical Genus of the New World). *Hypericum,* Suppl. f.* 48—50. *Sarothra.*

ORD. XXXIX. REAUMURIEÆ. *Ehrenb.* Reaumuria Family.

Calyx 5-parted, surrounded externally by imbricated bracteas. Petals 5, hypogynous. Stamens definite or indefinite, hypogynous, (according to Ehrenberg, whence he suggests the removal of the Order from *Ficoideæ,* where it had been previously placed), with or without an hypogynous disk; anthers peltate. Ovary superior. Styles several, filiform or subulate. Fruit capsular, of 2—5 valves and as many cells, opening between the dissepiments. Seeds definite, villous, erect. Embryo straight, surrounded by a small quantity of albumen. Radicle next the hilum.—*Shrubs. Leaves fleshy, small, alternate, without stipules. Flowers solitary.*

Ex. *Reaumuria*, a native of the shores of the Mediterranean; and *Hololachne* (*Tamarix Songarica, Pall.*) of Northern Asia.

ORD. XL. GUTTIFERÆ. *Juss.* Mangosteen Family, *Suppl. f.* 223.

Sepals 2—6, often persistent, with imbricated bracteas. Petals 4—10. Flowers sometimes monœcious, diœcious or polygamous. Stamens mostly indefinite; filaments unequal; anthers elongated, adnate, opening longitudinally and internally (in the *Symphonieæ* externally), rarely by pores. Ovary 1. Style none or short; stigma sessile, peltate and rayed or lobed. Fruit a capsule, drupe, or berry, 1-or many-celled, 1- or many-seeded, indehiscent, or opening at the introflexed margins of the valves, which form the dissepiments: often pulpy within. Seeds with a thin integument. Albumen none. Embryo straight. Cotyledons thick, sometimes combined.—*Tropical, chiefly S. American, trees or shrubs, sometimes parasitical, yielding a resinous, yellow, acrid, and purgative juice. Leaves almost always opposite, coriaceous, shortly petioled, often with numerous parallel veins reaching to the margin.*

Ex. *Clusia.* The roots of some of the species, which are parasitical, envelope whole forest-trees, destroying them and giving a most remarkable appearance to the woods. *Garcinia* yields the Mangosteen, that most delicious of East Indian fruits. *Xan-*

thochymus, Suppl. f. 223. *Stalagmitis;* the *S. gambogioides* is said to afford Gamboge, a well known drastic purgative. *Calophyllum. Canella; C. alba*, or the False Winter's bark, is a tonic and stimulant of the West Indies, which has been confounded with the true Winter's Bark, *Drimys Winteri* (see *p.* 274). Some refer *Canella* to *Meliaceæ.*

Ord. XLI. MARCGRAAVIACEÆ. *Juss.* Marcgraavia Family.

Sepals 2—7, ovate, often coriaceous, imbricated. Corolla sometimes monopetalous, calyptriform, or of 5 petals. Stamens definite or indefinite, inserted on the receptacle, or on an hypogynous membrane: filaments dilated at the base; anthers elongated, opening internally. Ovary 1, often furrowed. Style 1; stigma simple or capitate. Capsule coriaceous, often subglobose, many-valved, scarcely dehiscent; dissepiments from the middle of the valves, not reaching to the centre. Seeds very minute, numerous, imbedded in pulp.—*Exotic shrubs, frequently subscandent, with alternate leaves. Flowers spiked or umbellate, naked or bracteated; the bracteas often concave or curiously cucullate.*

Ex. *Marcgraavia. Norantea.*

Ord. XLII. HIPPOCRATACEÆ. *Juss.* Hippocratea Family.

Sepals 5 (rarely 4—6,) small, combined in the lower half, persistent. Petals 5 (rarely 4—6), equal, hypogynous? with a somewhat imbricated æstivation. Stamens 3, rarely 4—5; filaments distinct at the extremity, dilated at the base, and as far as the apex of the ovary united into a thick pitcher-shaped tube or covering resembling an hypogynous disk: anthers 1-celled, opening transversely at the extremity, or 2- or 4-celled. Ovary free within the staminal tube, trigonous: style 1; stigmas 1—3. Fruit consisting of 3 samara-like carpels, or a 1—3-celled berry. Seeds 4 in each cell, attached by pairs to the axis, erect, without albumen, some of them imperfect: embryo straight: radicle inferior. Cotyledons plane, elliptical-oblong, somewhat fleshy and cohering when dry.—*Ex-*

otic arborescent or climbing shrubs, generally glabrous. Leaves opposite, simple, entire or toothed, somewhat coriaceous. Racemes axillary, corymbose or fascicled. Flowers small, inconspicuous.

Ex. *Hippocratea. Salacia.*

Ord. XLIII. ERYTHROXYLEÆ. *Humb. et Kunth.* Red-wood Family.

Sepals 5, combined at the base, persistent. Petals 5, broad, with an appendage or plaited scale within, alternate with the sepals, equal, the margins lying over each other in æstivation. Stamens 10: filaments united at the base into a cup; anthers fixed by the base, erect, 2-celled, opening longitudinally at the sides. Ovary 1-celled, with a solitary pendulous ovule, or 3-celled, the lateral cells empty: styles 3, distinct: stigmas somewhat capitate, or almost united at the apex into one. Drupe 1-seeded. Seed angular: albumen horny: embryo linear, straight, central: cotyledons linear, plane, foliaceous: radicle superior, cylindrical, straight. Plumule inconspicuous.—*Exotic shrubs or trees, having the younger branches clothed with acute and often imbricated scales. Leaves alternate or rarely opposite, mostly glabrous. Flowers small, white or yellow-green. Peduncles bracteated at the base.*

Ex. *Erythroxylum*, so called from the redness of its wood: the bark of *E. suberosum*, according to St. Hilaire, yields a reddish brown dye used by the Brazilians. *Sethia.*

Ord. XLIV. MALPIGHIACEÆ. *Juss.* Barbadoes-Cherry Family, *Suppl. f.* 222.

Sepals 5, combined at the base, persistent, generally with large glands; æstivation imbricated. Petals 5, alternate with the sepals, inserted upon an hypogynous disk, unguiculate, sometimes unequal, rarely wanting. Stamens 10, alternate with the petals, inserted in the same manner, rarely fewer, sometimes solitary; filaments distinct or generally combined at the base; anthers roundish. Ovary 1, often 3-lobed. Styles 3, distinct or combined. Fruit of 3 cells or of 3 carpels, from imperfection 1—2-celled, dry or baccate; the cells 1-seeded. Seed without albumen. Embryo curved or straight: radicle short: cotyledons foliaceous or thickish.—*Exotic, chiefly tropical American shrubs, often climbing. Leaves opposite or rarely, in a few* Bannisteriæ, *alternate, simple, without dots, mostly with stipules. Flowers racemose or corymbose, the pedicels frequently jointed and bibracteate near the middle.*

Professor De Candolle has 3 groupes or Tribes, chiefly distinguished by the fruit.

TRIBE. I. MALPIGHIEÆ. Barbadoes-Cherry Tribe.—Styles 3, distinct or combined into 1. Fruit indehiscent, fleshy (often eaten in the West Indies). *Leaves opposite.*—Ex. *Malpighia, Suppl. f.* 222. *Bunchosia.*

TRIBE II. HIPTAGEÆ. Hiptage Tribe.—Styles 3, or combined into 1. Carpels dry, indehiscent, 1-seeded, often variously expanded into wing-like appendages. *Leaves opposite or whorled.* —Ex. *Hiptage.*

TRIBE III. BANISTERIEÆ. Banisteria Tribe.—Styles 3, distinct. Carpels dry, indehiscent, 1-seeded, variously expanded into wing-like appendages. *Leaves opposite, rarely verticillate.* —Ex. *Triopteris. Banisteria.*

ORD. XLV. ACERINEÆ. *Juss.* Maple Family, *Suppl. f.* 221.

Calyx 5-rarely 4—9-partite. Petals the same in number, inserted around an hypogynous disk, alternate with the lobes of the calyx, often of the same colour, rarely none. Stamens on the hypogynous disk, often 8, rarely 5—12; anthers oblong. Ovary didymous. Style 1; stigmas 2. Fruit a samara, of 2 indehiscent carpels at length separating, 1-celled, 1- or 2-seeded. Seeds fixed to the base of the cell, without albumen, but with a thickened inner coat to the testa. Embryo curved or convolute. Cotyledons foliaceous, wrinkled: radicle inferior.—*Trees of the temperate parts of the northern hemisphere, of great beauty. Leaves simple, often lobed in* Acer, *compound in* Negundo. *Flowers racemose or corymbose, axillary, often, by imperfection, diœcious or polygamous.*

Ex. *Acer, Suppl. f.* 221, of which *A. saccharinum* of N. America yields the Maple Sugar. *Negundo*, a North American, *Dobinea*, a northern Indian Genus.

Ord. XLVI. HIPPOCASTANEÆ. *De Cand.* Horse-Chestnut Family, *Suppl. f.* 12.

Calyx campanulate, 5-lobed. Petals 5 or 4, unequal, hypogynous. Stamens 7 or 8, inserted upon an hypogynous disk, distinct, unequal; anthers somewhat incumbent. Ovary roundish, trigonal, 3-celled, cells with 2 ovules. Style 1, filiform, tapering, acute. Capsule coriaceous, 1—2—3-valved, 2—3-celled, 2—4-seeded; the valves bearing the dissepiments in the middle. Seeds attached to the dissepiment, large, subglobose, with a smooth shining testa, and a broad, pale hilum: albumen none: embryo curved, inverted, with the radicle pointing to the hilum: cotyledons large, very thick, gibbous, germinating beneath the surface of the soil.—*Exotic handsome trees or shrubs, with opposite compound quinate or septenate leaves, without stipules. Racemes terminal, panicled; the pedicels articulated.*

The large seeds are farinaceous, but bitter and astringent.—Ex. *Æsculus.* The *Æ. Hippocastanum*, a native of northern India, has been long cultivated in this country for the beauty of its growth and flowers. *Pavia* is entirely North American.

Ord. XLVII. RHIZOBOLEÆ. *De Cand.* Caryocar Family.

Sepals 5, more or less combined. Petals 5, thick, unequal, alternate with the sepals, arising with the stamens from an hypogynous disk. Stamens numerous, in a double series, slightly monadelphous, the inner shorter and often imperfect: anthers short, oblong. Ovary subglobose, obscurely 4-sided, 4-celled, 4-seeded; styles 4; stigmas simple. Fruit a large drupe, containing 4, or fewer, rounded, slightly compressed, embossed nuts, with a very thick shell. Seed reniform, without albumen, with the funiculus dilated into a spongy excrescence. Embryo with a very large radicle, constituting nearly the whole kernel, the cauliculus (point of union between the radicle and cotyledons) much elongated: cotyledons small, lying in a furrow of the radicle.—*Trees of large size, of tropical America, with compound 3—5-foliolate leaves, and no stipules. Flowers large, racemose.*

Ex. *Caryocar; C. nuciferum* affords the Souari nut of the shops, of which the kernel is very delicious, and yields a valuable oil. (See *Bot. Magazine, t.* 2727 *and t.* 2728.)

Ord. XLVIII. SAPINDACEÆ. *Juss.* Soap-tree Family.

Sepals 4—5, distinct, or united at the base; æstivation imbricated. Petals as many as there are sepals, one, or occasionally all wanting, hypogynous, naked or villous or glandular in the middle or with a petaloid scale. Stamens equal in number with the petals, inserted upon an hypogynous glandular disk; filaments distinct. Ovary roundish: style 1—3. Fruit drupaceous or capsular, 3-celled, or, by imperfection, 1—2-celled; seeds solitary in each cell, fixed to the inner angle, without albumen. Embryo with its radicle directed to the base of the cell: cotyledons folded upon the radicle or straight.—*Exotic and chiefly tropical trees, or erect or climbing shrubs, rarely herbaceous. Leaves alternate, often compound, frequently with pellucid dots or lines.*

In this Order the leaves and branches of many species are said to be poisonous, and in Brazil, where the plants abound, St. Hilaire tells us that some species of *Magonia* are used for stupifying fish, and that the poisonous quality of the Lecheguana honey is attributed to its being collected from *Paullinia australis.* Yet the fruit of others is eaten: that of *Schmidelia edulis* and *Sapindus esculentus* in S. America; while those of the Litchi, *Euphoria Litchi;* Longan, *E. Longan;* and the Rambutan, *E. Nephelium*, are among the most delicious productions of India, China, and the Malay Archipelago. The root of *Cardiospermum Halicacabum* is an aperient. The fruit of *Sapindus saponaria* (or Soap-berry tree) is saponaceous.—Ex. *Cardiospermum. Paullinia. Sapindus. Euphoria. Cupania. Dodonæa.*

Ord. XLIX. MELIACEÆ. *Juss.* Bead-Tree Family, *Suppl. f.* 225.

Sepals 4—5, more or less combined. Petals as many, alternate with the sepals, often cohering at the base and generally having a valvate æstivation. Stamens double as many as petals (rarely equal, or 3 or 4 times as many) filaments united for the greater part of their length into a tube, at the mouth of which the anthers are sessile and adnate. Torus often large and cup-shaped around the base of the ovary. Fruit baccate, drupaceous or capsular, many- or by imperforation 1-celled; the valves, if present, bearing the dissepiments in the middle. Seed without albumen, not winged. Embryo straight, inverted.—*Exotic and almost entirely tropical trees or shrubs,* (*the Bead-tree,* Melia Azederach *or Pride of India, is an exception, being a native of Syria.*) *Leaves alternate, simple or compound, without stipules.*

Plants of this Family contain a bitter and more or less astringent principle. The juice of *Guarea Aubletii,* of Cayenne, is a purgative and violent emetic. The *Melia Azederach* is considered poisonous, and Bory de St. Vincent tells us of a spring of water in Spain, that was rendered unwholesome by a plantation of these trees on its margin; but as soon as the French army removed them, and the fruit ceased to fall in, the salubrity of the water was restored. In Java the fruit is employed as an anthelmintic; and tonic: it yields an oil, said to be antispasmodic. The pulp however that surrounds the fruit in *Sandoricum* and *Lancium* is esculent.

Tribe I. Melieæ.—Cotyledons flat and foliaceous.—Ex. *Turræa, Suppl. f.* 225. *Sandoricum. Melia.*

Tribe II. Trichilieæ.—Cotyledons very thick.—Ex. *Trichilia. Guarea. Heynea.*

Ord. L. CEDRELEÆ. *Br.* Mahogany Family. (Part of Meliaceæ, *DC.*)

Calyx 5-cleft, persistent. Petals 5, sessile, inserted at the base of a staminiferous disk, imbricated in æstivation. Stamens 10, inserted on the outside, below the apex of an hypogynous disk; those which are opposite the petals sterile; anthers acuminate, attached near the base; their cells side by side, bursting longitudinally. Disk hypogynous, cup-shaped, with 10 plaits. Ovary superior, 5-celled: style simple: stigma deeply 4-lobed, peltate. Capsule separable into 5 pieces, which are combined at the base, before bursting, with a short central axis which is finally distinct and persistent. Placenta central, with 5 longitudinal lobes, which occupy the cavities of the capsule, and therefore alternate with the pieces, dividing each cavity in two; finally becoming loose and having 2 (or more) seeds on each side. Seed erect or ascending, with the apex terminated in a wing; testa coriaceous, thickened at the base and sides. Albumen none, (a little, *DC.*): cotyledons flat, transverse: radicle transverse, very short, distant from the hilum: (embryo erect, *DC.*).—*Leaves alternate, without stipules, compound. Inflorescence terminal, panicled.* (*See Br. in App. to Flind. Voy.*)

This Order was united to *Meliaceæ*, till Mr. Brown separated it, chiefly on account of its winged and indefinite seeds. The individuals composing it are remarkable for bitterness and astringency, together with an aromatic principle; hence their wood is not liable to the attacks of insects, and hence arise the febrifugal properties which they so generally possess.

Cedrela febrifuga and *Swietenia febrifuga*, as their names imply, as well as *C. Toona* are employed medicinally. The bark of Mahogany is used as a substitute, though a very inferior one, for *Cinchona*. But it is the wood of the Mahogany of commerce (*Swietenia Mahogani*) which is the most precious product of this Natural Order. Doubts had existed (see *Bot. Misc. t.* 16, 17) whether the Mahogany of Honduras was the same species with that of Jamaica. I am enabled, from specimens I have lately received from an extensive Mahogany cutter in Honduras, to say that the two are identical: the differences in the wood no doubt arising from difference of soil, situation, &c.—Ex. *Cedrela. Swietenia. Flindersia. Oxleya.*

Ord. LI. HUMIRIACEÆ. *Adr. de Juss.* Humirium Family.

Calyx in 5 divisions. Petals alternate with the lobes of the calyx, and equal to them in number. Stamens hypogynous, double, triple or quadruple the number of petals, monadelphous at the base, with the *connectivum* produced beyond the short 2-celled anther: style simple: stigma lobed. Ovary free, generally surrounded with an hypogynous disk; 5-celled, cells with 1 or 2 ovules. Fruit drupaceous, with 5, or, by imperfection, fewer cells. Seed with a membranaceous integument. Embryo straight in a fleshy albumen, oblong.—*Trees or shrubs of Brazil. Leaves alternate, simple, coriaceous, without stipules. Flowers subscymose.*

Ex. *Humirium. Helleria.*

Ord. LII. AMPELIDEÆ. *Rich.* Vine Family, *Suppl. f.* 226.

Calyx small, the margin nearly entire. Petals 4—5, alternate with the teeth of the calyx, surrounding the disk on the outside of the ovary, broadest at the base, sometimes cohering above, and hence calyptriform, with a valvate æstivation. Stamens as many as there are petals, inserted opposite the petals upon the disk. Filaments distinct or slightly united at the base: anthers ovate, versatile. Ovary globose, free: style 1, very short or none: stigma simple. Berry globose, 2- or, by imperfection, 1-celled, juicy or fleshy. Seeds 4—5 (fewer by imperfection), fixed to a central axis, bony. Albumen horny. Embryo erect. Radicle inferior. Cotyledons lanceolate.—*Climbing or straggling exotic shrubs. Leaves with stipules, upper ones alternate, opposite the peduncles, petioled, simple, or compound. Peduncles racemose or in dense panicles, when abortive, becoming tendrils. Flowers small, greenish.*

One species of *Vitis, V. vinifera,* yields all the varieties of wine, grapes, raisins, &c., that are known in commerce, hence it is one of Nature's most precious gifts to man.—Ex. *Cissus. Vitis, Suppl. f.* 226. *Ampelopsis; A. hederacea* is commonly known in our gardens as the 5-fingered Ivy. To these Prof. De Candolle adds the small suborder *Leeaceæ,* principally distinguished by the monopetalous corolla, stamens alternate with the petals, (or opposite in *Leea,* Adr. de Juss), often monadelphous. Tendrils none.—Ex. *Leea. Lasianthera.* (?).

Ord. LIII. GERANIACEÆ. *Juss.* Crane's-bill Family, *Suppl. f.* 31—35, and *f.* 227.

Sepals 5, persistent, more or less unequal, with an imbricated æstivation, one of them lengthened into a spur, connate and continuous with the peduncle. Petals 5, (rarely 4 or none,) alternate with the sepals, unguiculate, equal or unequal, hypogynous or perigynous. Stamens monadelphous, rarely wholly distinct, twice or thrice as many as there are petals, some of them occasionally sterile, equal or unequal. Ovary of 5 cells or pieces, placed round a subpentagonal elongated axis: styles 5, combined upon the axis into one: stigmas 5. Carpels (often called *cocculi*) 5, submembranaceous, 1-celled, 1-seeded, eventually separating from the central indurated axis and terminated by the persistent style, which springs from the base and curls upwards. Seed solitary, pendulous, without albumen: embryo curved: radicle directed to the base of the cell: cotyledons foliaceous, convolute and variously plaited.—*Very generally diffused herbs or shrubs, with the stems jointed, at least in the younger and herbaceous kinds, and separable at the joints. Leaves opposite at the joints; or alternate, and then opposite the peduncle. Cirrhi none.*

Ex. *Geranium,* Suppl. f.* 31—35. *Erodium.* Pelargonium, Suppl. f.* 227, almost entirely a Cape Genus, the numerous varieties and hybrid kinds of which are the pride of the Florist.

Ord. LIV. TROPÆOLEÆ. *Juss.* Nasturtium Family, *Suppl. f.* 228.

Sepals 5, more or less combined, at the base above lengthened into a spur. Petals 5, inserted upon the calyx, alternate with its lobes, unequal, irregular, the 2 upper ones sessile, remote, fixed to the throat of the spur, 3 lower smaller, unguiculate, sometimes wanting. Stamens 8, distinct, closely surrounding the ovary, inserted on a disk: anthers terminal, oblong, erect, 2-celled, opening longitudinally. Ovary 1, trigonal, of 3 combined carpels: styles 3, united into 1, with 3 striæ, filiform: stigmas 3, acute. Fruit separable into 3 indehiscent carpels from a common axis, 1-celled, 1-seeded. Seed large, without albumen: embryo large: cotyledons straight, thick, at length combined into one body. Radicle concealed within the processes of the cotyledons.—*Glabrous, delicate, spreading or twining South American herbs. Leaves alternate, peltate, entire or lobed, without stipules. Peduncles axillary, 1-flowered.*

These plants possess the pungent property and the flavour of the Cress, whence the name of Indian Cress has been given to them, and De Candolle remarks that the Cabbage Butterfly which feeds on cruciferous plants will equally devour this exotic. *Tropæolum pentaphyllum* is also employed as an antiscorbutic; the flowers of *T. majus* are eaten with sallad, and its fruit is pickled and often sold for Capers. The roots of *T. tuberosum* are eaten in Peru.—Ex. *Tropæolum, Suppl. f.* 228. *Magallana.*

Ord. LV. BALSAMINEÆ. *Rich.* Balsam Family.

Sepals 5, irregular, deciduous, the 2 inner and upper of which are connate, the lower spurred. Petals 4, hypogynous, united in pairs, so that apparently there are only 2 petals, the fifth wanting. Stamens 5, hypogynous; filaments subulate; anthers 2-celled, bursting lengthwise. Ovary single: stigmas more or less divided into 5: cells 5, many-seeded. Fruit capsular, with 2 elastic valves and 5 cells formed by membranous projections of the placenta, which occupies the axis of the fruit, and is connected with the apex by 3 slender threads. Seeds numerous, suspended: albumen none. Embryo straight, with a superior radicle and plano-convex cotyledons.—*Succulent herbaceous plants. Leaves simple, opposite or alternate, without stipules. Peduncles axillary. Natives of the East Indies, Madagascar, Europe, Asia and N. America.*

The Common Balsam, *Balsamina hortensis,* DC. (*Impatiens Balsamina,* Linn.,) is universally cultivated for the beauty of its flowers, as is the Noli me tangere, *Impatiens Noli tangere,* on account of the highly elastic property of its seed-vessels.—Ex. *Balsamina. Impatiens.**

Ord. LVI. OXALIDEÆ. *DC.* Wood-Sorrel Family.

Sepals 5, sometimes slightly combined, equal, persistent. Petals 5, equal, unguiculate, sometimes cohering at the base, æstivation contorted. Stamens 10, more or less monadelphous; the 5 opposite the petals longer. Anthers 2-celled. Ovary with 5 angles, and 5 cells. Styles 5, filiform; stigmas somewhat capitate. Capsule membranaceous, 5-celled, 5—10-valved. Seeds few, fixed to a central axis, ovate, striated, included in a fleshy arillus, which opens with an elastic force, and ejects the seed. Albumen between cartilaginous and fleshy. Embryo with foliaceous cotyledons and a long radicle pointing to the hilum.—*Herbs or shrubs, of various parts of the world. Leaves mostly alternate, rarely opposite or whorled, compound or, by imperfection, simple.*

A family remarkable for the acid leaves, (and fruit, in *Averrhoa Bilimbi.*) *Oxalis acetosella* contains pure oxalic acid. The foliage is more or less sensitive. The tubers of *Oxalis crenata*, according to Mr. Don, attain to a considerable size, and when boiled, taste like the potatoe; its leaves and stems are employed in Lima as a sallad.—Ex. *Averrhoa. Oxalis.**

Ord. LVII. ZYGOPHYLLEÆ. *Br.* Bean-Caper Family.

Flowers perfect, regular. Calyx of 4—5 divisions, its æstivation convolute. Petals 4—5, alternate with the sepals, inserted upon the receptacle. Stamens 8—10, distinct. Ovary 1, 4—5-celled. Styles 4—5, combined into 1, sometimes a little separated at the extremity. Capsule rarely somewhat fleshy, with 4—5 angles or wings, bursting by 4—5 valves bearing the dissepiments in the middle, or with as many close cells; the sarcocarp not separable from the endocarp. Seeds generally fewer than the ovules, compressed and scabrous when dry, or ovate and smooth, or with a thin herbaceous testa. Embryo green: radicle superior: cotyledons foliaceous. Albumen whitish, between horny and cartilaginous, in *Tribulus* wanting.—*A widely dispersed exotic family of herbaceous plants, shrubs or trees, with hard wood, the branches often articulated at the joints. Leaves opposite* (*with stipules*), *usually unequally pinnate, not dotted. Flowers solitary, or in pairs, or threes, white, blue, or red, often yellow.*

Ex. *Tribulus. Zygophyllum. Guaiacum*, a genus well known by the exciting properties of the resin with which it abounds.

Ord. LVIII. RUTACEÆ. *Juss.* Rue Family. (Part of Rutaceæ of *DC.*)

Flowers perfect, regular. Calyx of 4—5 divisions. Petals of the same number, generally convolute and twisted. Stamens twice or thrice the number of petals, inserted round the base of a fleshy and sometimes disciform support to the ovary. Ovary in 3—5 lobes, more or less deeply divided, 3—5-celled: ovules 2, or 4—20 in each cell, pendent or adnate with the axis: style simple, or often, in the deeply lobed ovaries, separate at the base: stigma 3—5-angled or furrowed. Capsule rarely with loculicidal valves, generally 4—5-lobed, the lobes opening at the extremity and internally, the sarcocarp not separable from the endocarp. Seeds often fewer than the ovules pendulous, or adnate, reniform, scrobiculate, the integument testaceous. Embryo within a fleshy albumen of the same colour or green: radicle superior: cotyledons flattened.—*Perennial herbs or shrubs, of the warm or temperate parts of Europe and Asia. Leaves (with one exception) without stipules, alternate, simple, or deeply lobed, rarely pinnated, generally marked with pellucid dots. Flowers subcorymbose, white or yellow.*

Ex. *Peganum. Ruta;* yielding a strong odour and a powerfully aromatic bitter principle, which resides in an essential oil contained in numerous pellucid glands.

Ord. LIX. DIOSMEÆ. *Br.* Bucku Family, *Suppl. f.* 237, 238.

Flowers hermaphrodite, regular or irregular. Calyx of 4—5 divisions. Petals as many, distinct or united, rarely none; æstivation generally contorto-convolute, rarely valvate. Stamens equal to, or double the number of, the petals, sometimes, by imperfection, fewer, hypogynous or rarely perigynous. Disk or cup surrounding the pistil, free or adnate with the base of the calyx, or wanting. Ovaries sessile or placed upon a support (*gynophore*), equal in number to the petals or fewer, sometimes connate, sometimes in part or altogether distinct: 2 ovules in each, placed side by side, or one above the other, rarely 4. Styles as many as ovaries, altogether, or only at the extremity, combined. Stigma equal or broader, marked with as many lobes or furrows as there are styles. Fruit of 1—5 capsules, distinct, or rarely combined into one. Endocarp entirely separating from the sarcocarp, which opens internally with 2 valves, itself 2-valved, the valves opening at the base, but connected with a membrane which bears the seeds. Seeds in pairs or solitary; integument testaceous. Embryo with or without a fleshy albumen: radicle superior, straight or oblique: cotyledons varying in form.—*Trees, or more generally shrubs, rarely herbs, inhabiting the Tropics and the regions bordering upon them. Leaves without stipules, opposite or alternate, simple or pinnated, generally with glandular and pellucid dots. Flowers axillary or terminal, bracteated, white or reddish.*

Aromatic plants abounding in essential oil, many of which are used in medicine, and possess febrifugal properties. The Buckus which yield so grateful an odour to the Hottentots, are different species, and even genera of the Cape *Diosmeæ*. The leaves have lately been largely imported, and are, according to the Dublin Pharmacopeia, much esteemed as an excellent stomachic, and efficacious diuretic. *Galipea* (or *Cusparia febrifuga**) is the famous Angostura bark. One of the Quinas of Brazil is *Evodia febrifuga*. It is supposed to be owing to the copious volatile oil of *Dictamnus*, that in hot and dry weather, flame has been seen to issue from it.—Ex. *Dictamnus. Diosma. Correa. Boronia, Suppl. f.* 237, 238. *Evodia. Galipea.*

Ord. LX. XANTHOXYLEÆ.† *Nees.* Xanthoxylon Family.

Flowers separated, regular. Calyx of 3—4—5 divisions. Petals as many, generally longer than the calyx, with contorto-convolute æstivation, rarely none. Masc. Stamens equal in number with the petals, or double, generally longer; arising from the base of the stalk of the abortive pistils. Fæm. Stamens none or abortive and shorter than the pistil. Ovaries upon a stalk, equal to the petals in number or fewer, combined or distinct. Ovules 2 in each cell, collateral, or one above the other, rarely 4: styles as many as there are carpels, separate or combined, sometimes none; stigma 2—5-lobed or simple. Fruit simple, baccate or membranaceous, 2—5-celled, or compound, formed of drupes

* This is the *Bonplandia trifoliata* of *Willd.*

† Including the *Pteleaceæ*, a Tribe of Terebinthaceæ according to De Candolle.

or rarely of 1—5 bivalved capsules, with the sarcocarp generally fleshy, partly separating from the endocarp. Seeds solitary or in pairs, generally smooth and shining, their integument testaceous. Embryo in a fleshy albumen: radicle superior; cotyledons ovate, compressed.—*Trees or shrubs, chiefly tropical. Leaves without stipules, alternate or opposite, simple or usually pinnate, generally with pellucid dots.*

The *Xanthoxyleæ* are bitter, aromatic and pungent; hence several of the species are employed in medicine, especially of the genus *Xanthoxylon.—Ex. Brucea;* said to contain a poisonous principle in *B. antidysenterica. Xanthoxylon. Fagara. Ptelea. Cneorum.*

Ord. LXI. SIMARUBEÆ. *Rich.* Quassia Family.

Flowers perfect or separated. Calyx 4—5-partite, persistent. Petals 4—5, erect, deciduous. Stamens equal to, or double the number of, the petals, inserted upon an hypogynous disk. Ovary with as many lobes as there are petals. Style 1, filiform, enlarged at the base. Carpels as numerous as the petals, jointed upon the axis, capsular, 2-valved, opening internally, 1-seeded. Seed pendulous, without albumen: cotyledons thick: radicle short, superior.—*South American tropical trees or shrubs, with an intensely bitter bark, milky juice, and alternate pinnated leaves, without stipules.*

Ex. *Quassia;* the wood of *Q. amara* yields the celebrated bitter so called. *Simaruba* (*Quassia Simaruba L.*).

Ord. LXII. OCHNACEÆ. *DC.* Ochna Family.

Sepals 5, scarcely combined at the base, with an imbricated æstivation. Petals definite, 5, alternate with the sepals, rarely 10, spreading, caducous, with an imbricated æstivation. Stamens 5, alternate with the petals, or 10, or indefinite: filaments generally persistent: anthers 2-celled, inserted by their base. Ovary with as many cells as there are petals: style 1, filiform, persistent, enlarged into a subglobose, fleshy disk, called a *gynobase*, and bearing the cells of the ovary. Cells of the pericarp, or carpels, as many as there are petals, articulated upon the enlarged *gynobase* in a verticillate manner, 1-seeded, indehiscent, subdrupaceous. Seeds without albumen. Embryo straight. Radicle short. Cotyledons 2, thick.—*Tropical, glabrous trees or shrubs, abounding in a yellow watery juice. Leaves alternate, simple, with stipules. Flowers racemose, their pedicels articulated near the middle, rarely solitary.*

Ex. *Ochna;* which is astringent. *Gomphia. Walkera;* bitter and tonic.

Ord. LXIII. CORIARIEÆ. *DC.* Coriaria Family.

Flowers often monœcious or diœcious. Calyx 5-partite. Petals 5, fleshy, with an elevated keel. Stamens 10, 5 between the lobes of the calyx and the angles of the ovary, and 5 opposite to them: filaments filiform: anthers oblong, 2-celled. Ovary upon a fleshy disk, 5-angled, 5-celled: style none: stigmas 5, subulate, long, from the apex of the ovary. Carpels 5, close together when ripe, indehiscent, 1-seeded, surrounded with glandular lobes. Seed pendulous, without albumen. Embryo straight. Radicle superior. Cotyledons fleshy.—*Shrubs, with opposite square branches. Leaves opposite, simple, 3-nerved, entire, ovate or cordate. Buds scaly. Racemes terminal, leafy at the base, often with two little bracteas on the pedicels.*

Ex. *Coriaria;* of which *C. myrtifolia* is used for dyeing black, and its fruit is said to be poisonous.

Subclass II. Calycifloræ. Sepals more or less combined into one piece. Petals distinct or combined, and as well as the stamens inserted upon the calyx,* more or less remote

* The union of the stamens and petals with the calyx, or their apparent insertion, De Candolle and others consider as taking place through the medium of the *torus.*—" The *torus* is a dilatation of the peduncle, whence the stamens and petals originate. It is sometimes small, neither adnate with the calyx, nor with the ovary, and then the plants are called *Thalamifloræ;* sometimes larger and adnate with the calyx, then *Calycifloræ;* at other times adnate with the ovary, as in *Nymphæa,* and then in the proper sense the plants are termed *Epigynæ.* Sometimes the *torus,* which is adnate with the calyx, also circumscribes the stalk of the ovary, as in *Passifloreæ* and some *Leguminosæ.* The calyx does not adhere to the ovary, except through the medium of the *torus.*" *See De Cand. Prodr. v.* 2. *p.* 1, *in Note.*

from the base of the ovary. Ovary free or adnate with the calyx.—(The petals are wanting in *Samydeæ*, and *Aquilarineæ.*)

A. POLYPETALOUS. Petals usually distinct.

ORD. LXIV. STACKHOUSIEÆ. *Br.* Stackhousia Family.

Sepals 5, equal, combined into an inflated tube. Petals 5, equal, arising from the mouth of the tube of the calyx; their claws combined into a tube, longer than the calyx; their limb narrow, stellate. Stamens 5, distinct, unequal, (2 alternately shorter) arising from the mouth of the calyx. Ovary free, 3- or 5-lobed, the lobes distinct, each with a free erect ovule. Styles 3—5, sometimes combined at the base; 'stigmas simple. Fruit of 3—5, indehiscent, winged or wingless pieces; column central, persistent. Embryo erect in the axis of, and almost as long as, the fleshy albumen. —*Herbaceous plants of New Holland. Leaves simple, entire, alternate, sometimes minute; stipules lateral, very minute. Spike terminal, each flower with 3 bracteas.*

Allied, according to Dr. Brown, on the one hand to *Celastrineæ*, and on the other to *Euphorbiaceæ.*—Ex. *Stackhousia.*

ORD. LXV. CELASTRINEÆ. *Br.* Celastrus Family, *Suppl. f.* 265.

Sepals 4—5, combined at the base, distinct from the ovary, with an imbricated æstivation. Petals 4—5, alternate with the sepals, rarely none. Stamens 4—5, alternate with the petals, with a doubtfully perigynous insertion; anthers 2-celled. Ovary free, surrounded by a somewhat fleshy disk, 2—3—4-celled; cells 1- or many-seeded: ovules erect, rarely pendulous: style 1 or wanting: stigma 2—4-cleft. Pericarp a capsule, berry, drupe or samara, various in form, often deformed by the suppression of some of the cells. Seeds generally, especially in the capsular fruits, arillate. Albumen none or fleshy. Embryo straight.—*Shrubs or trees. Leaves usually simple, often stipuled, alternate or opposite. Flowers white or greenish.*

An Order allied to *Rhamneæ*, and to *Hippocrataceæ* (according to Mr. Brown): differing from the former in the imbricated, not valvular, æstivation of the sepals, in the stamens alternating with the petals and in the free ovary:—from the latter in the number of the stamens, 4—5, and their not being monadelphous.

TRIBE I. STAPHYLACEÆ. Bladder-senna Tribe.—Ex. *Staphylea. Turpinia.*

TRIBE II. EUNONYMEÆ. Spindle-tree Tribe.—Ex. *Euonymus, Suppl. f.* 265. *Celastrus.*

The third tribe, *Aquifoliaceæ* of De Cand., is with propriety separated from *Celastrineæ* by Brogniart and arranged with the COROLLIFLORÆ.

ORD. LXVI. RHAMNEÆ. *Br.* Buckthorn Family, *Suppl. f.* 266.

Calyx 4—5-cleft, with a valvate æstivation. Petals 4—5, (rarely wanting,) alternate with the calycine lobes, often scale-like, with a concave or cucullate limb. Stamens 4—5, opposite to the petals, consequently alternate with the calycine lobes; anthers 2-celled. Ovary sometimes wholly adnate with the calyx, sometimes adherent only with the base or as far as the middle, 2—4-celled; cells with one ovule: style 1: stigmas 2—4. Pericarp often indehiscent, a berry, drupe or samara, rarely a capsule. Seeds erect, destitute of arillus. Albumen none or often fleshy. Embryo straight. Radicle inferior: cotyledons somewhat foliaceous.—*Shrubs or small trees. Leaves simple, alternate, rarely opposite, frequently stipuled. Flowers small, often greenish.*

Some of the plants of this Family possess valuable properties. The Genus *Rhamnus*, especially *R. catharticus*, affords in its berries powerful purgatives; others yield a dye, as those of *R. infectorius* and *R. saxatilis*. *Zizyphus Lotus* is the esculent *Lotus* of the ancients, at least one kind of it, and gave name to the *Lotophagi*. Jujubes are the produce of the fruit of *Zizyphus vulgaris*.—Ex. *Zizyphus. Paliurus. Rhamnus, Suppl. f.* 266. *Ceanothus.*

ORD. LXVII. BRUNIACEÆ. *Br.* Brunia Family.

Calyx adherent with the ovary, (in *Raspalia* free); limb 4—5-cleft, the segments often callous at the point. Petals 5, from the mouth of the calyx, alternate with the segments;

æstivation imbricated. Stamens 5, alternate with the petals: anthers opening internally. Ovary half-adnate, 1—3-celled, cells 1—2-seeded; ovules placed side by side, suspended; style simple or bifid: stigma simple. Fruit dicoccous or indehiscent, seed with a small embryo at the apex of a fleshy albumen.—*South African shrubs, much branched, with the aspect of Heaths. Leaves small, linear, rigid, often imbricated, entire, generally whorled. Flowers small, capitate, rarely panicled or spiked, naked or involucrate, with three bracteas at the base of each.*

I follow De Candolle in the arrangement of this Order, which others, however, place near *Hamamelideæ,* and which Professor Lindley thinks approaches *Penæaceæ* in many points.—Ex. *Brunia. Staavia. Linconia.*

Ord. LXVIII. SAMYDEÆ. *Vent.* Samyda Family.

Calyx 5-, or 3—7-cleft, sometimes deeply so, the segments somewhat imbricated, often coloured within. Petals none, unless the coloured portion of the calyx can be considered as such. (*De Cand.*) Stamens from the tube of the calyx, 2 or 3 or 4 times as many as the segments of the calyx; filaments monadelphous at the base, all antheriferous or with the alternate ones sterile, hairy or ciliated, the alternate ones bearing ovate, erect, 2-celled anthers. Ovary free, 1-celled: style 1, filiform: stigma capitate or somewhat lobed. Capsule coriaceous, 1-celled, 3—5-valved, many-seeded, the valves separating imperfectly, somewhat pulpy and coloured within. Seeds attached to the valves, ovate, umbilicated, with a fleshy arillus. Albumen fleshy. Embryo inverted, minute: cotyledons ovate, leafy, plaited: radicle at the opposite extremity of the hilum.—*Tropical trees or shrubs of S. America. Leaves alternate, often distichous, stipuled, simple, entire or toothed, evergreen, often with pellucid dots. Peduncles axillary.*

Although there are no real petals in this Order, De Candolle refers it hither on account of the situation of the stamens. Its dotted leaves indicate an affinity with *Terebinthaceæ.* Mr. Arnott arranges it with the Monochlamydeæ, as he does the three following Orders.—Ex. *Samyda. Casearia.*

Ord. LXIX. HOMALINEÆ. *Br.* Homalium Family.

Tube of the calyx short, obconical, often adnate with the ovary; limb with 5—15 divisions. Petals (inner segments of a calyx, according to *De Cand.*), 5—15, alternate with the divisions of the calyx. Glands within the calycine segments, sessile. Stamens arising from the base of the petals, singly or 3 or 6 together: anthers 2-celled, opening longitudinally. Ovary generally half united to the calyx, 1-celled with many ovules: styles 3—5, simple, filiform or subulate. Pericarp capsular or baccate. Placentas parietal, as many as there are styles, many-seeded. Seeds small, ovate or angular. Embryo on a fleshy albumen.—*Tropical shrubs. Leaves alternate, simple, toothed or entire, with deciduous stipules. Flowers spiked, racemose or panicled.*

Ex. *Homalium. Blackwellia. Astranthus. Aristotelia.*

Ord. LXX. CHAILLETIACEÆ. *Br.* Chailltiae Family.

Calyx persistent, 5-cleft, coloured within, with an imbricated (valvate, *Lindl.*) æstivation. Petals 5, arising from the bottom of the calyx and alternate with its segments. Stamens 5, alternate with the petals: anthers roundish, 2-celled. Ovary distinct, hairy, 2- or 3-celled, each cell with 2 ovules: styles 2—3, short, distinct or combined: stigmas somewhat capitate. Fruit a dry drupe, 1—2—3-celled. Seeds solitary in each cell, pendulous from the extremity, without albumen. Embryo thick: radicle short, superior: cotyledons fleshy.—*Tropical trees or shrubs. Leaves alternate, stipuled, shortly petiolate, ovate, entire. Flowers axillary, the peduncle often connate with the petiole.*

Ex. *Chailletia. Leucosia. Tapura.*

Ord. LXXI. AQUILARINEÆ. *Br.* Aquilaria Family.

Calyx turbinate, coriaceous, 5-lobed. Petals none. Stamens monadelphous, 10 fertile, 10 sterile; the former inserted between the latter, which are petaloid or scale-like: anthers innate, 2-celled, bursting longitudinally. Ovary free, 1-celled, ovate, crowned by a short, simple stigma: ovules 2, parietal, suspended, with their foramen in the apex, which is tapering and turned to the bottom of the cell. Capsule pyriform, 2-valved, 1-celled, with the valves bearing the seed. Seeds solitary, with an arillus or tail, (probably suspended, of a similar form with the ovule and with the radicle at the opposite extremity to the hilum.)—*East Indian trees. Leaves alternate, entire.*

Ex. *Aquilaria.* Aloes-wood, the Bois d'Aigle of Sonnerat, a fragrant resinous substance, is the produce of *Aquilaria Malaccensis* and of *A. Agallocha. Ophispermum. Gyrinops.*

Ord. LXXII. TEREBINTHACEÆ. *Juss.* Terebinth Family, *Suppl. f.* 264.

Flowers perfect, or polygamous or diœcious. Calyx 3—5-cleft, or partite, with an imbricated æstivation, very seldom adherent with the ovary. Petals rarely wanting, generally equalling the number of calycine lobes, and alternate with them, distinct, or occasionally combined at the base, with an imbricated or valvate æstivation. Stamens, along with the petals, arising from the bottom or from a disk of the calyx, or rarely from a *torus* surrounding the ovary, sometimes equal in number with the petals, and alternate with them, sometimes double (or rarely 4 times as many). Carpels many, distinct, each with one style, or many combined by their ovaries: some of them abortive, and hence the carpel often appears solitary, capsular or drupaceous. Seeds few, often solitary and without albumen. Embryo straight, or more or less curved: radicle generally superior.—*Trees or shrubs, mostly tropical, with a balsamiferous or gummy bark. Leaves alternate, without stipules, often compound; flowers small, often panicled.*

De Candolle has the following Tribes, which many Botanists consider as distinct Orders.

Tribe I. Anacardieæ seu Cassuvieæ. Cashew Tribe.—Petals and stamens inserted upon the calyx, or calycine disk.

Ovary one, 1-celled, with one ovule. Seed supported upon a stalk arising from the bottom of the cell, incurved at the extremity, without albumen. Cotyledons thick, folded upon the radicle.—Ex. *Anacardium*, the fruit of which is the well known and singular *Cashew-nut*, borne as it is upon the enlarged very thick and fleshy pear-shaped peduncle. *Semecarpus*, or Marking-nut tree, *Suppl. f.* 264, so called from the use made of the nut in the East Indies, to mark table-linen and articles of apparel. If these are put over the nut and pricked through, the juice exuding will make an indelible stain, which serves as an excellent natural marking-ink. *Mangifera*, the Mango-tree, whose fruit is so highly esteemed in India. *Melanorhœa*. *Pistacia*. These all yield valuable varnishes, which are often dangerous to many constitutions. Mastic is the produce of *Pistacia Lentiscus;* Terebinth or Scio Turpentine of *P. Terebinthus.*

TRIBE II. SUMACHINEÆ. Sumach Tribe.—Petals and stamens inserted upon the calyx or calycine disk. Ovary solitary, 1-celled, with 1 ovule. Seed supported upon a stalk arising from the base of the cell, pendulous, without albumen. Cotyledons foliaceous; radicle curved back upon their edges.—Ex. *Rhus*, many species of which yield a poisonous juice, as *R. Toxicodendron*, and varnishes. *Schinus* abounds so much in an essential oil, that if recently broken pieces of the leaf be thrown on the surface of water, they move, as if spontaneously, and often in circles, by the sudden ejection of the oil.

TRIBE. III. SPONDIACEÆ. Hog-Plum Tribe.—Petals inserted beneath the 10-toothed annular disk of the ovary, with a somewhat valvate or imbricated æstivation. Stamens 10. Ovary 5- or 2—4-celled; cells with one ovule: styles 5. Drupe with 2—5 cells. Seeds without albumen. Cotyledons plano-convex. *Leaves impari-pinnate.*—Ex. *Spondias*, whose fruit is known in the West Indies, under the name of *Hog-Plum.*

TRIBE IV. BURSERACEÆ. Balm of Gilead Tribe.—Petals 3—5, inserted beneath the calycine disk, generally with a valvate æstivation. Stamens twice, (rarely 4 times,) the number of petals. Ovary 2—5-celled; cells with 2 ovules: style 1 or more: stigmas as many as there are cells. Drupe with 2—5 cells. Seeds without albumen. Cotyledons plaited and wrinkled, fleshy. Radicle superior, straight. *Leaves impari-pinnate, sometimes stipuled.*—A small but very important natural groupe, agreeing in the presence of a copious, fragrant, resinous juice. Ex. *Boswellia; B. serrata* yields the gum-resin called Olibanum. *Balsamodendron;* of which Genus, *B. Gileadense* affords the Balm of Gilead; *B. Opobalsamum*, the Balsam of Mecca or Opobalsamum. *Bursera; B. paniculata* (*Colophania Mauritiana, DC.*) is the Bois de Colophane of the Mauritius.

TRIBE V. AMYRIDEÆ. Amyris Tribe.—Flowers perfect. Petals 4, hypogynous, subunguiculated, with an imbricated æstivation. Stamens twice the number of the petals. Torus incrassated, prominent. Ovary 1-celled, with 2 ovules in each cell: stigma sessile, capitate. Pericarp somewhat drupaceous, indehiscent, 1-seeded. Seed without albumen. Cotyledons fleshy: radicle short, superior. *Leaves compound, with pellucid dots. Pericarp glandular.*—Fragrant, resinous, tropical shrubs: allied in many respects to *Aurantiaceæ;* but in general structure and properties to the present order.—Ex. *Amyris,* of which various species yield resins, as the Resin of Coumia, from *A. ambrosiaca;* Gum Elemi of Nevis, from *A. hexandra, Ham.*, and probably the gum-resin called Bdellium. *A. toxifera* is poisonous.

PTELEACEÆ, (Tribe VI. of DC.) is referred to *Xanthoxyleæ* by Adrien de Jussieu and in the present work, *p.* 308.

TRIBE VI. CONNARACEÆ. Connarus Tribe.—Petals 5, inserted upon the calyx, with an imbricated, rarely valvate æstivation. Stamens 10. Carpels 5, 1-styled, distinct, sometimes solitary by imperfection and 1-seeded. Seeds erect from the bottom of the cell, often arillate, without albumen in *Connarus* and *Rourea,* albuminose in *Cnestis.* Cotyledons thick and fleshy in the seeds without albumen, foliaceous in those with albumen. Plumule of two leaves, its leaflets conduplicate. *Leaves compound, without dots or stipules.*—Ex. *Connarus* and *Omphalobium,* closely allied to *Leguminosæ. Cnestis. Brucea,* of this Tribe in De Candolle, is here referred to *Xanthoxyleæ.*

ORD. LXXIII. LEGUMINOSÆ. *Juss.* Pea Family, *f.* 182, & *Suppl. f.* 40—47, & 262, 263.

Calyx 5-parted, toothed or cleft, free, with the odd segment anterior, the segments often unequal and variously combined. Petals 5, or, by imperfection, 4, 3, 2, 1, or none, inserted into the base of the calyx, either papilionaceous or regularly spreading, the odd petal posterior. Stamens definite or indefinite, perigynous, either distinct or monadelphous or diadelphous, very seldom triadelphous; anthers versatile. Ovary simple, superior, 1-celled, 1- or many-seeded; style simple, proceeding from the upper margin of the ovary; stigma simple. Fruit either a legume or a drupe. Seeds attached to the upper suture, solitary or several, occasionally with an arillus; embryo destitute of albumen, straight or with the radicle bent upon the cotyledons; cotyledons either remaining under ground in germination, or elevated above the ground and becoming green, like leaves.—*Herbaceous plants, shrubs or vast trees, extremely variable in appearance, and inhabiting almost every part of the world. Leaves alternate, mostly compound, with the petiole often tumid. Stipules* 2 *at the base of the petiole, and* 2 *at the base of each leaflet, often deciduous. Pedicels usually articulated, with* 2 *bracteoles under the flower.*

One of the most extensive and at the same time the most important, on account of its useful products, of all the Natural Orders. A great number afford medicines and dyes; many of them yield food for man; others for cattle.

The Genera are thus arranged in the valuable *Prodromus* of De Candolle; to which I must refer for the characters of the divisions, &c.

TRIBE I. SOPHOREÆ. Sophora Tribe.—Ex. *Sophora. Edwardsia. Podalyria* and many other South African genera. *Viminaria, Suppl. f.* 262, *Pultenæa* and many genera are peculiarly Australasian.

TRIBE II. LOTEÆ. Lotus Tribe.—Ex. *Hovea. Borbonia. Crotalaria. Ulex,* Suppl. f.* 41. *Genista.* Cytisus;* Suppl. f.* 40, of which *C. Laburnum* is said to have poisonous qualities in the seeds, (one of the few exceptions to the almost universally innocent qualities of this family,) and *C. scoparius* (*Spartium, L.*) is a powerful diuretic. *Ononis.* Anthyllis.* Medicago.* Trigonella;** the *T. cærulæa* gives the peculiar colour and flavour to Schabzigher cheese. *Melilotus.* Trifolium.* Lotus.* Psoralea: P. glandulosa* is used as tea in Chili, under the name of *Culen. Indigofera,* of which several species, but especially *I. tinctoria,* yield Indigo. *Glycirrhiza* (the Liquorice). *Tephrosia; T. toxicaria* is employed to intoxicate fish, as is the bark of *Piscidia, P. Erythrina* belonging to the same tribe. *Oxytropis.* Astragalus,* Suppl. f.* 263; Gum Tragacanth is the produce, according to some, of *A. Tragacantha, L.*, and *A. Creticus;* according to others, of *A. gummifer.*

TRIBE III. HEDYSAREÆ. Saint-foin Tribe.—Ex. *Scorpiurus. Ornithopus.* Hippocrepis.* Smithia. Hedysarum. Onobrychis;** the Saint-foin.

TRIBE IV. VICIEÆ. Vetch Tribe.—Ex. *Cicer,* the Lentil. *Faba,* the garden Bean. *Vicia,** the Vetch. *Ervum.* Pisum,* the garden Pea. *Lathyrus,* Suppl. f.* 42. *Orobus.**

TRIBE V. PHASEOLEÆ. Kidney-bean Tribe.—Ex. *Abrus; A. precatorius* affords those bright scarlet seeds of which rosaries and necklaces are made, and which are known with us under the name of Crab's eyes. *Phaseolus*, the Kidney-bean. *Soja*, a Chinese and Japanese plant, from which soy is prepared. *Mucuna* (*Stizolobium*, Pers.); the beautiful seeds of *M. urens* are frequently brought to this country under the name of Asses' eyes, and are also cast on shore in Orkney and in Norway, conveyed by the gulf-stream and currents from the West Indies; *M. pruriens* affords Cow-age, or Cow-itch. *Lupinus*. *Erythrina*, of which one species, *E. monosperma*, yields Gum Lac of commerce.

TRIBE VI. DALBERGIEÆ. Dalbergia Tribe.—Ex. *Dalbergia*. *Pterocarpus; P. erinacea* yields Gum Kino, as the *P. Draco* does Gum Dragon, and *P. santalinus*, the Saunders wood. *Brya*, the Jamaica Ebony.

TRIBE VII. SWARTZIEÆ. Swartzia Tribe.—Ex. *Swartzia*.

TRIBE VIII. MIMOSEÆ. Mimosa Tribe.—Ex. *Entada*, which affords the large sword-like Pods or Legumes from the West Indies, which are often seen in the cabinets of the curious. *Mimosa*, including the *M. sensitiva*, and other species remarkable for the sudden movement of their leaves when touched. *Acacia*, a most extensive and important Genus. Some of the species possess medicinal properties. Gums are afforded by *A. Arabica*, *Senegalensis*, *Nilotica*, and many others; *Catechu* by *A. Catechu*.

TRIBE IX. GEOFFREÆ. Earth-nut Tribe.—Ex. *Arachis;* the Earth-nut, or Pea-nut of warm climates, where it is extensively cultivated. *Dipterix;* or Tonquin bean. *Geoffroya*.

TRIBE X. CASSIEÆ. Cassia Tribe.—Ex. *Gleditschia*. *Guilandina*. *Cæsalpinia*. *Hæmatoxylon*, or Logwood. *Ceratonia;* the St. John's bread. *Cassia*, affording the powerful medicine called Senna, especially in the *C. Senna*. *Copaifera*, the balsam of Copaiva. *Hymenæa*, the Gum Anime. *Bauhinia* (see p. 189.).

TRIBE XI. DETARIEÆ. Detarium Tribe.—Ex. *Detarium*.

ORD. LXXIV. ROSACEÆ. *Juss.* Rose Family, *Suppl. f.* 18, 19, 256—261.

Sepals 5, below more or less combined into a tube, and thence 5-lobed, generally persisting, free or adherent with the ovary. Petals of the same number, rarely wanting, inserted upon the calyx; æstivation imbricated, mostly regular. Stamens inserted with the petals, usually indefinite; filaments with an incurved æstivation; anthers 2-

celled, opening longitudinally. Carpels numerous, sometimes reduced and solitary, sometimes united among themselves, or with the tube of the calyx into one. Ovaries 1-celled. Styles simple, dilated upwards into variously formed stigmas, frequently lateral, distinct or rarely combined. Seeds 1—2, rarely more in each carpel, erect or inverted, without albumen (except in *Hirtella* and *Neillia*). Embryo straight: cotyledons leafy or fleshy.—*Herbs or trees. Leaves alternate, simple or compound, with 2 stipules at the base. Inflorescence various.*

An extensive family, remarkable for the astringent properties of a great proportion of its species, and for the wholesome fruit. De Candolle has the following Tribes, which many esteem distinct Orders.

TRIBE I. CHRYSOBALANEÆ. Cocoa-Plum Tribe.—Ovary solitary, free, style lateral from the base. Ovules 2, erect. Seeds often solitary. Flowers more or less irregular, having the stalk of the ovary cohering on one side to the tube of the calyx, and the stamens most numerous and developed on one side. *Tropical trees or shrubs. Leaves simple, entire.*—Ex. *Chrysobalanus;* the Cocoa-Plum, an esculent fruit. *Hirtella.*

TRIBE II. AMYGDALEÆ. Almond Tribe.—Carpels generally solitary, rarely 2 or more. Style terminal. Drupe with a solitary nut, having 2 ovules, 1—2 seeds. Seed-stalk from the base of the cell. Seed suspended to the end of a stalk which coheres with the side of the cell. Albumen none. Cotyledons thick. Calyx not adherent with the ovary, 5-cleft, deciduous. *Trees or shrubs. Leaves undivided, with the lower serratures or petioles glandular. Stipules free. Flowers white or reddish. The leaves and kernels abound in hydrocyanic acid.*—Ex. *Amygdalus;* the Almond. *Persica;* the Peach and Nectarine. *Armeniaca;* the Apricot *Prunus;** including the various kinds of Plum. *Cerasus*;* the Cherry, *Suppl. f.* 261.

TRIBE III. SPIRÆACEÆ. Meadow-sweet Tribe.—Carpels many, free from the calyx, rarely slightly combined among themselves and arranged in a circle, 5 or fewer, apiculated with the style, at length capsular, opening with an interior suture, somewhat 2-valved. Seeds 2—4, rarely 1, arising from the margin of the inner suture at the middle or near the base, without arillus and without albumen. Embryo straight, inverted in *Spiræa*, probably erect in others. Cotyledons flat, thickish. *Shrubs or Herbs.*—Ex. *Kerria* (the *Corchorus Japonicus* of our gardens.) *Spiræa,** *Suppl. f.* 260.

TRIBE IV. NEURADEÆ. Neurada Tribe.—Calyx 5-cleft, with a short tube adhering to the ovary, the lobes somewhat incumbent or valvate in æstivation. Petals 5. Stamens 10. Carpels 10, combined into a 10-celled, compressed capsule. Seeds solitary, obliquely pendulous.—*Herbaceous plants, natives of sandy plains, suffrutescent at the base, and usually decumbent. Leaves with 2 stipules, downy, sinuato-pinnatifid or bipinnatifid. Seeds germinating in the capsule. Lindl.* (who suggests that this may rather be a tribe of *Ficoideæ.*)—Ex. *Neurada. Grielium.*

TRIBE V. DRYADEÆ. Dryas Tribe.—Calyx 5- (rarely more, or 4-) cleft, with a valvate æstivation, and often small bracteas alternating with the lobes. Petals as many as there are lobes to the calyx and alternate with them. Stamens many, rarely 5 and then opposite to the lobes of the calyx, inserted at the mouth of the calycine tube. Carpels numerous, rarely few, crowded, inserted upon a swollen disk, free from the calyx and among themselves, bearing a style below the apex. Styles furrowed within; stigma spreading, oblique. Achenia dry or baccate. Seed solitary, erect or inverted, without albumen. Embryo straight; cotyledons flattish. — *Herbs or shrubs. Leaves opposite, mostly compound. Stipules 2, lateral, adnate with the petiole.*—Ex. *Dryas.** *Geum.** *Rubus.** *Fragaria,** *Suppl. f.* 259. *Comarum.** *Potentilla,** of which, as of the other genera, many species are very astringent. *Tormentilla;** the Tormentil. *Sibbaldia,** *Suppl. f.* 258. *Agrimonia.** *Brayera,* an Abyssinian plant, the most powerful of anthelmintics.

TRIBE VI. SANGUISORBEÆ. Burnet Tribe.—Flowers often separated. Calyx 3—5-fid, with a valvate æstivation; the tube contracted at the apex, enclosing the carpels and sometimes at length slightly adnate with them. Petals none, or 4 combined at the base into a rotate corolla. Stamens as many as there are calycine lobes, some often imperfect. Carpels few, 1—2, with the style inserted a little below the apex; stigma often tufted. Achenia dry, indehiscent, 1-seeded. Seed inverted, or in *Cliffortia* and *Cephalotus,* erect.—*Herbs or low shrubs; with frequently opposite and compound leaves, and small flowers.*—Ex. *Alchemilla.** *Cephalotus;* a most curious Australian Genus, with appendages to the leaves like those of *Nepenthes* (p. 85). *Sanguisorba.** *Poterium.**

TRIBE VII. ROSEÆ. True Rose Tribe.—Tube of the calyx contracted at the apex; the limb 5-partite, with a somewhat spirally imbricated æstivation, often cut in a pinnatifid manner. Petals 5. Stamens numerous. Carpels numerous, inserted into the tube of the calyx which encloses them, dry, indehiscent, subcrustaceous, bearing the style from the interior side, a little below the apex: styles distinct, or combined into a column, exserted beyond the contracted mouth of the calyx. Seed solitary in the achenium, without albumen, inverted. Embryo straight: cotyledons nearly plane.—*Shrubs or small trees; with mostly imparipinnated leaves, serrated leaflets, and stipules adnate with the petiole.*—Ex. *Rosa,* Suppl. f.* 257; *R. Damascena* affords the Attar of Roses. One, and only one, of the 150 described species of the Genus, *R. berberidifolia*, has the compound leaf reduced to a simple leaflet.

TRIBE VIII. POMACEÆ. Apple Tribe.—Tube of the calyx campanulate or urceolate, fleshy when ripe, more or less adnate with the enclosed carpels; limb 5-lobed. Petals 5, inserted at the mouth of the calyx, deciduous, with an imbricated æstivation. Stamens numerous, with an inflexed æstivation. Disk often fleshy. Ovaries generally 5, 1-celled: styles 1—5: stigmas simple. Pome (or apple) formed of the fleshy calyx and carpels, which latter are cartilaginous or bony, two-valved or indehiscent. Seeds generally 1—2 in each carpel (many in *Cydonia*), erect, with a cartilaginous or bony integument. Cotyledons oval, fleshy.—*Spinous or unarmed shrubs or trees; with simple, rarely pinnated, stipuled leaves.*—Ex. *Cratægus.* Cotoneaster.* Mespilus;** the Medlar, *Suppl. f.* 18, 19. *Pyrus;** Apple and Pear. *Cydonia;* the Quince.

ORD. LXXV. CALYCANTHEÆ. *Lindl.* Carolina Allspice Family.

Sepals and petals confounded, indefinite, imbricated, combined into a fleshy tube. Stamens indefinite, inserted into a fleshy rim at the mouth of the tube, the inner ones sterile: anthers adnate, turned outwards. Ovaries several, simple, 1-celled, with 1 terminal style, adhering to the inside of the tube of the calyx: ovules solitary, or sometimes 2, of which one is abortive, ascending. Nuts enclosed in the fleshy tube of the calyx, 1-seeded, indehiscent. Seed ascending. Albumen none: cotyledons convolute, with their faces next the axis: radicle inferior.—*Shrubs of Japan and N. America; with square stems, having 4 woody imperfect axes surrounding the central ordinary one. Leaves opposite, simple, scabrous, without stipules. Flowers highly aromatic, axillary, solitary. Lindl.* (who ranges the Order near *Monimieæ*, but its situation is doubtful.)

Ex. *Calycanthus. Chimonanthus.*

ORD. LXXVI. COMBRETACEÆ. *Br.* Myrobalan Family.

Flowers rarely polygamous. Tube of the calyx adherent with the ovary; limb 4—5-lobed, at length deciduous. Petals none, or 4—5 upon the top of the tube of the calyx and alternate with its lobes. Stamens with the same insertion, double in number to the lobes of the calyx, rarely equal or triple; filaments distinct, exserted, filiform or subulate: anthers 2-celled, opening longitudinally. Ovary 1-celled, with 2—4 ovules, which are pendulous from the extremity of the cell: style 1, slender; stigma simple. Fruit a drupe, berry or nut, with 1 cell, 1-seeded, indehiscent, often winged. Seed pendulous, filling the cavity of the pericarp, without albumen. Embryo with the radicle superior: cotyledons foliaceous.—*Usually tropical trees or shrubs; with alternate or opposite stipuled leaves. Spikes axillary or terminal.*—An Order in many respects allied to *Santalaceæ* and *Eleagneæ* among the MONOCHLAMYDEÆ.

TRIBE I. TERMINALIEÆ. Myrobalan Tribe.—Embryo cylindrical, elliptical; cotyledons spirally convolute. Flowers with a 5-fid calyx; petals usually wanting; stamens 10.—Ex. *Terminalia,* highly astringent.

TRIBE II. COMBRETEÆ. Combretum Tribe.—Embryo cylindrical, elliptical or angular; cotyledons thick, irregularly or longitudinally plaited. Flowers with a 4—5-fid calyx; 4—5 petals; 8—10 stamens.—Ex. *Combretum. Quisqualis.*

ORD. LXXVII. VOCHYSIEÆ. *St. Hil.* Vochysia Family.

Sepals 4—5, united at the base, imbricated in æstivation, unequal, the upper ones spurred. Petals 1, 2, 3 or 5, alternate with the lobes of the calyx and inserted into their base, unequal. Stamens 1—5, generally opposite to the petals, rarely alternate, inserted at the bottom of the calyx, several usually sterile, one fertile with an ovate 4-celled anther. Ovary free or adherent with the calyx, 3-celled, the ovules in the axils of each cell, solitary or in pairs. Style or stigma 1. Capsule trigonous, 3-celled, 3-valved, the valves opening along their middle. Seeds without albumen. Embryo straight, inverted: cotyledons large, foliaceous, plaited convolute; radicle short, superior.—*South American trees. Branches opposite. Leaves opposite or whorled, entire, with* 2 *stipules. Flowers usually in terminal racemes or panicles.*—An Order in some respects approaching *Violarieæ.*

Ex. *Vochysia. Qualea.*

Ord. LXXVIII. RHIZOPHOREÆ. *Br.* Mangrove Family.

Tube of the calyx adherent with the ovary, rarely free; limb 4—13-lobed, with a valvate æstivation, or, occasionally, with the lobes cohering into a calyptra. Petals inserted on the calyx, alternate with its lobes and equalling them in number. Stamens inserted with the petals, of the same number, or double or triple: filaments distinct, subulate, erect; anthers ovate, erect. Ovary 2-celled, the cells with 2 or many pendulous ovules. Fruit indehiscent, 1-celled, 2-seeded, crowned with the calyx. Seed pendulous, without albumen; radicle long: cotyledons plane.—*Tropical and maritime trees or shrubs; with opposite, simple, entire or toothed leaves and interpetiolary stipules. Peduncles axillary.*

Ex. *Rhizophora,* the Mangrove tree, whose stems form such dense thickets along the low muddy shores in tropical climates, as to create a most unwholesome atmosphere. *Carallia.*

Ord. LXXIX. ONAGRARIÆ. *Juss.* Evening-Primrose Family, *Suppl. f.* 249, 250.

Tube of the calyx wholly, or in part only, adnate with the ovary; limb 2—5-generally 4-lobed, with a valvate æstivation. Petals of the same number as the lobes of the calyx, and alternate with them, generally regular; inserted on the mouth of the tube, with a twisted æstivation; rarely none. Stamens definite: filaments distinct, filiform; anthers oblong or ovate. Ovary with many cells, often crowned with a disk; style filiform; stigma capitate or lobed. Fruit a capsule, berry or drupe, 2- or 4-celled. Seeds many (rarely solitary) in each cell, fixed to the central angle, without albumen. Embryo straight: radicle long, roundish: cotyledons short.—*Herbs or shrubs, mostly of temperate regions; with simple, alternate or opposite, entire or toothed leaves. Flowers axillary or in terminal racemes.*

TRIBE I. MONTINEÆ. Montinia Tribe.—Fruit capsular; seeds with a membranaceous wing.—*Trees or shrubs, with alternate leaves.*—Ex. *Montinia.*

TRIBE II. FUCHSIEÆ. Fuchsia Tribe.—Fruit a berry. Tube of the calyx extended beyond the ovary.—*South American trees or shrubs, with opposite leaves.*—Ex. *Fuchsia, Suppl. f.* 250.

TRIBE III. ONAGREÆ. Evening-Primrose Tribe.—Fruit capsular, with many cells, and naked (not winged) seeds. Tube of the calyx mostly extended beyond the ovary. Stamens double the number of petals.—*Herbaceous, rarely somewhat shrubby, plants.*—Ex. *Epilobium,* Suppl. f.* 249. *Œnothera.**

TRIBE IV. JUSSIEÆ. Jussiæa Tribe.—Fruit capsular, with many-seeded cells. Tube of the calyx persistent with the ovary and not extended beyond it.—*Herbs, rarely shrubs.*—Ex. *Jussiæa. Ludwigia. Isnardia.**

TRIBE V. CIRCÆEÆ. Enchanter's Night-shade Tribe.—Tube of the calyx produced beyond the ovary. Fruit capsular, ovato-globose. Stamens 2.—*Herbs or shrubs, with opposite, petiolate, cordate or ovate leaves. Flowers racemose.*—Ex. *Lopezia. Circæa.**

TRIBE VI. HYDROCARYES. Water-Chestnut Tribe.—Fruit hard, indehiscent, with horn-like projections, 1-celled, 1-seeded. Seed pendulous; cotyledons very unequal.—*Floating herbs.*—Ex. *Trapa,* the large seeds of which are eaten in the South of Europe.

ORD. LXXX. HALORAGEÆ. *Br.* Water-Starwort Family, *Suppl. f.* 251, 252.

Tube of the calyx adherent with the ovary for its whole length; the limb divided or none. Petals inserted upon the top of the calyx, alternate with its lobes and equal to them in number, or wanting. Stamens inserted in the same place, double the number of the petals, equal to them or fewer.

Ovary adherent with the calyx, often many-celled; styles none (2 and filiform in *Callitriche*); stigmas equal in number to the cells, papulose or pencil-formed. Fruit 1- or many-celled, indehiscent, membranaceous or bony, the cells 1-seeded. Seeds pendulous in the cells, with a fleshy albumen. Embryo central, straight: radicle superior, rounded, elongated: cotyledons short.—*Herbaceous or somewhat shrubby, often aquatic plants, of temperate climates, with alternate, opposite or whorled leaves. Flowers axillary or arranged in terminal spikes, sometimes monœcious or diœcious.*

Ex. *Serpicula. Haloragis. Myriophyllum,* Suppl. f.* 251. *Callitriche,** whose affinity is however very doubtful. *Hippuris,* Suppl. f.* 252.

Ord. LXXXI. CERATOPHYLLEÆ. *Gray.* Hornweed Family.

Flowers monœcious. Calyx free, many-parted; the lobes equal. Petals none. Masc. Stamens 12—20, without filaments: anthers ovato-oblong, 2-celled, with 2 or 3 points at the apex, collected into the centre of the calyx. Fem. Ovary free, ovate, 1-celled: style filiform, incurved, oblique: stigma simple. Nut 1-celled, 1-seeded, apiculated with the persistent style, indehiscent. Seed pendulous. Albumen none. Embryo straight: radicle superior: cotyledons 4, whorled, alternately smaller, with a much divided plumule. —*Aquatic, submerged herbs, distinct as an Order, but of very doubtful affinity; with whorled rather rigid leaves, cut into slender segments and somewhat serrated.*

Ex. *Ceratophyllum.**

Ord. LXXXII. LYTHRARIEÆ. *Juss.* Loosestrife Family, *Suppl. f.* 255.

Calyx of 1 piece, free, tubular or campanulate, the lobes with a valvate æstivation, often with teeth in the sinuses. Petals inserted between the lobes at the mouth of the calyx, varying in number, generally very deciduous, sometimes none. Stamens inserted on the calycine tube, below the petals, and equal in number with them, or double, triple or quadruple, sometimes fewer. Anthers ovate, 2-celled, inserted at the back. Ovary free: style filiform; stigma generally capitate. Capsule membranaceous, enclosed in the calyx, usually 1-celled, opening longitudinally or irregularly. Seeds many, small, without albumen, adhering to a central receptacle or placenta. Embryo straight; radicle turned to the hilum; cotyledons plane, foliaceous.—*Herbs, rarely shrubs. Branches round or square. Leaves opposite, rarely alternate, simple, entire, without stipules or glands. Flowers axillary, spiked or racemose.*

Ex. *Peplis.** *Lythrum,** an astringent, *Suppl. f.* 255. *Cuphea. Lawsonia;* the Henna of the Eastern nations. *Lagerstrœmia.*

Ord. LXXXIII. TAMARISCINEÆ. *Desv.* Tamarisk Family.

Sepals 4—5, united at the base, hence 5-partite, persistent, with a subimbricated æstivation. Stamens equal or double the number of the petals; filaments distinct or united for a considerable length. Ovary free, ovato-pyramidal, trigonous: style sometimes very short, trigonous; stigmas 3, patent or collected into a head. Capsule trigonal, 3-valved, 1-celled, many-seeded; placentas 3, attached to the middle of the valves, often occupying only the base. Seeds erect or ascending, oblong, compressed, with a tuft of hairs at the extremity. Albumen none. Embryo straight; radicle small, inferior; cotyledons plano-convex, oblong.—*Shrubs, rarely perennial suffruticose herbs, of the northern hemisphere, mostly extra-tropical; with alternate, small, persistent, squamiform, entire, often glaucous leaves. Flowers in crowded spikes or racemes. Pedicels bracteated. Petals white or rose-coloured.*

Ehrenberg and others consider the stamens to be hypogynous: hence they place this Order in Thalamifloræ.—Ex. *Tamarix;** having a bitter and astringent bark. Some species contain sulphate of soda in considerable abundance. The Manna of Mount Sinai is said to be the produce of *T. Gallica*, our British species. *T. Songarica*, Pall., is now the Genus *Hololachne,* and is referred to *Reaumurieæ. Myricaria.*

Ord. LXXXIV. MELASTOMACEÆ. *Juss.* Melastoma Family, *Suppl. f.* 254.

Sepals 4—6, usually 5, combined into an hemisphærical ovate or oblong tube, in bud often adnate with the ovary by means of 8—12 longitudinal nerves, between which are cavities which receive the incurved young anthers: limb various. There is a *torus* or membraniform lining, adnate with the calycine tube, upon the edge of which, at the mouth of the calyx, the petals arise, which are equal in number with its lobes and alternate with them, often ciliato-dentate at the margin, twisted in æstivation. Stamens inserted along with the petals, of double the number (rarely equal); the alternate ones, opposite the lobes of the calyx, alone fertile; filaments in æstivation folded inwards, so that the young anthers are pendulous; anthers long, 2-celled, often beaked and opening with 2 pores, rarely longitudinally with a double suture; at the base often articulated and variously swollen and spurred. Ovary more or less adnate with the calyx, with several cells and several ovules: style 1; stigma simple. Pericarp dry and distinct from the calyx, or a berry and adnate with the calyx, many-celled: the cells of the capsules bursting longitudinally half-way down, the valves bearing the dissepiments in the middle. Placentas attached to a central column. Seeds very numerous, minute, with a brittle testa and no albumen. Embryo straight or curved: cotyledons sometimes unequal.—*Trees, shrubs, or herbs, generally inhabitants of the tropics. Leaves opposite, undivided, usually entire, without dots, with several ribs. Flowers terminal, panicled, often thyrsoid.*

SUBORDER I. MELASTOMEÆ.—Anthers opening by 2 pores at the extremity.—Ex. *Meriana. Melastoma. Rhexia. Blakea, Suppl. f.* 254.

SUBORDER II. CHARIANTHEÆ.—Anthers 2-celled, opening by a double longitudinal fissure.—Ex. *Chairanthus. Chænopleura.*

ORD. LXXXV. MEMECYLEÆ. *DC.* Memecylon Family.

Tube of the calyx ovate or subglobose, adherent with the ovary; the limb short, 4—5-lobed or toothed. Petals 4—8, inserted upon the calyx and alternate with its lobes. Stamens 8—10; filaments distinct; anthers incurved, 2-celled. Style filiform; stigma 1. Berry crowned with the limb of the calyx, 2—4-celled. Seeds few, without albumen; cotyledons leafy, convolute; radicle straight.—*Tropical shrubs; with opposite, simple, entire leaves, without dots or stipules. Flowers axillary, pedicellate.*

Ex. *Memecylon. Mouriria.*

Ord. LXXXVI. ALANGIEÆ. *DC.* Alangium Family.

Tube of the calyx ovoid, somewhat contracted at the apex; limb campanulate, 5—10-toothed. Petals 5—10, linear, patulous or reflexed. Stamens much exserted, double or four times the number of petals; filaments distinct, filiform, very hairy at the base; anthers adnate, linear, 2-celled, opening inwards by a double longitudinal fissure, often sterile. Disk fleshy, at the base of the limb of the calyx. Drupe oval, fleshy, somewhat ribbed and downy, and slightly crowned with the limb; nucleus bony, 1-celled, with a foramen at the extremity. Seed 1, (3, *Rheede*) inverted, ovate, with a fleshy friable albumen. Embryo straight: radicle long, ascending; cotyledons plane, leafy, cordato-ovate.—*Handsome tropical trees; with spinous branches. Leaves entire, alternate, without dots or stipules. Fruit eatable. Roots aromatic.*

Ex. *Alangium.*

Ord. LXXXVII. PHILADELPHEÆ. *Don.* Syringa Family.

Tube of the calyx turbinate, adherent with the ovary, the limb 4—10-parted, persistent. Petals 4—10, alternate with the lobes of the calyx, convolute and imbricated in æstivation. Stamens 20—40, inserted at the mouth of the calyx in one or two series: styles more or less distinct or combined into one; stigmas several. Capsule half-adnate with the calyx, 4—10-celled, many-seeded. Seeds chaffy, subulate, smooth, clustered upon the placentas in the inner angles of the cells, with a loose membranaceous arillus and a fleshy albumen. Embryo inverted, nearly the length of the albumen: cotyledons oval, obtuse, nearly plane; radicle roundish, superior, straight, obtuse, longer than the cotyledons.—*Shrubs of the temperate parts of the northern hemisphere, having many points of agreement with* Hydrangea *in* Saxifragaceæ. *Leaves opposite, toothed or entire, without stipules and dots. Peduncles axillary or terminal, in trichotomous cymes. Flowers white.*

Ex. *Philadelphus. Decumaria. Deutzia.*

ORD. LXXXVIII. MYRTACEÆ. *Br.* (*including* Granateæ, *Don* and *De Cand.*). Myrtle Family, *Suppl. f.* 53—56, 253.

Tube of the calyx adherent with the ovary, its limb 4- or 5-cleft, sometimes falling off, like a cap, in consequence of the cohesion of the apex. Petals equal in number with the segments of the calyx, with an imbricated æstivation, rarely none. Stamens either twice as many as there are petals, or indefinite: filaments either all distinct, or connected in several parcels, curved inwards before flowering; anthers ovate, 2-celled, small, bursting lengthwise. Ovary combined with the tube of the calyx, 2—4—5- or 6-celled: style simple: stigma simple. Fruit either dry or fleshy, dehiscent or indehiscent. Seeds usually indefinite, variable in form. Embryo without albumen, straight or curved, with its cotyledons and radicle distinguishable or conferruminated into one mass.—*Exotic trees or shrubs, mostly of warm or tropical climates. Leaves opposite, entire, with transparent dots and a vein running parallel with their margin, without stipules. Inflorescence variable, usually axillary. Flowers red, white, occasionally yellow, never blue.*

An extensive and well-marked Natural Order, abounding in a pungent, aromatic, volatile oil; many of the genera yield excellent fruits.

TRIBE I. CHAMÆLAUCIEÆ.—Ex. *Calythrix; Chamælaucium:* Australian genera.

TRIBE. II. LEPTOSPERMEÆ. Leptospermum Tribe.—Ex. *Melaleuca, Suppl. f.* 53—56; *M. Leucadendron* of the East Indies yields the Cajeput oil. *Eucalyptus, Suppl. f.* 253, some of the species of this genus afford Tannin, employed in the arts. *Leptospermum*, chiefly Australian plants.

TRIBE III. MYRTEÆ. Myrtle Tribe.—Ex. *Psidium*, whose fruit is the Guava, of which there are several kinds. *Myrtus*. *Caryophyllus*; the buds constitute the Cloves of commerce. *Eugenia*; *E. Pimenta* (*Myrtus L.*) affords Allspice. *Jambosa*, whose fruit is the Malay and Rose-apple.

TRIBE IV.? BARRINGTONIEÆ. Barringtonia Tribe.—Ex. *Barringtonia*. *Stravadium*.

ORD. LXXXIX. LECYTHIDEÆ. *Rich.* Lecythis Family. (*part of* Myrtaceæ, DC.)

Tube of the calyx adherent with the ovary; its limb 2—6-leaved, or urceolate and divided; æstivation valvate or imbricated. Corolla of 6 petals, sometimes cohering at the base, with an imbricated æstivation. Stamens indefinite, epigynous, either connected into a single, petaloid, cucullate, unilateral body, or monadelphous at the base. Ovary combined at the tube of the calyx, 2—6-celled; ovules indefinite, or definite, attached to the axis; stigma simple. Fruit a woody capsule, opening with a lid (*pyxidium*), or remaining closed. Seeds several, covered by a thick integument. Embryo without albumen, either undivided, or with two large plaited leafy or fleshy cotyledons, sometimes folded upon the radicle, which is next the hilum.—*Large trees of tropical America, with alternate, entire or toothed leaves, and minute, deciduous stipules, destitute of pellucid dots. Flowers large, showy, terminal, solitary or racemose.*

Ex. *Lecythis*; the esculent seeds of *L. ollaria* are brought from Brazil, and sold in our shops under the name of *Sapucaja* nuts. *Bertholletia*; the seeds of *B. excelsa* are the Brazil-nuts of the shops. *Couroupita*; *C. Guianensis* is the Cannon-ball tree, for a figure and description of which see *Bot. Mag. t.* 3158, 9.

ORD. XC. CUCURBITACEÆ. *Juss.* Gourd Family, *Suppl. f.* 270.

Flowers generally monœcious or diœcious. Sepals 5, more or less united, sometimes obsolete. Petals 5, often more or less united, and sometimes continuous with the calyx, marked with reticulated veins and not unfrequently fringed. Stamens 5, distinct or connected in 3 bundles (triadelphous): anthers 2-celled, very long, often combined, sinuous, rarely ovate. Ovary combined with the calyx: styles short; stigmas 3—5, 2-lobed, thick, velvetty, rarely fringed. Fruit fleshy, more or less succulent, crowned by the scar of the calyx, 1-celled, with three parietal placentas. Seeds flat, obovate, enveloped in an arillus which is juicy or dry, and membranous. Testa coriaceous, often thick at the margin. Embryo straight, without albumen: cotyledons foliaceous, veined; radicle next the hilum.—*Plants chiefly of warm or hot climates, with annual or perennial, fibrous or tuberous roots. Stems mostly herbaceous, climbing by lateral tendrils (abortive leaves). Leaves palmated, or with palmated ribs, alternate, succulent, generally rough. Flowers solitary, panicled, or fascicled, axillary.*

An important Natural Family, yielding esculent fruits and medicine, abounding in a bitter laxative.—Ex. *Telfairia*, (*Joliffæa, DC.*) *T. pedata* bears a fleshy fruit, 3 feet long, filled with large esculent seeds, from which a valuable oil is extracted. *Lagenaria* (*Cucurbita, L.*); the dried coat of the fruit of *L. vulgaris* is extensively used in warm countries for flasks, under the name of Bottle Gourd. *Cucumis*, the Cucumber and Melon Genus, including the Colocynth, Bitter Apples, or Bitter Cucumber, *C. Colocynthis*. *Bryonia*,* *Suppl. f.* 270. *Elaterium*, a powerful cathartic. *Cucurbita*, the Gourd.

Ord. XCI? PAPAYACEÆ. *Ag.* Papaw Family.

Flowers separated. Calyx free, minute, 5-toothed. Corolla monopetalous; in the male flower tubular, with 5 lobes and 10 stamens, all arising from the same line, alternate ones opposite the lobes on short filaments, the rest sessile; anthers adnate, 2-celled, bursting longitudinally; in the female flower, the corolla divided into 5 deciduous pieces to the base. Ovary superior, 1-celled, with 5 many-seeded parietal placentas; stigma sessile, 5-lobed, lacerated. Fruit fleshy, indehiscent, 1-celled, many-seeded. Seeds enveloped in a loose mucous coat, with a brittle furrowed testa. Embryo in the axis of a fleshy albumen, with flat cotyledons, and a radicle turned towards the hilum.—*Trees of South America, simple or slightly* *branched and leafy at the top, yielding an acrid milky juice. Leaves alternate, lobed, on long petioles. Flowers in axillary racemes, or short panicles.*

The situation of this little Order is doubtful; the insertion of the stamens is quite at variance with the neighbouring Orders, though it is allied in the fruit to *Cucurbitaceæ* and *Passifloreæ*. That fruit is eaten in warm climates, and the tree possesses this remarkable property, that old and tough meat, hogs, poultry, &c., washed with the juice, or even suspended among the branches of it, become tender in a short space of time, and it is thus employed very generally in the West Indies.—Ex. *Carica;* the Papaw.

ORD. XCII. PASSIFLOREÆ. *Juss.* Passion-flower Family, *Suppl. f.* 187 & 271.

Sepals 5, united below into a more or less elongated tube; the mouth frequently crowned with a number of filamentous processes *(corona filamentosa, L.)* between the petals and the stamens. Petals 5, perigynous, with an imbricated æstivation, sometimes wanting. Stamens 5, rarely indefinite, monadelphous, surrounding the stalk *(torus, DC.)* of the ovary; anthers linear, opening longitudinally on the outside, 2-celled. Ovary free, 1-celled; styles 3 or none. Fruit stipitate, generally surrounded by the calyx, 1-celled, with 3 parietal, many-seeded placentas, 3-valved; sometimes fleshy and indehiscent. Seeds numerous, surrounded by a pulpy arillus: testa brittle; albumen thin, fleshy. Embryo straight; radicle pointing to the hilum.—*Herbs or climbing shrubs, rarely arborescent. Leaves alternate, mostly stipuled, with the limb or petioles often glandular. Peduncles axillary; or abortive and becoming cirrhi.*

A beautiful Order, chiefly inhabiting the tropical parts of South America, where the fruits of several species of Passion-flower are eaten under the name of Grenadilla.

TRIBE I. PAROPSIEÆ. Paropsia Tribe.—Ex. *Simeathmannia. Paropsia.*

TRIBE II. PASSIFLORÆ veræ. True Passion-flower Tribe.—Ex. *Passiflora, Suppl. f.* 271. *Murucuja. Modecca.*

TRIBE III. MALESHERBIEÆ. Malesherbia Tribe, (of which Mr. Don has constituted the order *Malesherbiaceæ*).—Ex. *Malesherbia.*

Ord. XCIII. LOASEÆ. *Juss.* Loasa Family.

Tube of the calyx adherent with or closely surrounding the ovary; limb 5- rarely 4-partite, persistent. Petals 5—10, arising from the mouth of the calyx; the interior, if present, generally squamiform and truncated. Stamens indefinite, in several rows, arising from within the petals, free or collected and united at the base into bundles placed opposite each petal, in the cavity of which they lie in the bud, the exterior often sterile: anthers small, oval. Ovary adherent with the calyx or included in it: style 1: stigma 1 or several. Fruit capsular or fleshy, 1-celled, with parietal placentas at the sutures. Seeds numerous, without arillus. Embryo in the axis of a fleshy albumen; with the radicle pointing to the hilum: cotyledons small, flat.—*American, often extra-tropical, herbaceous plants, with powerfully stinging hairs. Leaves opposite or alternate, simple, often lobed, without stipules. Peduncles axillary or lateral, 1-flowered.*

Ex. *Bartonia. Loasa. Blumenbachia.* (Excluding *Eschscholtzia*, referred hither by De Candolle, which belongs to *Papaveraceæ.)*

Ord. XCIV. TURNERACEÆ. *Humb. et Kunth.* Turnera Family.

Calyx free, 5-lobed, with an imbricated æstivation. Petals 5, inserted into the tube of the calyx, alternate with its lobes, equal, with a twisted æstivation. Stamens 5, inserted below the petals into the tube of the calyx, alternate with them and shorter, distinct: anthers oblong, erect, 2-celled. Ovary free: styles 3 or 6, cohering more or less, often multifid at the extremity. Capsule 3-valved, 1-celled, opening as far as the middle, the valves bearing the placentas in the middle. Seeds numerous, crustaceous, reticulated, with a thin membranous arillus on one side. Embryo slightly curved, in the centre of a fleshy albumen: radicle turned towards the hilum.—*Herbaceous South American plants, with a simple not stinging pubescence. Leaves alternate, simple, toothed, pinnatifid, without stipules, often with two glands at the apex of* *the petiole. Flowers axillary, the peduncle free or cohering with the petiole, bearing 2 small bracteas. Petals yellowish, rarely blue.*

Some botanists arrange this Order near *Cistineæ*, from which it differs, however, in the insertion of the stamens, and the direction of the radicle.—Ex. *Turnera.*

Ord. XCV. FOUQUIERACEÆ. *DC.* Fouquiera Family.

Calyx of 5, persistent, imbricated, ovate or roundish sepals. Petals combined into a tube, inserted at the base of the calyx; its limb 5-lobed, regular. Stamens 10—12, inserted along with the corolla, not adnate with it, distinct, protruded: anthers 2-celled, opening longitudinally. Ovary free, sessile; style filiform, trifid at the extremity. Capsule trigonous, 3-valved, the valves bearing the dissepiments in the middle, thus imperfectly 3-celled. Seeds fixed to the centre, few (many being abortive), compressed, winged. Albumen fleshy, thin. Embryo central, straight: cotyledons plane.—*Mexican shrubs or trees, whose place in the system is doubtful; with somewhat fleshy leaves, clustered in the axil of a spine or swelling.*

Ex. *Fouquiera. Bronnia.*

Ord. XCVI. PORTULACEÆ. *Juss.* Purslane Family, *Suppl. f.* 247.

Sepals 2, sometimes 3—5, cohering below. Petals variable, generally 5, sometimes cohering into a short tube, or wanting. Stamens inserted along with the petals into the base of the calyx, variable in number, all fertile; filaments distinct, often opposite to, and adnate with, the petals; anthers variable, opening lengthwise. Ovary 1, 1-celled: style 1, filiform: stigmas several, much divided. Capsule 1-celled, opening transversely, or by 3 valves, occasionally 1-seeded and indehiscent. Seeds generally numerous, fixed to a central placenta. Albumen farinaceous, central. Embryo curved round the albumen: radicle elongated.—*Succulent herbs or shrubs. Leaves alternate, rarely* *opposite, entire, without stipules, or sometimes with membranous ones on each side. Flowers axillary or terminal, generally expanding only in the bright sunshine.*

Allied on the one hand to *Caryophylleæ;* on the other to *Paronychiæ;* in the farinaceous albumen and excentric embryo resembling *Polygoneæ.*—Ex. *Portulaca; P. oleracea** is the Purslane. *Talinum. Claytonia. Montia,* Suppl. f.* 247.

Ord. XCVII. PARONYCHIEÆ. *St. Hil.* Paronychia Family.

Sepals 5, rarely 3—4, more or less cohering. Petals minute, alternate with the lobes of the calyx, sometimes wanting. Stamens perigynous, inserted opposite to the lobes of the calyx; filaments 2; anthers 2-celled. Ovary free: styles 2—3, distinct or more or less combined. Fruit small, dry, often membranaceous, indehiscent, or 3-valved. Seeds numerous, attached to a free central placenta or solitary and pendulous from an erect stalk. Albumen farinaceous. Embryo cylindrical, lateral, more or less curved: radicle turned towards the hilum.—*Herbaceous or somewhat shrubby, very much branched plants; with opposite or alternate, often fascicled, small, sessile, entire leaves, and mostly scariose stipules. Flowers small, greenish-white, sessile and axillary, or in terminal bracteated cymes.*

This Order comes still nearer to *Caryophylleæ* than the foregoing, and borders also upon *Amaranthaceæ,* and *Chenopodiaceæ,* especially through *Scleranthus.*

Tribe I. Telephieæ. Telephium Tribe.—Ex. *Telephium. Corrigiola.**

Tribe II. Illecebreæ. Illecebrum Tribe.—Ex. *Herniaria.* Illecebrum.* Paronychia.*

Tribe III. Polycarpeæ. Polycarpon Tribe.—Ex. *Polycarpon.**

Tribe IV. Pollichieæ. Pollichia Tribe.—Ex. *Pollichia.*

Tribe V. Sclerantheæ. Knawel Tribe.—Ex. *Scleranthus.** (Of this Tribe Dr. Brown constitutes a distinct Order.)

Tribe VI. Minuartieæ. Minuartia Tribe.—Ex. *Minuartia. Loeflingia.*

ORD. XCVIII. CRASSULACEÆ. *DC.* Houseleek Family, *Suppl. f.* 242.

Sepals 3—20, more or less combined. Petals equal to them in number, and alternate with them, inserted into the bottom of the calyx. Stamens inserted along with the petals, either equalling them in number, and then alternate with them, or twice as many, those opposite the petals the shortest; filaments distinct, subulate; anthers oval, 2-celled, bursting longitudinally. There is a nectariferous scale at the base of each ovary. Ovaries as many as there are petals, and opposite to them, placed in a circle, distinct, 1-celled, tapering into the stigmas. Carpels several, 1-celled, opening longitudinally and internally. Seeds attached to the margin of the suture, variable in number. Albumen thin, fleshy. Embryo straight: radicle turned towards the hilum.—*Succulent herbs or shrubs. Leaves fleshy. Flowers in cymes, often unilateral.*

Plants of this Order are refrigerant, sometimes acrid.—Ex. *Tillæa.* Crassula. Cotyledon.* Sedum.* Sempervivum,* Suppl. f.* 242. *Francoa* and *Galax* are allied to this Order, according to Adrien de Jussieu: with Mr. Don they constitute a separate family, called *Galacineæ.*

ORD. XCIX. FICOIDEÆ. *Juss.* Fig-Marigold Family, *f.* 178, & *Suppl.* 248.

Sepals 4—8, rarely 5, more or less combined at the base, free, or adnate with the ovary, equal or unequal, with an imbricated or valvate æstivation. Petals none, and then the calyx is coloured within, or very numerous (in *Nitraria,* 5,) inserted upon the calyx. Stamens inserted upon the calyx, indefinite, distinct: anthers oblong, incumbent. Ovary free, or adnate with the calyx, many-celled: stigmas numerous, distinct. Capsule surrounded by the fleshy calyx, many- or 5-celled, opening in a stellated manner at the apex. Seeds fixed to the internal angle of the cells, numerous, rarely solitary. Embryo curved on the outside of a farinaceous albumen, spiral in *Glinus,* straight in *Nitraria.*—*Shrubby* *or herbaceous plants, chiefly abounding in the arid plains of Southern Africa. Leaves fleshy, opposite or alternate. Flowers usually terminal.*

The leaves of some are esculent: others yield soda abundantly. —Ex. *Mesembryanthemum*, *f.* 178, and *Suppl. f.* 248, of which *M. edule* is eaten, and *M. nodiflorum* is said to be an ingredient in the preparation of Maroquin leather. A most extensive genus, remarkable for the beauty of its flowers, expanding in the full blaze of day, and for the structure of some of the seed-vessels (see *p.* 136 and *f.* 178). *Sesuvium. Tetragonia; T. expansa* is cultivated and eaten under the name of New Zealand Spinach. *Nitraria:* this constitutes an Order with Professor Lindley: and *Reaumuria*, referred hither by De Candolle, is the type of *Reaumurieæ.*

Ord. C. CACTEÆ. *Juss.* Indian-Fig Family, *Suppl. f.* 246.

Sepals numerous, usually indefinite and gradually passing into petals, combined into a tube, the lower part or the whole of which adheres to the ovary. Petals numerous, usually indefinite, arising from the mouth of the calyx, sometimes irregular, often more or less combined. Stamens numerous, in many series, more or less cohering with the petals and sepals; filaments slender, frequently very long; anthers ovate, versatile. Ovary fleshy, 1-celled, with many ovules, arranged upon parietal placentas: style filiform: stigmas many, clustered. Fruit a fleshy berry, smooth or scaly or tuberculated, umbilicated at the apex, 1-celled, many-seeded; seeds enveloped in pulp, oval, or obovate, without albumen. Embryo straight, curved or spiral, with a short thick radicle.—*Succulent shrubs, inhabiting arid soils in all the warmer parts of the New World, of varied and very grotesque forms, globose or columnar, jointed, angled or furrowed, rounded or compressed. Leaves minute, very deciduous, accompanied by fascicles of spines. Flowers sessile.*

The fruit of many of the Order is esculent. Hedges are made of the Opuntia groupe in warm countries: while others of the same tribe support the Cochineal insect.—Ex. *Mammillaria. Melocactus. Cereus. Opuntia. Rhipsalis.*

Ord. CI. GROSSULARIEÆ. *DC.* Currant Family, *Suppl. f.* 245.

Tube of the calyx adnate with the ovary, its limb 4—5-parted, regular, often coloured. Petals 5 or 4, inserted into the mouth of the calyx, and alternating with its lobes, equal. Stamens 4—5, inserted alternately with the petals. Ovary 1-celled, with 2 opposite, parietal placentas: ovules numerous: style single, 2—3—4-cleft. Fruit baccate, subglobose, crowned with the withered flower. Seeds many, suspended among the pulp by filiform stalks. Testa gelatinous, adhering firmly to the albumen, which is horny. Embryo minute, excentrical, with the radicle next the hilum.—*Shrubs of temperate climates, often spinous. Leaves alternate, lobed, with a plaited vernation. Flowers greenish-white, yellow or red, solitary or in racemes.*

Ex. *Ribes, Suppl. f.* 245; including the Gooseberry and the Currant.

Ord. CII. SAXIFRAGACEÆ. *Juss.* Saxifrage Family, *Suppl. f.* 243, 244.

Sepals 5, rarely 3—7, more or less cohering; the tube altogether, or in part, adnate with the ovary, or free; the limb toothed or lobed, generally persistent. Petals usually as many as there are sepals, inserted upon the tube of the calyx, alternate with its lobes, rarely none. Stamens inserted on the calyx, equal in number with the petals, and alternate with them, sometimes double and then half opposite the petals, and half alternating with them: filaments subulate: anthers ovate, 2-celled. Ovary generally of 2 carpels, rarely 3—5, united: styles equal in number with the ovaries, distinct or combined, persistent: stigma capitate or clavate. Fruit capsular, generally of 2 valves, rarely 3—5: the margins of the valves sometimes introflexed so as to be more or less 2-celled; the valves opening internally, sometimes from the base to the apex; sometimes from the apex to the base between the styles. Placentas occupying the introflexed margins of the valves more or less completely. Seeds many, minute, nearly horizontal. Albumen fleshy. Embryo small: radicle short, directed towards the hilum: cotyledons short, ovate.—*Trees, shrubs or herbs, of varied appearance.*

Tribe I. Escallonieæ. Escallonia Tribe.—Shrubs or trees. Leaves alternate, simple, without stipules. Flowers with 5 (rarely 6) petals and stamens. Styles of the carpels 2, combined.—Ex. *Escallonia. Itea.*

Tribe II. Cunoniaceæ. Cunonia Tribe.—Shrubs or trees. Leaves opposite. Stipules interpetiolary. Flowers with 4—5 petals, 8—10 stamens, 2—3 styles, styles distinct or combined. Fruit 2—3-celled.—Ex. *Weinmannia. Cunonia. Ceratopetalum, Suppl. f.* 244.

Tribe III. Bauereæ. Bauera Tribe.—Shrubs. Leaves opposite, sessile, compound, without stipules. Flowers of 7—9 petals and many stamens. Styles 2. Capsule 2-celled, opening between the styles.—Ex. *Bauera.*

Tribe IV. Hydrangeæ. Hydrangea Tribe.—Shrubs. Leaves opposite, simple, without stipules. Flowers corymbose, of 5 petals, 10 stamens, 2—5 styles; the outer, and frequently all, often sterile, ample, dilated. Fruit capsular, rarely baccate, 2—5-celled.—Ex. *Hydrangea.*

Tribe V. Saxifrageæ. Saxifrage Tribe.—Herbs. Leaves without stipules, alternate, rarely opposite. Flowers racemose or panicled, rarely solitary.—Ex. *Saxifraga,* Suppl. f.* 243. *Chrysosplenium.* Heuchera.*

Ord. CIII. UMBELLIFERÆ. *Juss.* Umbelliferous Family, *Suppl. f.* 203—212.

Calyx adherent with the ovary; its limb 5-toothed, teeth minute, often obsolete. Petals 5, inserted upon the mouth of the tube of the calyx, on the outside of a fleshy disk which covers the ovary, often bifid or obcordate, with an inflexed point; sometimes very unequal, the outer ones (in the umbel) the largest: æstivation somewhat imbricated. Stamens 5, alternate with the petals, inserted along with them. Ovary 2-celled: ovules solitary, pendulous: styles 2, distinct: stigmas capitate. Fruit dry (*cremocarpium*, DC.), consisting of two carpels or achenia, (*merecarpia*, DC.) combined by their inner faces, (the point of union called the *commissura*, DC.), to a common, central, generally bipartite stalk or axis (*carpophorum*, DC.); eventually separating, pendulous, variously shaped, each more or less distinctly marked with 5 longitudinal primary ridges (*juga primaria*), separated by interstices (*interstitia*), in which are frequently secondary ridges (*juga secundaria*). Within the coat of the carpels are often longitudinal ducts or canals (*vittæ*), replete with an oily or resinous substance, and generally coloured. Seed solitary, pendulous. Embryo minute, in the base of a horny albumen: radicle directed to the hilum.—*Herbs, chiefly of the temperate parts of the northern hemisphere. Stem often fistulose and furrowed. Leaves alternate, generally compound and embracing the stem with their sheathing bases. Flowers umbellate, usually involucrate.*

A most extensive and extremely important Natural Order, including many poisonous plants, these being chiefly such as grow in watery places, and many esculent and aromatic ones often yielding gum-resins, usually such as inhabit dry places. *Ferula Assafœtida* yields the drug so called. Galbanum is from *Bubon Galbanum.* The fruit of this Family is never injurious: those of Coriander, Anise and Dill, being agreeable aromatics.

For an account of the characters of the divisions and subdivisions I must refer to De Candolle's Prodromus, and here content myself with an Enumeration of the British Tribes and Genera, with a brief mention of some useful species, whether natives or otherwise.

TRIBE I. HYDROCOTYLEÆ. White-rot Tribe.—Ex. *Hydrocotyle.**

TRIBE II. SANICULEÆ. Sanicle Tribe.—Ex. *Sanicula.** *Actinotus,** (*Eriocalia,* Sm.) *Suppl. f.* 205, 209. *Astrantia, Suppl. f.* 206. *Eryngium, Suppl. f.* 212.*

TRIBE III. AMMINEÆ. Ammi Tribe.—Ex. *Cicuta ;** *C. virosa* is the Water Hemlock, or Cowbane, a deadly poison. *Apium ;** *A. graveolens* is the Celery. *Petroselinum ;** *P. sativum* is the Parsley. *Trinia.** *Helosciadium.** *Sison,** *Suppl. f.* 211. *Ægopodium.** *Carum ; C. Carui,* the Carroway seed. *Bunium ;** the Earth nut. *Pimpinella.** *Sium ;** the roots of *S. Sisarum* afford the Skirret. *Bupleurum.**

TRIBE IV. SESELINÆ. Seseli Tribe.—Ex. *Œnanthe.** *Æthusa,** Fools' Parsley or lesser Hemlock: very unwholesome, if not poisonous. *Fœniculum;** Fennel. *Seseli.** *Ligusticum;** Lovage.* *Silaus.** *Meum.** *Crithmum ;** Samphire.

TRIBE V. ANGELICEÆ. Angelica Tribe.—Ex. *Angelica.**

TRIBE VI. SELINEÆ (*Peucedaneæ, DC.*) Selinum Tribe.—*Peucedanum,** *Suppl. f.* 203. *Pastinaca ;** the Parsnep. *Heracleum ;** *H. gummiferum* yields Gum Ammoniac.

TRIBE VII. TORDYLINEÆ. Hart-wort Tribe.—Ex. *Tordylium.**

TRIBE VIII. DAUCINEÆ. Carrot Tribe.—Ex. *Artedia, Suppl. f.* 204. *Daucus,** the Carrot.

TRIBE IX. CAUCALINEÆ. Bur-Parsley Tribe.—Ex. *Caucalis,** *Suppl. f.* 208. *Torilis.**

TRIBE X. SCANDICINEÆ. Shepherd's-Needle Tribe.—Ex. *Scandix, Suppl. f.* 210. *Anthriscus.** *Chærophyllum.** *Myrrhis.**

TRIBE XI. SMYRNEÆ. Alexanders Tribe.—Ex. *Echinophora.** *Conium ;** *C. maculatum* is the true Hemlock.† *Physospermum.** *Smyrnium.**

TRIBE XII. CORIANDREÆ. Coriander Tribe.—Ex. *Coriandrum ;** the Coriander.

ORD. CIV. ARALIACEÆ. *Juss.* Aralia Tribe, *Suppl. f.* 202.

Tube of the calyx adnate with the ovary; the limb entire or toothed. Petals 5—10, alternate with the calycine teeth, their æstivation valvate, rarely none (*Adoxa*), or probably converted into stamens. Stamens equal in number with the petals, rarely double, inserted below the edge of a large epigynous disk: anthers 2-celled, (peltate, *Don.*) Ovary 2- or more-celled, each cell with one ovule: styles many, simple, sometimes distinct and divergent, at other times combined into one, rarely wanting: stigmas simple. Berry 2—15-celled, crowned with the limb of the calyx, with as

† Professor Geigers of Heidelberg succeeded in determining that the active principle of Hemlock resides in an organic salt, which is volatile and similar to a volatile oil. The peculiar qualities of this salt, whether considered individually, or when brought into combination with acids, its rapidly changeable character, and the brilliant play of colours while undergoing this change, render it one of the most interesting of chemical productions. Its poison is of the deadliest description. The smallest quantity taken internally induces paralysis, and one or two grains are sufficient to destroy the largest animal.—*Athenæum, for Feb.* 1833, *p.* 93.

many 1-seeded cells as there are styles. Seeds angled (erect, *Don*); testa crustaceous. Embryo small, inverted: albumen fleshy. Radicle superior.—*Trees or shrubs, rarely herbs; stems sometimes climbing or rooting. Leaves alternate, without stipules, simple or compound. Flowers umbellate or capitate, the umbels or heads often racemed, or involucrate.*

Ex. *Adoxa.** *Panax, Suppl. f.* 202; *P. quinquefolium* affords the Ginseng. *Aralia.*

Ord. CV. HAMAMELIDEÆ. *Br.* Witch-Hazel Family.

Tube of the calyx more or less adherent with the ovary, 4-lobed or repando-dentate. Petals 4, linear, elongated, inserted upon the calyx and alternate with its lobes, with a valvate and involute æstivation, rarely none. Stamens double the number of petals and inserted along with them; some alternate with the petals and fertile, some opposite to the petals and sterile: filaments short: anthers inserted by their base, 2-celled, dehiscence various. Ovary adnate with its base, 2-celled; ovules pendulous: styles 2 (rarely 3). Capsule adnate with the persistent base of the calyx, 2-celled, 2-valved, the valves bifid at the apex. Seed pendulous. Albumen horny. Embryo straight: radicle superior: cotyledons foliaceous, plane or somewhat involute at the margin. —*Shrubs of N. America or the north of China and Japan, with alternate, petiolated, entire or sinuato-dentate, bistipuled leaves. Flowers axillary, subsessile, fasciculated, often bracteated, sometimes polygamous.*

Ex. *Hamamelis. Fothergilla.*

Ord. CVI. CORNEÆ. *DC.* Cornel Family.

Tube of the calyx adnate with the ovary; limb 4-lobed. Petals 4, oblong, broad at the base, inserted upon the top of the calycine tube, regular, with a valvate æstivation. Stamens 4, inserted along with the petals, and alternate with them: anthers ovato-oblong, 2-celled; style filiform: stigma simple. Drupe baccate, crowned with the limb of the calyx, with a 2-celled nucleus. Seed pendulous and solitary in the cells. Albumen fleshy. Embryo with a superior radicle, shorter than the 2 oblong cotyledons.—*Trees or shrubs, rarely herbs. Leaves* (*one species excepted*) *opposite, entire or toothed. Flowers capitate, umbellate or corymbose, naked or involucrate, rarely diœcious.*

Ex. *Cornus.** The bark of *C. florida* and *C. sericea* is tonic.

B. Monopetalæ. Petals combined or corolla monopetalous.

Ord. CVII. LORANTHACEÆ. *Juss.* Loranthus Family.

Flowers perfect or separated. Tube of the calyx adnate with the ovary, and with two little bracteas at the base, the limb short, entire or lobed. Petals 4—8, free, or more or less combined, with a valvate æstivation. Stamens as many as there are petals, opposite to them; the filaments more or less adnate with the corolla, or wanting; anthers versatile at the apex of the filaments, or erect, or, in the absence of the filament, adnate with the lobes of the corolla. Ovary ovate or turbinate, adnate with the calyx; style filiform or none; stigma capitate. Berry umbilicated or crowned with the limb of the calyx, 1-celled, 1-seeded: testa membranaceous. Albumen fleshy. Embryo with the radicle superior, thickened at the extremity; or truncate.—*Shrubs, mostly tropical and parasitical. Leaves generally opposite, more or less fleshy, entire, sometimes wanting.*

Ex. *Viscum,** the Misseltoe, whose bark is astringent and berries viscid. *Loranthus.*

Ord. CVIII. CAPRIFOLIACEÆ. *Juss.* Honeysuckle Family, *Suppl. f.* 200, 201.

Tube of the calyx adnate with the ovary, the limb 5-lobed. Corolla of one petal, inserted upon the calyx, the limb more or less lobed, sometimes irregular. Stamens inserted upon the calyx, adnate with the base of the corolla, alternate with its lobes, equal in number with them (one sometimes abortive), exserted or included: filaments subulate: anthers ovate, 2-celled; style exserted or wanting. Stigmas 1 or 3, distinct or collected into a head. Berry crowned with the limb of the calyx, generally dry, or fleshy, 1- or more-celled. Seeds solitary, 2 or many in each cell, sometimes several abortive, pendulous; testa crustaceous. Albumen fleshy. Embryo in the centre of the albumen; radicle superior; cotyledons ovato-oblong.—*Shrubs, rarely trees, chiefly of the northern or temperate parts of the northern hemisphere. Leaves opposite, without stipules, or usually so, simple or pinnated. Flowers terminal and corymbose or axillary.*

The bark of several is astringent. The flowers of the Elder are a well known domestic medicine. *Triosteum perfoliatum* is a mild cathartic.

TRIBE I. SAMBUCEÆ. Elder Tribe.—Ex. *Sambucus.* Viburnum,* Suppl. f.* 201.

TRIBE II. LONICERÆ. Honeysuckle Tribe.—Ex. *Triosteum. Lonicera.* Linnæa,* Suppl. f.* 200.

ORD. CIX. RUBIACEÆ. *Juss.* Madder Family, *Suppl. f.* 196—199.

Tube of the calyx adherent with the ovary, the limb truncated or lobed, generally regular, formed of as many sepals as petals, rarely with accessary teeth. Corolla of one piece, inserted on the top of the tube of the calyx, 4—5- rarely 3—8-lobed, with a twisted or valvate æstivation. Stamens equal in number to the lobes of the corolla, alternate with them, and more or less adnate with the tube: anthers oval, 2-celled, opening internally. Ovary 2- or many- rarely 1-celled, crowned with a fleshy cup, from which arises the single style: stigmas often 2, rarely many, distinct or more or less cohering. Fruit baccate, capsular or drupaceous, 2- or many-celled, the cells 1—2- or many-seeded. Seeds in the 1-seeded cells fixed to the base or apex; in the polyspermous ones to a central placenta and generally horizontally. Albumen copious, horny or fleshy. Embryo straight or slightly curved, in the middle of the albumen: radicle turned to the hilum: cotyledons foliaceous.—*Trees, shrubs or herbs with rounded or tetragonal branches. Leaves simple, bordered with a nerve, and thence entire, opposite, with two stipules, more* *or less combined or cut, sometimes foliaceous and then the leaves are verticillate.*

A vast and important Natural Order, with roots, as in *Rubia*, (the Madder) endowed with dyeing properties, often, as in Ipecacuanha, acrid, emetic, purgative and diuretic. Sometimes the barks, as in the *Cinchonas*, are astringent, slightly aromatic, and powerful febrifuges : at other times, the horny albumen abounds in an agreeable aroma, as the Coffee.

TRIBE I. CINCHONACEÆ. Cinchona Tribe.—Ex. *Nauclea;* the powerfully astringent extract called Gambeer is afforded by the leaves of *N. Gambeer. Cinchona;* the Peruvian bark, *Suppl. f.* 197.

TRIBE II. GARDENIACEÆ. Gardenia Tribe.—Ex. *Sarcocephalus*, an esculent fruit of Sierra Leone. *Gardenia.*

TRIBE III. HEDYOTIDEÆ. Hedyotis Tribe.—Ex. *Condaminea;* a febrifuge ; as is *Rondeletia. Hedyotis. Oldenlandia.*

TRIBE IV. ISERTIEÆ. Isertia Tribe.—Ex. *Isertia.*

TRIBE V. HAMELIEÆ. Hamelia Tribe.—Ex. *Hamelia, Suppl. f.* 199.

TRIBE VI. CORDIEREÆ. Cordiera Tribe.—Ex. *Cordiera.*

TRIBE VII. GUETTARDIACEÆ. Guettarda Tribe.—Ex. *Morinda.** *Guettarda. Antirrhœa.*

TRIBE VIII. PÆDERIEÆ. Pæderia Tribe.—Ex. *Pæderia.*

TRIBE IX. COFFEACEÆ. Coffee Tribe.—Ex. *Chiococca; C. racemosa* is a powerful febrifuge. *Ixora;* a favourite Genus of the Hindoos, on account of the beauty of its flowers. *Coffea; C. Arabica* affords the true Coffee, *Suppl. f.* 198. *Psychotria*, some of which are emetics. *Cephaelis;* the roots of *C. Ipecacuanha* are the true Brazilian Ipecacuanha.

TRIBE X. SPERMACOCEÆ. Spermacoce Tribe.—Ex. *Spermacoce. Richardsonia*, of which the species are emetics.

TRIBE XI. ANTHOSPERMEÆ. Anthospermum Tribe.—Ex. *Anthospermum.*

TRIBE XII. STELLATÆ. Madder Tribe (a distinct Family according to some authors, and the only tribe of which we have any Genera in Britain). *Sherardia,* Suppl. f.* 196. *Asperula.** *Rubia;** Madder.* *Galium.**

TRIBE XIII. OPERCULARIEÆ. Opercularia Tribe.—Ex. *Opercularia.*

Ord. CX. VALERIANEÆ. *DC.* Valerian Family.

Tube of the calyx adnate with the ovary; limb toothed or partite, or at first involute, and afterwards expanding into a feathery pappus. Corolla tubular, funnel-shaped, often 5-lobed, rarely 3—4-lobed, the lobes obtuse, the tube equal or gibbous, or spurred at the base. Stamens 1—5, inserted into the tube of the corolla, alternate with its lobes when of the same number: anthers ovate, 2-celled. Style filiform; stigmas 2—3, distinct or combined. Fruit membranaceous or bony, indehiscent, crowned with the more or less persistent limb of the calyx, 3-celled, with 2 cells empty; or only 1. Seed solitary, pendulous, without albumen. Embryo straight: radicle superior; cotyledons flat.—*Annual or perennial herbs, chiefly of temperate climates, rarely suffrutescent. Leaves opposite, without stipules, entire or pinnated.*

The thick perennial roots are odorous, tonic and bitter, and used as vermifuges: the slender annual ones scentless.—Ex. *Nardostachys; N. Jatamansi* is the Spikenard of the ancients. *Fedia;* F. olitoria* is cultivated as a salad. *Centranthus** (*Valeriana rubra* and its allies). *Valeriana.**

Ord. CXI. DIPSACEÆ. *Juss.* Teasel Family, *Suppl. f.* 5—7.

Tube of the calyx adnate with the ovary: the limb various, short or elongated, entire, toothed, or often ending in hairy or feathery and pappus-like bristles. Corolla of one petal, inserted at the mouth of the tube of the calyx, rarely ringent, often somewhat unequal, 4—5-cleft. Stamens 4, inserted into the tube of the corolla, alternate with its lobes, almost always distinct: anthers 2-celled. Style filiform: stigma simple, longitudinal or capitate. Fruit indehiscent, membranaceous, or somewhat bony, crowned with the limb of the calyx, often covered by an involucellum or outer calyx, 1-celled, 1-seeded. Seed pendulous. Albumen fleshy. Embryo straight: radicle superior.—*Herbs or shrubs, abounding in the south of Europe and north of Africa. Leaves opposite, rarely verticillate, varying in shape, even on the same individual. Flowers densely capitate, and surrounded by a many-leaved involucre.*

Ex. *Morina. Dipsacus.* D. Fullonum* is the Fuller's Teasel. *Scabiosa,* Suppl. f.* 5—7. *Knautia.**

Ord. CXII. CALYCEREÆ. *Br.* Calycera Family.

Tube of the calyx adnate with the ovary; limb of 5 unequal segments. Corolla regular, funnel-shaped, with a long slender tube and 5 segments, each of which has 3 principal veins; there are glandular spaces below the stamens, alternate with them. Stamens 5, monadelphous: anthers combined by their lower half into a cylinder. Ovary 1-celled: ovule solitary, pendulous: style simple, glabrous: stigma capitate. Fruit an indehiscent pericarp, crowned by the rigid, spiny segments of the calyx. Seed solitary, pendulous, sessile. Embryo in the axis of a fleshy albumen: radicle superior.—*Herbaceous South American plants. Leaves alternate, without stipules. Flowers collected in heads, which are either terminal or opposite the leaves, surrounded by an involucre. Florets sessile, perfect or neuter.*

Distinguished from *Compositæ* by the pendulous seeds and superior radicle, and the presence of albumen; from *Dipsaceæ,* by the monadelphous filaments and partly distinct anthers.—Ex. *Boopis. Calycera.*

Ord. CXIII. COMPOSITÆ. *Adans.* Composite Family, *Suppl. f.* 57—69.

Tube of the calyx adnate with the ovary; the limb entire or toothed or resembling scales, or mostly expanded into a simple or feathery pappus, sometimes wanting. Corolla regular and funnel-shaped, or irregular and ligulate, sometimes 2-lipped, generally 4—5-toothed. Stamens 4 or 5, alternate with the teeth of the corolla: anthers cohering in a cylinder. Ovary 1, 1-celled, with a single erect ovule; style 1: stigmas simple or bifid. Fruit an achenium, crowned with the limb of the calyx or pappus. Seed erect, without albumen. Embryo straight: radicle directed to the hilum.—*Herbaceous plants or shrubs, rarely trees, of every part of the world. Flowers (called flosculi, or florets) capitate, inserted into a broad receptacle, and surrounded by an involucre. Bracteas often among the flowers.*

This vast and important Order has been recently much illustrated by Cassini, and more especially by Lessing. But I shall confine myself to the 3 great natural groupes of Jussieu.

TRIBE I. CYNAROCEPHALÆ. Artichoke Tribe, *Suppl. f.* 61—65.—Florets all tubular: receptacle hairy or pitted. Style swollen and hairy below the stigma. The plants are generally intensely bitter and tonic.—Ex. *Carthamus*, which affords a deep yellow dye. *Cynara*, the Artichoke and Cardoon.—*Arctium*,* a sudorific and diaphoretic. *Serratula*.* *Saussurea*.* *Carduus*;* *Suppl. f.* 61—64. *Cnicus*.* *Onopordum*.* *Carlina*.* *Centaurea*,* *Suppl. f.* 65.

TRIBE II. CICHORACEÆ. Succory Tribe, *Suppl. f.* 57—60' Florets all ligulate, yielding a milky juice, which is bitter and narcotic, often dissipated or modified by culture.—Ex. *Tragopogon*,* or Salsafy; and *Scorzonera*, whose roots are blanched and eaten. *Helminthia*,* *Suppl. f.* 57—60. *Picris*.* *Sonchus*.* *Lactuca*;* the Lettuce, affords a kind of opium. *Prenanthes*.* *Leontodon*.* *Apargia*.* *Thrincia*.* *Hieracium*.* *Crepis*.* *Borkhausia*.* *Hypocharis*.* *Lapsana*.* *Cichorium*,* the Succory, and Endive.

TRIBE III. CORYMBIFERÆ. Corymbiferous Tribe, *Suppl. f.* 66—69.—Florets generally of 2 kinds in each head; those of the centre tubular, those of the circumference ligulate. These plants are usually aromatic and stimulant, containing bitter principle and essential oil: many possess powerful febrifugal qualities: others are anthelmintics and emmenagogues. The tuberous roots of *Helianthus tuberosus* are the Jerusalem Artichoke.—Ex. *Tanacetum*;* the Tansy. *Artemisia*;* Wormwood; *A. Chinensis* affords the Moxa of China. *Gnaphalium*.* *Conyza*.* *Erigeron*.* *Tussilago*.* *Petasites*.* *Senecio*.* *Aster** and *Solidago*;* of which the species abound so much in N. America. *Inula*;* *T. Helenium*, is the *Helecampane*. *Limbarda*.* *Pulicaria*,* *Suppl. f.* 66—69. *Cineraria*.* *Doronicum*.* *Bellis*.* *Chrysanthemum*.* *Pyrethrum*.* *Matricaria*.* *Anthemis*;* *A. nobilis* is the true Chamomile. *Achillæa*.* *Bidens*.* *Eupatorium*;* the N. American *E. perfoliatum*, and probably other allied species, is a powerful tonic, stomachic and febrifuge. *Chrysocoma*.* *Diotis*.*

ORD. CXIV. BRUNONIACEÆ. *Lindl.* (Goodenoviæ Sect. III. *Br.*) Brunonia Family.

Calyx free, in 5 divisions, with 4 bracteas at the base. Corolla monadelphous, nearly regular, 5-parted, marcescent. Stamens definite, hypogynous, alternate with the segments of the corolla: anthers collateral, slightly cohering. Ovary

1-celled, with a single erect ovule: style single: stigma enclosed in a 2-valved cup. Fruit a membranous utricle, enclosed within the indurated tube of the calyx. Seed solitary, erect, without albumen. Embryo with plano-convex, fleshy cotyledons, and a minute inferior radicle.—*Herbaceous Australian plants, stemless and with simple hairs, destitute of glands. Leaves radical, entire, without stipules. Flowers blue, collected into heads, and surrounded by enlarged bracteas.*

Ex. *Brunonia.*

Ord. CXV. GOODENOVIEÆ. *Br.* Goodenia Family, *Suppl. f.* 194.

Tube of the calyx adnate or half-adnate, rarely free; the limb 5-cleft, or 5—3-partite, sometimes entire or obsolete, generally equal, persistent. Corolla monopetalous, more or less irregular, deciduous or marcescent; the tube cleft behind, sometimes cut into 5 deep pieces, whilst the calyx is nearly free; the limb 5-parted, 2- or 1-lipped; the disk of the segments lanceolate, plane; the sides or wings of a thinner texture, elevated, with an induplicate æstivation, rarely obsolete, or wanting. Stamens 5, free, alternate with the segments of the corolla; filaments distinct; anthers distinct or cohering, linear, vertical, fixed by the base, undivided, 2-celled, the cells opening longitudinally; pollen simple or compound. Ovary 2- or 1- (rarely 4-) celled, with indefinite or definite erect ovules; sometimes with a gland between the two anterior filaments; style 1, simple (rarely divided): stigma fleshy, obtuse, undivided or 2-lobed, surrounded by a somewhat membranaceous, cup-shaped, entire or 2-lobed *indusium.* Pericarp, when the seeds are indefinite, a 2- rarely 4-celled capsule, or in consequence of the abbreviated dissepiment almost 1-celled: dissepiment generally parallel to the valves, the axis bearing the seeds;—when the seeds are definite (1 in each cell), a drupe or nut, bearing the seed at the base of the cell. Seed with a thickish or bony testa. Albumen fleshy, rarely wanting. Embryo erect: cotyledons often foliaceous.—*Australian herbs or shrubs, pubescent or glandular, not milky. Leaves scattered, without sti-*

pules, simple, sometimes lobed and toothed. Inflorescence various, terminal or axillary. Flowers distinct, rarely aggregate, yellow, blue, or purplish, seldom inclining to red.

Ex. *Goodenia. Velleia. Scævola, Suppl. f.* 194. *Dampiera.*

Ord. CXVI. STYLIDIEÆ. *Br.* Stylidium Family, *Suppl. f.* 73—76.

Tube of the calyx adnate with the ovary; limb 2—6-partite, 2-lipped or regular, persistent. Corolla monopetalous, with the limb 5—6-cleft, irregular, rarely equal, with an imbricated æstivation, at length deciduous. Stamens 2; filaments cohering with the style into a column; anthers didymous, sometimes simple, incumbent upon the stigma. Ovary 2-celled or partially 1-celled, many-seeded, often crowned with an anterior gland, or 2 opposite ones: style 1: stigma undivided or bifid. Capsule 2-valved, 2-celled, with the dissepiment parallel, sometimes abbreviated, or at length, by its separation from the inflexed margins of the valves, almost 1-celled. Seeds fixed to the axis of the dissepiment, erect, small, sometimes pedicellate. Albumen fleshy and somewhat oily. Embryo minute, included.—*Herbaceous (or suffrutescent) plants, caulescent or stemless, not milky: hairs, if present, simple, glandular or acute. Leaves scattered, sometimes verticillate, entire, with the margins naked or ciliated: those of the root in the stemless species crowded. Flowers spiked, racemose, corymbose or solitary, terminal, rarely axillary: pedicels often with bracteas.*

Ex. *Stylidium, Suppl. f.* 73—76; a genus remarkable for the highly irritable nature of the column. *Levenhookia.*

Ord. CXVII. CAMPANULACEÆ. *Juss.* Bell-flower Family, *Suppl. f.* 193, 195.

Tube of the calyx adnate with the ovary; its limb 4—8-generally 5-cleft, equal, persistent. Corolla monopetalous, deciduous or marcescent, regular or irregular, 5- sometimes 4—6—8-cleft, rarely of 5 petals with broad connivent claws. Stamens inserted upon a disk which is adnate with the ovary (base of the corolla?), sometimes upon the corolla, equal in number with the segments of the corolla, and alternate with them; anthers fixed to the base, 2-celled, cells apposite, opening longitudinally, distinct or cohering. Ovary 2- or many-celled, many-seeded. Style 1; stigma 1, or generally as many as there are cells of the ovary, naked or covered by an indusium. Capsule wholly adnate with the tube of the calyx, and opening below the limb with lateral pores, or half-adnate and valvate at the extremity, the valves bearing the placentas. Seeds numerous, small, with a fleshy albumen. Embryo straight, as long as the albumen.—*Herbs, sometimes shrubs, mostly of temperate climates, generally milky. Leaves alternate, rarely opposite, with stipules, simple, sometimes much lobed. Flowers various, distinct, sometimes capitate and involucrate.*

The milky juice is acrid, but the roots of some species of the first tribe are eaten under the name of Ramps and Rampions.

TRIBE I. CAMPANULEÆ. Bell-flower Tribe.—Corolla monopetalous, regular. Anthers distinct.—Ex. *Campanula,* Suppl. f.* 193. *Phyteuma.* Jasione.**

TRIBE II. LOBELIEÆ. Lobelia Tribe.—Corolla irregular; (sometimes of 5 petals.) Anthers often connate.—Ex. *Lobelia,* Suppl. f.* 195; *L. longiflora* of the West Indies, and *L. Tupa* of Chili, are highly poisonous.

ORD. CXVIII. GESNERIEÆ. *Rich.* Gesneria Family.

Tube of the calyx half-adnate with the ovary; the limb with 5 divisions, and a valvate æstivation. Corolla monopetalous, irregular, tubular, with 5 unequal lobes, sometimes 2-lipped. Stamens 4, (rarely 2,) didynamous, sometimes the rudiment of a fifth is present: anthers 2-celled, cohering, with a thick tumid *connectivum.* Ovary 1-celled, with 2 fleshy, 2-lobed, parietal, polyspermous placentas, surrounded at its base by glands, which alternate with the stamens: style simple: stigma capitate, concave. Fruit capsular or succulent, free above, 1-celled, 2-valved, opening between the placentas. Seeds numerous, minute. Testa thin. Embryo erect, in the axis of a fleshy albumen: radicle pointing to the hilum. —*Herbaceous or somewhat shrubby plants, natives of the West*

Indies and South America. Leaves opposite, without stipules. Flowers showy.

Nearly allied, in many respects, to *Scrophularineæ* and *Orobancheæ*.—Ex. *Gesnera. Gloxinia.*

ORD. CXIX. VACCINIEÆ. *DC.* Billberry Family, *Suppl. f.* 192.

Tube of the calyx adnate with the ovary, the limb entire or 4—5—6-lobed. Corolla monopetalous, 4—6-lobed, inserted along with the stamens, (which are twice as many as there are lobes of the corolla,) upon an epigynous disk or torus: anthers 2-celled, with 2 horns. Ovary 1: style 1: stigma 1. Fruit a berry, crowned with the persistent limb of the calyx, 4—5-celled; cells few-seeded. Embryo straight, in the axis of a fleshy albumen: cotyledons very short: radicle long, inferior.—*Small shrubs, chiefly inhabiting mountains or high northern latitudes, with deciduous or evergreen leaves. The properties are slightly tonic and astringent; the fruit esculent.*

Ex. *Vaccinium, Suppl. f.* 192, affords the Cranberry, the Billberry, and Whortleberry.

SUBCLASS III. COROLLIFLORÆ. Calyx free (not adnate with the ovary), formed of sepals more or less combined. Petals united, so as to form an hypogynous monopetalous corolla, which bears the stamens. Ovary free.

ORD. CXX. ERICEÆ. *Juss.* Heath Family, *Suppl. f.* 190, 191.

Calyx persistent, free, 3—4- often 5-partite. Corolla inserted into the base of the calyx (almost hypogynous), 4—5-cleft, marcescent. Stamens definite, equal and alternate with the segments of the corolla, or twice as many, distinct, inserted at the base of the calyx or of the corolla. Anthers 2-celled, the cells hard and dry, usually opening by pores, and furnished with appendages. Ovary 1, free, surrounded at the base by a disk or by scales: style 1: stigma 1. Fruit many-celled, baccate, or frequently capsular, many-seeded, many-valved; dehiscence various. Seeds minute, attached to central placentas: testa firmly adhering to the nucleus. Embryo straight in the axis of a fleshy albumen; radicle next the hilum.—*Shrubs or undershrubs, chiefly extra-tropical, almost unknown in Australia; with evergreen, rigid, entire, alternate, whorled or opposite leaves, without stipules.*

Many are astringent and diuretic; *Rhododendron* and *Kalmia* are poisonous.—Ex. *Erica; Suppl. f.* 191, of which two kinds, with *Calluna*, form a considerable portion of the vegetation in large districts of England and Scotland, and of which above 300 species are found at the Cape of Good Hope; *Calluna.** *Menziesia.** *Azalea.** *Ledum.** *Rhododendron, Suppl. f.* 190. *Andromeda.** *Arbutus.**

Ord. CXXI. MONOTROPEÆ. *Nutt.* Monotropa Family. (Pyrolaceæ, *Lindl.*)

Calyx 5-leaved, persistent, free. Corolla monopetalous, hypogynous, regular, deciduous, 4- or 5-toothed, with an imbricated æstivation. Stamens hypogynous, twice as numerous as the divisions of the corolla: anthers 2-celled, opening by fissures or pores, with or without appendages. Ovary superior, 4—5-celled, many-seeded, with an hypogynous disk: style 1, straight or declinate: stigma simple. Fruit capsular, 4—5-celled, dehiscent, with central placentas. Seeds indefinite, very minute: testa large, loose and reticulated. Albumen fleshy. Embryo at one extremity of the albumen.—*Herbaceous, rarely frutescent plants, of the temperate or colder parts of the northern hemisphere. Leaves simple, often wanting.*

In many respects allied to *Ericeæ,* but differing in habit and in the testa of the seeds.—Ex. *Pyrola.** *Chimaphila; C. umbellata* is a powerful diuretic. *Monotropa.**

Ord. CXXII. EPACRIDEÆ. *Br.* Epacris Family, *Suppl. f.* 8, 9.

Calyx 5- (rarely 4-) partite, often coloured, persistent. Corolla hypogynous, monopetalous (the tube sometimes 5-partite); the limb 5- (rarely 4-) cleft, equal, sometimes opening transversely by the cohesion of the segments, its æstivation valvate or imbricated, deciduous or marcescent. Stamens as many as there are segments to the corolla (rarely fewer), and alternate with them; filaments inserted on the petals, or hypogynous; anthers simple, with a single polliniferous receptacle, forming a complete partition, rarely having a border; pollen globose, slightly angled, or formed of 3 globules. Ovary sessile, generally with 5 sometimes connate glands at the base, many- (rarely 1-) celled, with solitary or indefinite seeds: style 1; stigma 1, sometimes toothed. Pericarp drupaceous, baccate, or capsular. Seeds without albumen. Embryo cylindrical, straight in the axis, more than half the length of the albumen.—*Shrubs or small trees of Australia* (*where they hold the place of the Heaths*), *with hairs, when present, simple. Leaves alternate, rarely opposite, entire, seldom serrated, often petioled, their bases sometimes dilated, imbricated, cucullate and somewhat sheathing. Flowers spicate or racemose, terminal, or solitary and axillary, white, purple, or rarely blue; the calyx and pedicels with* 2 *or many bracteas, generally of the same texture with the calyx.*

This and the 2 preceding Orders are placed, by many Botanists, with the *Calycifloræ*, but the insertion of the stamens and corolla seems to be truly hypogynous. By some it is united to *Ericeæ*, from which it differs chiefly in the 1-celled anthers, without appendages. The fruit of *Lissanthe sapida* is one of the few edible fruits of New Holland. Dr. Brown, who constituted the Order, divides it into two sections.

SECT. I. Cells of the ovary 1-seeded. Pericarp indehiscent, rarely capsular.—Ex. *Styphelia. Lissanthe. Leucopogon.*

SECT. II. Cells of the ovary many-seeded. Pericarp capsular.—Ex. *Epacris, Suppl. f.* 8, 9. *Sprengelia.*

ORD. CXXIII.? STYRACEÆ. *Rich.* Storax Family.

Tube of the calyx adnate with the ovary, or more or less free, the limb with 5 divisions. Corolla hypogynous or perigynous, monopetalous, the number of its divisions frequently different from that of the calyx, with an imbricated æstivation. Stamens definite or indefinite, arising from the tube of the corolla, unequal, more or less cohering: anthers innate, 2-celled, bursting internally. Ovary with 1—5 cells;

ovules definite, erect or suspended: style simple: stigma somewhat capitate. Fruit drupaceous, crowned by the limb of the calyx, or enclosed in the free tube of it, with usually only 1 seed. Embryo in the midst of the albumen: radicle long, directed to the hilum: cotyledons flat, foliaceous.—*Exotic trees or shrubs. Leaves alternate, without stipules, often turning yellow in drying. Flowers axillary, solitary or clustered, with scale-like bracteas.*

I have followed Professor Lindley in retaining *Halesia* in this Order, from which Mr. Don has removed it. Others, again, separate the *Styraceæ* from *Symploceæ*. As it stands now, the Family belongs as much to the *Calyciforæ* as to the *Corollifloræ*.—Ex. *Styrax;* of which *S. officinale* affords Gum Storax, and *S. Benzoin*, Gum Benzoin. *Halesia. Symplocos.*

ORD. CXXIV. BELVISIEÆ. *Br.* Belvisia Family.

Calyx of one piece; the limb divided, persistent. Corolla monopetalous, plaited, (many-lobed or undivided, simple or double,) deciduous. Stamens either definite or indefinite, inserted at the base of the corolla. Ovary adnate with the tube of the calyx: style 1: stigma lobed or angled. Pericarp baccate, many-seeded.—*South African, and Brazilian (?) shrubs, with alternate, entire leaves, without stipules. Flowers axillary or lateral, solitary.*

Ex. *Belvisia. Asteranthos;* placed with *Styraceæ* by M. Desfontaines.

ORD. CXXV. EBENACEÆ. *Vent.* Ebony Family, *Suppl. f.* 189.

Flowers separated, seldom perfect. Calyx in 3—6 divisions, nearly equal, persistent. Corolla monopetalous, hypogynous, regular, deciduous, somewhat coriaceous, usually pubescent externally, and glabrous internally; its limb with 3—6 divisions, with an imbricated æstivation. Stamens definite, either arising from the corolla, or hypogynous, twice as many as the segments of the corolla, sometimes 4 times as many, or the same number, and then alternate with them: filaments simple in the perfect flowers, generally double in the separated ones, both the divisions bearing anthers, but the inner are generally smaller: anthers attached by their bases, lanceolate, 2-celled, opening longitudinally, sometimes bearded: pollen globular, smooth. Ovary sessile, without any disk, with several cells, the cells each having 1—2 ovules, pendulous from their apex; style divided, seldom simple; stigmas bifid or simple. Fruit fleshy, round or oval, often by imperfection few-seeded, its pericarp sometimes opening in a regular manner. Seed with a membranous testa, of the same figure as the albumen, which is cartilaginous and white: embryo in the axis, or but little out of it, straight, white, generally more than half as long as the albumen: cotyledons foliaceous: radicle directed towards the hilum.—*Chiefly tropical trees or shrubs, not milky, with a heavy wood. Leaves alternate, without stipules, obsoletely articulated with the stem, quite entire, coriaceous. Inflorescence axillary. Peduncles solitary, those of the barren flowers divided, those of the fertile 1-flowered, with minute bracteas.*

Ex. *Diospyros, Suppl. f.* 189; *D. Ebenus* is the Ebony. *Maba. Ferreola.*

Ord. CXXVI. SAPOTEÆ. *Juss.* Sappodilla Family, *Suppl. f.* 187.

Flowers perfect. Calyx divided, regular, persistent. Corolla monopetalous, hypogynous, regular, its divisions equal in number to those of the calyx, rarely double or triple, deciduous. Stamens inserted on the corolla, definite, distinct; fertile ones equal in number to the segments of the calyx, and opposite those segments of the corolla which alternate with the latter, rarely more, with anthers generally turned outwards; sterile ones as many, alternating with the fertile ones, sometimes none. Ovary 1, many-celled, the cells 1-seeded: ovules erect: style 1; stigma undivided or lobed. Fruit a many- or 1-celled berry; cells 1-seeded; seeds nut-like, sometimes cohering into a many-celled putamen. Testa bony, shining. Embryo erect, white, large, often included in a fleshy albumen: cotyledons foliaceous in the albuminose seeds, or fleshy in the exalbuminose ones, sometimes connate: radicle short, straight or slightly curved, directed to the hilum.—*Trees or shrubs of hot climates, generally milky. Leaves alternate, entire, coriaceous, without stipules. Inflorescence axillary.*

Ex. *Achras; A. mammosa* is the Mamme Sapota: *A. Sapota*, the Sappodilla, a favourite fruit of the West Indies; their bark too is astringent. *Chrysophyllum;* the Star-Apple. *Bassia*, *Suppl. f.* 187. *Mimusops.*

Ord. CXXVII. ILICINEÆ. *Brongn.* Holly Family.

Sepals 4—6, with an imbricated æstivation. Corolla monopetalous, hypogynous, 4—5-partite; æstivation imbricated. Stamens inserted into the base of the corolla, alternate with its lobes: filaments erect: anthers adnate: disk none. Ovary fleshy, distinct, somewhat truncate, with from 2—6 cells: ovules solitary, pendulous from a cup-shaped stalk: stigma nearly sessile, lobed. Fruit fleshy, indehiscent, with 2—6, 1-seeded nucules. Seed suspended. Albumen large, fleshy. Embryo small, 2-lobed, lying near the hilum: cotyledons minute: radicle superior.—*Trees or shrubs. Leaves alternate or opposite, coriaceous. Flowers small, axillary, solitary or fascicled.*

The bark and berries are astringent and tonic. Of the bark of the common Holly, bird-lime is made. An infusion of the leaves of *Ilex Paraguensis* is the Paraguay tea of South America, where it is as universally drunk as Chinese tea is in our country.—Ex. *Ilex. Prinos. Myginda.*

Ord. CXXVIII. MYRSINEÆ. *Br.* Myrsine Family, *Suppl. f.* 188.

Flowers sometimes polygamous. Calyx 5—4-fid, persistent. Corolla monopetalous, hypogynous, 5—4-fid, equal. Stamens 5—4, inserted at the base of the corolla, and opposite to its lobes: filaments distinct, or rarely connate, sometimes none, sometimes with sterile, petaloid, alternate ones: anthers fixed by their emarginate bases, with cells opening longitudinally. Ovary 1, 1-celled, with many peltate, ovules immersed in little pits of the free, central placenta: style 1, often short; stigma lobed or entire, drupe or Berry generally

1- sometimes 2—4-seeded. Seeds peltate, hollow at the hilum: testa simple. Albumen fleshy. Embryo transverse, often curved: cotyledons short: radicle inferior.—*Trees or shrubs, with alternate, undivided, coriaceous leaves, or suffrutescent with opposite or terete leaves. Inflorescence various. Flowers small, white, generally marked with linear immersed glands.*

Ex. *Myrsine, Suppl. f.* 188. *Ægicera. Ardisia. Embelia.*

Ord. CXXIX. JASMINEÆ. *Juss.* Jasmine Family, *Suppl. f.* 173.

Flowers perfect or rarely (in *Fraxinus*) polygamous. Calyx of one piece, tubular below, the limb 4—5—8-lobed. Corolla monopetalous, regular, 4—5—8-lobed or partite, with a twisted or valvate æstivation, sometimes wanting. Stamens 2, inserted upon the corolla: filaments inserted upon the corolla, generally short; anthers 2-celled, opening longitudinally and internally. Ovary sessile, 2-celled, the cells with 2 pendulous or erect ovules: style simple: stigma 2-lobed. Fruit dry and dehiscent or indehiscent, 1—2-celled, the cells 1—2-seeded, sometimes fleshy. Seeds with a thin and membranaceous, or a thick testa. Albumen white, fleshy or somewhat horny, sometimes very thin. Radicle cylindrical, directed to the hilum.—*Trees or shrubs, with generally opposite leaves. Flowers axillary or racemose, terminal.*

Tribe I. Jasmineæ. Jasmine Tribe.—Ovules erect; seed with little or no albumen. Æstivation of the corolla imbricated, its lobes 5 or more.—Chiefly tropical and Indian plants, with deliciously fragrant flowers, which yield an oil highly esteemed as a perfume.—Ex. *Jasminum. Nyctanthes. Bolivaria.*

Tribe II. Oleineæ. Olive Tribe.—Ovules pendulous. Seed with a copious albumen. Æstivation of the corolla somewhat valvate.—Natives chiefly of temperate climates. A valuable oil is extracted from the pericarp of the *Olea Europæa.* Its bark, like that of the Ash, is bitter and astringent, and employed as a febrifuge. Manna is the concrete juice of an Ash, the *Fraxinus rotundifolia.*—Ex. *Olea, Suppl. f.* 173. *Ligustrum.* Fraxinus.* Syringa,* the Lilac.

Ord. CXXX. ASCLEPIADEÆ. *Br.* Asclepias Family, *Suppl. f.* 185.

Calyx of 5 divisions, persistent. Corolla monopetalous, hypogynous, 5-lobed, regular, with an imbricated æstivation, rarely valvate, deciduous. Stamens 5, inserted at the base of the corolla, alternating with the segments of the limb: filaments generally connate: anthers 2-celled, or, from the nearly complete dissepiments, almost 4-celled. Pollen, on the dehiscence of the anthers, united into as many masses as there are cells, or occasionally cohering, either in pairs, in fours, or singly to the 5 processes of the stigma. Ovaries 2: styles 2, closely approximate, often very short; stigma common to both, dilated, pentagonal, with processes at the angles. Follicles 2, one sometimes abortive. Placenta attached to the suture, eventually separating. Seeds numerous, imbricated, pendulous, generally connate at the hilum. Albumen thin. Embryo straight: cotyledons foliaceous: radicle superior: plumule inconspicuous.—*Shrubs or herbs, abounding in the tropics, and in Southern Africa and New Holland, rare in temperate climes, mostly milky and climbing, differing from all known Dicotyledonous plants, according to Brown, in the coalescing of the pollen into definite masses, which on the opening of the anthers are affixed to* 5 *glands of the stigma: in this economy, however, there is an analogy with the* Orchideæ. *Leaves entire, opposite, sometimes alternate or verticillate, often furnished with interpetiolary cilia in the room of stipules. Flowers somewhat umbellate, fascicled or branched, interpetiolary.*

The milk of these plants is usually acrid and bitter, and many are employed in medicine. Several species of *Cynanchum* are emetic, and the roots of others are purgative. The Scammony of Montpelier is prepared from the roots of *Cynanchum Monspeliacum*, that of Smyrna from *Periploca Scammonis:* yet the young shoots of several kinds are eaten, and the milk of some species is used as an aliment, especially *Asclepias lactifera.*—Ex. *Asclepias. Cynanchum. Stapelia;* a most singular and extensive Genus of Southern Africa. *Pergularia; Suppl. f.* 185.

Ord. CXXXI. APOCYNEÆ. *Br.* Apocynum Family, *Suppl. f.* 185.

Calyx of 5 divisions, persistent. Corolla monopetalous, hypogynous, regular, 5-lobed, with an imbricated æstivation, deciduous. Stamens 5, situated on the corolla, and alternate with the segments of the limb: filaments distinct: anthers 2-celled, opening longitudinally; pollen granular, immediately applied to the stigma. Ovaries 2 or 1, 2-celled, generally many-seeded: styles 2 or 1: stigma 1. Pericarp a follicle or capsule, drupe or berry, double or single. Seeds generally without albumen. Embryo foliaceous. Plumule inconspicuous.—*Trees or shrubs, often milky. Leaves opposite, sometimes verticillate, rarely scattered, entire, frequently with interpetiolary cilia which are glandular. Inflorescence somewhat corymbose. Allied to* Gentianeæ *and* Rubiaceæ.

An important Order, containing more acrid and more powerful properties than the preceding, highly poisonous in some of the individuals, especially the *Tanghinia veneniflua* of Madagascar (see *Curt. Bot. Mag. t.* 2968, *and Bot. Miscell. v.* 3. *t.* 110.) whose seeds are employed in the famous ordeal of that country, for convicting criminals. Here belongs strychnia, afforded by *Strychnos Nux vomica:* yet the bark of another species of the same Genus, *S. Pseudo-quina* of Brazil, is esteemed equal to the *Cinchona* in the cure of intermittent fevers. The root of *Nerium odorum* is a poison; yet the nearly allied *Tabernæmontana utilis*, (*Arn.*) the Hya-hya of British Guiana, is the milk-tree of that country, giving out a copious and nutritive fluid, like cream. *Urceola elastica* and other plants of this Order afford Caoutchouc. *Wrightia tinctoria* yields a blue dye; *W. antidysenterica* is a tonic and febrifuge.—Ex. *Vinca;* Suppl. f.* 186; *V. minor* is bitter and astringent, and was formerly an officinal plant. *Nerium. Apocynum. Cerbera. Gardneria. Strychnos;* which with some authors forms a distinct Order, *Strychniæ.*

Ord. CXXXII. GENTIANEÆ. *Juss.* Gentian Family, *Suppl. f.* 182—184.

Calyx monophyllous, divided, persistent. Corolla monopetalous, hypogynous, often regular, marcescent or deciduous; the limb divided, equal, the lobes agreeing in number with the segments of the calyx, generally 5, sometimes 4—8, with an imbricated æstivation. Stamens situated upon the corolla, equal in number to the segments and alternating with them, some rarely abortive. Ovary 1, 1—2-celled, many-seeded. Style 1, or 2, more or less connate: stigmas 1—2. Capsule, sometimes a berry, many-seeded, 1—2-celled, often

2-valved with the margins of the valves introflexed, and in the 1-celled pericarps bearing the seeds, in the 2-celled ones they are inserted upon a central placenta. Seeds small. Embryo straight, in the axis of a soft, fleshy albumen: radicle directed to the hilum.—*Widely dispersed herbs, or rarely shrubs, generally glabrous, with opposite, entire, exstipulate leaves. Flowers terminal or axillary.*

The bitter and stomachic properties of this Order are highly esteemed, and they are very universal.—Ex. *Gentiana,* Suppl. f.* 182; *G. lutea* is the bitter Gentian; *G. Chirita,* the famous East Indian stomachic: a spirit is distilled from the former in Switzerland, and called Gentian-wasser. *Chlora.* Exacum,* Suppl. f.* 183. *Erythræa.* Swertia.* Chlora.* Menyanthes.* Villarsia,* Suppl. f.* 184. *Spigelia,* which Von Martius has removed to a distinct Order, *Spigeliaceæ.*

Ord. CXXXIII. LOGANIACEÆ. *Br.* Logania Family.

Calyx inferior, 5-parted. Corolla regular or irregular, with convolute æstivation. Stamens situated on the corolla, all placed on the same line, 5 or 1: pollen with 3 bands. Ovary free, 2-celled: style continuous: stigma simple. Fruit either capsular or 2-celled with placentas finally becoming loose, or drupaceous with 1—2-seeded stones. Seeds peltate, with a finely reticulated integument, sometimes winged: albumen fleshy or cartilaginous. Embryo with the radicle turned towards the hilum.—*Shrubs, herbaceous plants or trees, of tropical India, Africa, and New Holland. Leaves opposite, entire, usually with stipules which are combined in the form of interpetiolary sheaths. Flowers racemose, corymbose or solitary.*

Ex. *Logania. Gærtneria. Pagamæa.*

Ord. CXXXIV. POTALIACEÆ. *Mart.* Potalia Family.

Calyx inferior, with 4, 5 or 6 divisions. Corolla regular, with 5—10 divisions; æstivation twisted, convolute. Stamens arising from the corolla, all upon the same line: pollen simple, elliptical. Ovary superior: style continuous: stigma simple. Fruit succulent, with from 2—4 cells and central placentas. Seeds numerous, peltate: testa double. Embryo supposed by Von Martius to have its radicle turned away from the hilum, lying in a cartilaginous albumen.—*Tropical trees or shrubs, quite glabrous. Leaves opposite, entire, united by interpetiolary, sheathing stipules. Flowers terminal, bracteated, in panicles or corymbs.*

Ex. *Potalia. Fagræa.*

Ord. CXXXV. BIGNONIACEÆ. *Br.* Trumpet-flower Family, *Suppl. f.* 181.

Calyx monophyllous, divided or entire, sometimes spathaceous. Corolla monopetalous, hypogynous, often irregular, 4—5-lobed. Stamens: filaments 5, unequal, generally 4, sometimes 2 or all are antheriferous: anthers 2-celled; the cells equal in their insertion. Ovary surrounded by a glandular disk, 2-celled, or imperfectly 4-celled, many-seeded: style 1: stigma of 2 plates. Capsule 2-valved, 2-celled, sometimes imperfectly 4-celled: dissepiment parallel with, or contrary to, the valves, eventually free, bearing the seeds at the commissure along with the valves. Seeds tranverse, foliaceous, compressed. Albumen none. Embryo straight, foliaceous; radicle centrifugal.—*Chiefly tropical trees or shrubs, often twining or scandent. Leaves opposite, or very rarely alternate, compound, or occasionally simple, without stipules. Inflorescence terminal, somewhat panicled.*

Ex. *Bignonia, Suppl. f.* 181. *Tecoma. Jacaranda.*

Ord. CXXXVI. DIDYMOCARPEÆ. *Don,* (Cyrtandraceæ, *Jack*) Didymocarpus Family.

Calyx campanulate, 5-cleft, or 5-leaved, equal. Corolla tubular, irregular, 5-lobed, somewhat 2-lipped, the lobes imbricated in æstivation. Stamens 4, didynamous, of which 2 are sometimes sterile: anthers 2-celled. Ovary free, elongated, surrounded by an annular disk, 1-celled, with 2 many-seeded placentas, each of which consists of 2 diverging plates: style filiform: stigma 2-lobed, or consisting of 2 plates. Fruit capsular or succulent; the former siliquiform and

2-valved, 1-celled, with double longitudinal placentas, which often cohere, so as to give the appearance of 2 cells. Seeds very numerous, minute, suspended, naked or comate. Albumen none. Embryo straight, cylindrical: radicle next the hilum.—*Chiefly tropical plants of the Old World, terrestrial or parasitical, usually herbaceous and stemless, occasionally caulescent, and sometimes shrubby. Leaves usually opposite or radical. Flowers umbellate, often purple or pink.*

Ex. *Cyrtandra. Didymocarpus.*

Ord. CXXXVII. PEDALINEÆ. *Br.* Oil-seed Family.

Calyx with 5 nearly equal divisions. Corolla monopetalous, hypogynous, irregular; the throat swollen; the limb 2-lipped. Stamens 4, didynamous, included, with the rudiments of a fifth. Ovary surrounded below with a glandular disk, many-celled; the cells 1—2-seeded. Style 1: stigma divided. Fruit a juiceless, muricated, many-celled drupe. Seeds with a thin papery testa. Albumen none. Embryo straight.—*Tropical herbs; with opposite leaves and axillary flowers, having 2 bracteas. The seeds of* Sesamum *yield a great quantity of fixed oil.*

Ex. *Sesamum. Pedalium. Martynia. Josephinia.*

Ord. CXXXVIII. POLEMONIACEÆ. *Juss.* Greek-Valerian Family, *Suppl. f.* 180.

Calyx free, of 1 piece with 5 divisions, persistent, sometimes irregular. Corolla regular, 5-lobed. Stamens 5, inserted into the middle of the tube of the corolla, and alternate with its segments. Ovary 3-celled, with a few or many ovules: style simple: stigma trifid: ovules ascending or peltate. Capsules 3-celled, 3-valved, few or many-seeded, opening between the dissepiments, or opposite to them; the valves separating from the axis. Seeds angular or oval, or winged, often enveloped in mucus, ascending. Embryo straight in the axis of a horny albumen: radicle inferior: cotyledons elliptical, foliaceous.—*Herbaceous plants of temperate climates,* *having their maximum in North-west America, with opposite or occasionally alternate, simple or compound leaves:* Cobæa *has a climbing stem.*

Ex. *Polemonium.* Phlox, Collomia. Ipomopsis, Suppl. f.* 180. *Cobæa.*

Ord. CXXXIX. HYDROLEACEÆ. *Br.* Hydrolea Family.

Calyx 5-partite, free, persistent, with an imbricated æstivation. Corolla hypogynous, monopetalous, regular. Stamens situated on the corolla, regular, agreeing in number with the segments of the calyx: anthers deeply lobed at the base. Ovary superior, surrounded by an annular disk, 2—3-celled, opening through the middle of the cells, the dissepiments attached to the valves: placentas either single and spongy, or double and thin. Seeds indefinite, very small. Albumen fleshy, with a straight cylindrical embryo in its axis.—*Herbaceous plants or small shrubs, sometimes spiny. Leaves alternate, entire or lobed, without stipules, often clothed with glandular or stinging hairs.*

Ex. *Hydrolea. Nama. Diapensia.*

Ord. CXL. CONVOLVULACEÆ. *Juss.* Bind-weed Family, *Suppl. f.* 179.

Calyx with 5 divisions, persistent. Corolla monopetalous, hypogynous, regular; the limb 5-fid, generally plaited, deciduous. Stamens 5, inserted at the bottom of the corolla and alternate with its segments. Ovary single, with an annular gland at the base, 2—4-celled, rarely imperfectly 1-celled, sometimes 2—4-partite, with few definite, erect ovules, when more than one, collateral: style 1, often divided at the apex, sometimes as far as the base: stigmas obtuse or acute. Capsule 1—4-celled, the margins of the valves corresponding to the angles of a free dissepiment, bearing the seeds at its base, sometimes without valves or opening transversely (*capsula circumscissa*). Seeds with a small quantity of mucilaginous albumen. Embryo curved: cotyledons wrinkled: radicle inferior.—*Herbs or shrubs chiefly of the tropics, generally climbing and milky, glabrous or with a simple pubescence. Leaves alternate, undivided or lobed, rarely pinnatifid, without stipules. Inflorescence axillary or terminal; peduncles* 1- *or many-flowered, the pedicels often with two bracteas.*

The roots yield a copious acrid and purgative milky juice. *Convolvulus Jalapa* affords Jalap, and *C. Scammonia* the Scammony, and many others may be employed medicinally. An esculent root, the Sweet Potatoe, is afforded by *Convolvulus Batatas.*—Ex. *Convolvulus,** *Suppl. f.* 179. *Cuscuta ;** climbing leafless parasites. *Falkia.*

ORD. CXLI. BORAGINEÆ. *Juss.* (including *Cordiaceæ*, *Br.* and *Heliotropiaceæ* and *Ehretiaceæ* of Martius). Borage Family, *Suppl. f.* 178.

Calyx with 5 (rarely 4) divisions, persistent. Corolla hypogynous, monopetalous, mostly regular, 5- sometimes 4-cleft; its æstivation imbricated. Stamens inserted upon the corolla, of the same number with its segments, rarely more. Ovary 4-partite, 4-seeded or simple, and 2—4-celled; ovules definite, pendulous. Nucules 4, distinct or combined below; sometimes a 4-celled drupe, or a berry with 2—4 bony seeds. Seeds without albumen or nearly so. Embryo inverted.—*Herbs or shrubs, most abundant in the temperate latitudes of the northern hemisphere. Leaves alternate, without stipules, generally rough. Flowers frequently in secund spikes, sometimes panicled or corymbose, sometimes axillary, solitary.*

The mucilaginous and emollient properties of this family are well known. The roots of several yield dyes.—Ex. *Heliotropium*, constituted by Martius a distinct Order, on account of the coherent nucules eventually separating into 4 pieces, and of the style, which is continuous from the apex of the ovarium. *Echium.** *Pulmonaria.** *Lithospermum,** *Suppl. f.* 178. *Symphytum.** *Borago.** *Lycopsis.** *Anchusa.** *Myosotis.** *Asperugo.** *Cynoglossum.** *Cordia. Ehretia.*

ORD. CXLII. HYDROPHYLLEÆ. *Br.* Water-leaf Family.

Calyx with 5 or 10 divisions. Corolla monopetalous, regular or nearly so, hypogynous, 5-lobed, with 2 plates at the base of each lobe. Stamens alternate with the segments of the corolla, in æstivation inflexed: anthers ovate, innate, 2-celled, bursting longitudinally. Ovary simple, 1-celled, free, with slight traces of an hypogynous disk: style simple or divided, terminal: stigma bifid: ovules attached to 2 parietal or fungous stalked placentas, either definite or indefinite. Fruit capsular, few- or many-seeded, invested with the permanent calyx. Seeds definite or indefinite, suspended. Embryo cylindrical, lying towards the end of the albumen, which is abundant and somewhat cartilaginous, its radicle superior and next the hilum.—*Herbaceous, hispid, American plants. Leaves either opposite or alternate, and lobed. Peduncles opposite the leaves.*

Ex. *Hydrophyllum. Nemophila. Phacelia.*

Ord. CXLIII. SOLANEÆ. *Juss.* Nightshade Family, *Suppl. f.* 177.

Calyx with 5 (rarely 4) divisions, persistent. Corolla monopetalous, hypogynous, the limb 5- (rarely 4-) cleft, regular or a little unequal, deciduous; its æstivation, in the true genera plaited, in the spurious genera imbricated. Stamens inserted upon the corolla, as many as there are segments to the corolla and alternate with them, one sometimes abortive. Ovary 1, 2—4-celled, many-seeded; style 1; stigma obtuse, rarely lobed. Pericarp 2—4-celled; either a capsule with a double dissepiment parallel with the valves; or a berry with placentas adnate with the dissepiment. Seeds numerous, sessile. Albumen fleshy. Embryo included, more or less curved, often out of the centre: radicle directed to the hilum.—*Herbs or shrubs, most abundant in the tropics. Leaves alternate, undivided or lobed, the floral ones sometimes in pairs. Inflorescence various, often remote from the axil; pedicels bracteated.*

Closely allied, as Mr. Brown observes, to *Scrophularinæ*, differing chiefly in the curved or spiral embryo, in the plaited æstivation of the corolla and in the usually regular flowers, with the same number of stamens as there are segments of the corolla. Thus those with the corolla not plaited, and with a straight embryo, constitute a separate section, to which Mr. Lindley has added a third, the *Nolana* Tribe. Those of the first section or tribe are eminently narcotic and exciting, many of them dangerous poisons; which qualities however vary in degree in different individuals: thus what exists in the Potatoe is dissipated by heat, and the tubers are rendered quite wholesome. The Mullein Tribe are inert or mucilaginous.

TRIBE I. SOLANEÆ. True Nightshade Tribe.—Corolla mostly of a lurid colour, with the limb usually plaited. Stamens equal in number with the segments of the corolla. Embryo much curved.—Ex. *Solanum*,* *Suppl. f.* 177; *S. tuberosum* is the common Potatoe; *S. Dulcamara*, the Bitter-sweet; *S. esculentum*, the Egg-plant, whose fruit, with that of several others, is used in cookery; *S. pseudo-quina* is a bitter and febrifuge, esteemed by the Brazilians equal to the *Cinchona*. *Atropa*;* *A. Belladonna* is the Deadly Nightshade. *Datura*.* *Hyoscyamus*,* the Henbane. *Capsicum*. *Physalis*. *Nicotiana*, the Tobacco.

TRIBE II. NOLANEÆ. Nolana Tribe.—Corolla plaited. Stamens equal in number to the lobes of the corolla. Ovary divided into 5 or more deep lobes. Fruit drupaceous. Embryo much curved. —Ex. *Nolana*.

TRIBE III. VERBASCEÆ. Mullein Tribe.—Corolla not plaited. Stamens 5 and unequal or didynamous. Embryo slightly curved.—Ex. *Verbascum*.* *Cassia*. *Anthocercis*.

ORD. CXLIV. OROBANCHEÆ. *Juss.* Broom-Rape Tribe.

Calyx of one piece, bracteated, sometimes cut into deep bracteiform laciniæ. Corolla hypogynous, monopetalous, irregular, with a bilabiate limb, marcescent. Stamens 4, inserted upon the corolla, didynamous. Ovary single, free, 1-celled, many-seeded: style 1; stigma simple or 2-lobed: capsule 1-celled, 2-valved; the valves free, bearing the placentas in the middle. Seeds numerous, very minute. Albumen fleshy or horny, including the small embryo in a lateral hilum near the apex.—*Extra-tropical, leafless, scaly plants, of the northern hemisphere, often parasitic upon the roots of other plants, lurid, never green. Flowers solitary or in spikes.*

Ex. *Orobanche*.* *Lathræa*.* *Phelypæa*.

Ord. CXLV. SCROPHULARINÆ. *Juss.* Figwort Family, *Suppl. f.* 2. *f.* 171, & 175, & 176.

Calyx divided, persistent. Corolla monopetalous, hypogynous, often irregular, with an imbricated æstivation, deciduous. Stamens generally 4, didynamous, rarely equal, sometimes 2. Ovary many-seeded, 2-celled: style 1; stigma 2-lobed, rarely undivided. Capsule (or very seldom a berry,) 2-celled, 2—4-valved, the valves entire or bifid, with the dissepiment either double, from the inflexed margins of the valves; or simple, parallel with the valves and entire; or opposite to them. Placentas central, adnate with the dissepiment or separable from it. Seeds numerous, albuminose. Embryo included, straight: radicle directed towards the hilum.—*Widely extended herbs, rarely shrubs, mostly with opposite leaves, and varied inflorescence.*

Generally acrid bitter plants, frequently employed as purgatives or emetics.—Ex. (With 2 stamens.) *Veronica,* Suppl. f.* 2. *Gratiola,* a powerful purgative.—(With four anther-bearing stamens.) *Bartsia,* Suppl. f.* 171. *Euphrasia,** the Eyebright. *Rhinanthus.* Melampyrum.* Pedicularis.* Antirrhinum,* Suppl. f.* 175. *Linaria.* Scrophularia.* Digitalis,** the Foxglove. *Limosella.* Sibthorpia,* Suppl. f.* 176.

Ord. CXLVI. LABIATÆ. *Juss.* Labiate Family, *Suppl. f.* 21, 22.

Calyx tubular or regular and quinquefid, or 5—10-toothed or 2-lipped, the lips entire or divided. Corolla monopetalous, hypogynous, tubular, irregular. Upper lip undivided or bifid; in æstivation overlapping the inferior trifid one. Stamens 4, didynamous, 2 of them sometimes sterile; filaments inserted alternately with the lobes of the lower lip: anthers 2-lobed, the lobes often divaricated, sometimes 1-celled. Ovaries 4, 1-seeded, connected at the base by means of the style, situated upon a glandular disk: ovules erect: style 1, originating from the receptacle: stigma bifid, usually acute. Fruit of 4 achenia or small nuts enclosed in the persistent calyx, one or more not unfrequently abortive: albumen little or none. Embryo erect: cotyledons plane.—*Herbs, rarely shrubs, chiefly of the temperate regions of the Old World, with a square stem and opposite branches. Leaves opposite, without stipules, simple, undivided or lobed. Flowers opposite, whorled, capitate, spiked or solitary, axillary or terminal, bracteated or naked.*

An extensive Natural Family, abounding in essential oils, as the Lavander, Thyme, Mint, &c. They are tonic and stomachic, and many are employed in medicine, and others as savoury herbs.—Ex. (Stamens 2, fertile). *Lycopus.** *Rosmarinus.* *Salvia.**—(Stamens 4, fertile.) *Mentha.** *Thymus.** *Origanum;** Marjoram. *Teucrium.** *Hyssopus.* *Ajuga.** *Ballota;** Horehound.* *Leonurus.** *Galeobdolon.** *Galeopsis.** *Lamium,** *Suppl. f.* 21, 22. *Betonica.** *Stachys.** *Nepeta.** *Lavandula*, the Lavander. *Glechoma.** *Marrubium;** White Horehound. *Acinos.** *Calamintha.** *Clinopodium.** *Melittis.** *Prunella.** *Scutellaria.**

Ord. CXLVII. VERBENACEÆ. *Juss.* Vervain Family, *Suppl. f.* 174.

Calyx tubular, persistent. Corolla hypogynous, monopetalous, tubular, with the limb generally irregular, deciduous. Stamens usually 4, didynamous, rarely equal, sometimes 2. Ovary 2- or 4-celled, with erect, solitary, or geminate ovules: style 1: stigma bifid or undivided. Pericarp a drupe or berry: albumen little or none: embryo erect.—*Trees or shrubs, rarely herbs, chiefly abounding in the warmer parts of America. Leaves without stipules, generally opposite, simple or compound. Flowers in opposite corymbs, or alternately spiked, sometimes in crowded heads, rarely axillary or solitary.*

Ex.—*Clerodendron.* *Vitex.* *Callicarpa.* *Verbena,** *Suppl. f.* 174. *Tectona* is the Teak, whose hard wood is most extensively employed for ship-building in the East Indies and in the British navy.

Ord. CXLVIII. MYOPORINEÆ. *Br.* Myoporum Family.

Calyx 5-partite, persistent. Corolla monopetalous, hypogynous, nearly equal or 2-lipped. Stamens 4, didynamous, sometimes with the rudiment of a fifth, which rarely bears pollen. Ovary 2—4-celled; cells 1—2-seeded, with pendulous ovules; style 1: stigma rarely divided. Drupe with a 2—4-celled putamen; the cells 1—2-seeded: seeds albuminose. Embryo cylindrical: radicle superior.—*Scarcely pubescent shrubs, chiefly of the Southern hemisphere, most abundant in New Holland. Leaves simple, without stipules, alternate or opposite. Flowers axillary, without bracteas, except in* Avicennia.

Ex. *Myoporum. Stenochilus. Avicennia,* which is the White Mangrove of Brazil, used in that country for tanning.

Ord. CXLIX. SELAGINEÆ. *Juss.* Selago Family.

Calyx tubular, persistent, with a definite number of teeth or divisions, rarely consisting of 2 sepals. Corolla tubular, hypogynous, more or less irregular, with 5 lobes. Stamens 4, usually didynamous, arising from the top of the tube of the corolla, seldom 2: anthers usually adnate with the dilated top of the filament, rarely versatile. Ovary very minute: style 1, filiform. Fruit 2-celled, the cells either separable or inseparable, 1-celled, membranaceous. Seed solitary, erect. Embryo in the axis of a fleshy albumen: radicle inferior.—*Herbaceous plants, or small branched shrubs, natives exclusively of Southern Africa. Leaves alternate, usually sessile, toothed or entire, often fascicled. Flowers sessile, spiked, with large bracteas.*

Ex. *Selago. Hebenstreitia.*

Ord. CL. ACANTHACEÆ. *Juss.* Acanthus Family, *Suppl. f.* 172.

Calyx with 5 or 4 divisions, or tubular, equal or unequal, rarely multifid, or entire and obsolete, persistent. Corolla monopetalous, hypogynous, bearing the stamens, generally irregular; the limb ringent or 2-lipped, rarely 1-lipped, sometimes nearly equal, deciduous. Stamens generally 2, antheriferous, sometimes 4 and didynamous, the shorter ones occasionally sterile: anthers either 2-celled, with the cells unequal or equal in regard to their insertion; or 1-celled, bursting longitudinally. Ovary surrounded by a glandular disk at its base, 2-celled; the cells 2- or many-seeded: style 1; stigma 2-lobed, rarely undivided. Capsule 2-celled, the cells 2- or many-seeded, sometimes, by imperfection, 1-seeded, elastically 2-valved, the dissepiment opposite to the valves, separable into 2 pieces through the axis, (the middle being sometimes open :) these pieces are attached to the valves, occasionally separating elastically from them ; entire, or sometimes spontaneously dividing in 2; their inner margin bearing the seeds. Seeds roundish, generally subtended by subulate ascending processes of the dissepiment : testa loose. Albumen none. Embryo curved or straight : cotyledons large, nearly orbicular : radicle cylindrical, descending, and at the same time centripetal, curved or straight; plumule conspicuous.—*Herbs or shrubs, chiefly inhabiting the tropics ; with the pubescence, when present, simple, sometimes capitate, rarely stellate. Leaves opposite, occasionally quaternate, without stipules, simple, undivided, entire or serrated, rarely sinuated or slightly lobed. Inflorescence terminal or axillary, spiked, racemose, fasciculate, panicled or solitary. Flowers generally in opposite, sometimes in alternate spikes, with 3 bracteas, the lateral ones rarely wanting, sometimes large, foliaceous, and occasionally including the minute obsolete calyx.*

Ex. *Justicia, Suppl. f.* 172. *Ruellia. Acanthus.*

Ord. CLI. LENTIBULARIÆ. *Rich.* Butterwort Family, *Suppl. f.* 170.

Calyx divided, persistent. Corolla monopetalous, hypogynous, irregular, spurred and 2-lipped. Stamens 2, included, inserted at the bottom of the corolla. Ovary 1-celled : style 1, very short : stigma 2-lipped. Capsule 1-celled, many-seeded, with a large central placenta. Seeds small, without albumen : embryo sometimes undivided.—*Aquatic or marsh, herbaceous plants, with the radical leaves undivided or compound, root-like and bearing bladders. Scapes with stipuliform, minute scales, or destitute of them, sometimes with whorled vesicles, usually undivided, single-flowered or with many-flowered racemes or spikes. Flowers with a single bractea or rarely none.*

Ex. *Pinguicula.* Utricularia,* Suppl. f.* 170.

Ord. CLII. PRIMULACEÆ. *Vent.* Primrose Family, *Suppl. f.* 169.

Calyx divided, 5-rarely 4-cleft, regular, persistent. Corolla of 1 petal, hypogynous, regular, with the limb in 5, rarely 4, divisions. Stamens inserted upon the corolla, as many as there are calycine segments, and opposite to them. Ovary 1-celled: style 1: stigma capitate. Capsule valvate, with a free central placenta. Seeds numerous, peltate, albuminose. Embryo included, parallel with the hilum: radicle with no determinate direction.—*Herbs, chiefly of the temperate and cold parts of the Old World. Leaves often opposite, sometimes whorled or scattered.*

Ex. *Anagallis,** *Suppl. f.* 169. *Cyclamen.** *Lysimachia.** *Hottonia.** *Primula.** *Centunculus.** *Trientalis.** *Samolus.** *Glaux,** (which Mr. Don refers to *Plantagineæ.*) *Dodecatheon. Androsace.*

Ord. CLIII. GLOBULARINÆ. *DC.* Globularia Family.

Calyx of 1 piece, tubular, 5-lobed. Corolla hypogynous, inserted upon the receptacle, tubular, 5-lobed. Stamens 4—5, inserted upon the top of the tube, and alternate with the lobes of the corolla: anthers inserted by the middle of the back, 1-celled. Ovary free, oval, 1-celled, with a single pendulous ovule. Style bifid. Fruit oval, 1-seeded, covered with the persistent calyx. Embryo straight: radicle superior. Albumen fleshy.—*Herbs, or small shrubs, of the temperate parts of Europe, with alternate leaves. Flowers capitate, surrounded by a many-leaved involucre, placed on a convex, chaffy receptacle.*

This is, by some authors, arranged next to *Dipsaceæ.*—Ex. *Globularia*:—A tonic and purgative bitter.

Ord. CLIV. PLUMBAGINEÆ. Lead-wort Family, *Suppl. f.* 168.

Calyx tubular, plaited, persistent. Corolla of 1 or 5 petals, equal. Stamens definite, hypogynous in the monopetalous corollas! inserted upon the petals in the polypetalous ones! Ovary 1, free, 1-seeded, with the ovule inverted, pendulous from the apex of a stalk arising from the bottom of the ovary. Styles 5! (rarely 3 or 4;) stigmas as many. Fruit an almost valveless utricule. Seed inverted: integument simple. Embryo straight: radicle superior.—*Herbaceous or suffrutescent plants, frequently growing on the sea-coast, in various situations, and with a very diversified aspect. Leaves alternate or clustered, undivided, somewhat sheathing at the base. Flowers spiked or capitate.*

Ex. *Plumbago:* acrid and employed as a vesicatory. *Statice,* Suppl. f.* 168; *S. Caroliniana* is a powerful astringent.

Ord. CLV. PLANTAGINEÆ. *Juss.* Rib-grass Family, *Suppl. f.* 166.

Flowers perfect, or separated. In the Perfect Flowers; calyx (?) 4-partite, persistent: corolla (?) monopetalous, tubular, hypogynous, scariose, persistent; the limb 4-partite. Stamens 4, inserted upon the tube, alternate with its segments; filaments exserted, flaccid, with an induplicate æstivation: anthers 2-celled, the cells placed close together, side by side, bursting longitudinally. Ovary sessile, without any disk, 2- rarely 4-celled, the ovules peltate, solitary, in pairs or indefinite. Style 1, capillary: stigma slightly hispid, undivided, rarely cleft. Capsule opening transversely, with a longitudinal dissepiment, at length free. Seeds sessile on the dissepiment, solitary or 2, sometimes indefinite: testa mucilaginous. Albumen of the same shape as the seed, fleshy. Embryo in the centre of the albumen, straight: radicle inferior. —In the separated flowers: Sterile Fl. Calyx and corolla as in the perfect flowers. Stamens inserted upon the receptacle: rudiment of the pistil minute.—Fertile Fl. Calyx none, unless the bracteas be considered as such. Corolla urceolate, undivided, contracted at the mouth, obsoletely toothed. Stamens none. Ovary 1-seeded, with an erect ovule. Style and stigma as in the perfect flowers. Capsule opening transversely. —*Herbs universally dispersed. Stems generally short, or scarcely any. Radical leaves crowded, sometimes subcylindrical, with the* *axils woolly. Scapes axillary, not often terminal, undivided. Flowers spiked, rarely somewhat solitary, each with a single bractea.*

Slightly bitter and astringent plants; their seeds mucilaginous. —Ex. *Plantago,* Suppl. f.* 166. *Littorella.**

SUBCLASS IV. MONOCHLAMYDEÆ.† Perianth single; the calyx and corolla forming but one floral covering, or altogether wanting.

DIV. I. Flowers perfect: each usually with stamens and pistil.

ORD. CLVI. NYCTAGINEÆ. *Juss.* Marvel of Peru Family, *Suppl. f.* 167.

Perianth tubular, somewhat coloured, constricted in the middle; the limb entire or toothed, æstivation plaited. Stamens definite, hypogynous: anthers 2-celled. Ovary 1-seeded, with an erect ovule: style 1; stigma 1. Fruit a thin utricule, included in the enlarged persistent tube of the perianth. Seed destitute of proper integument, (its testa being adnate with the utricule.) Albumen mealy, included in a sinus of the embryo. Embryo with foliaceous cotyledons: radicle inferior: plumule inconspicuous.—*Herbaceous or shrubby, or arborescent plants, chiefly natives of warm climates. Leaves opposite, generally unequal, rarely alternate. Flowers axillary or terminal, crowded or solitary, with an involucre, which is common or partial, monophyllous or polyphyllous, sometimes minute.*

Ex. *Mirabilis* (a purgative), *Suppl. f.* 167. *Boerhaavia. Pisonia.*

ORD. CLVII. AMARANTHACEÆ. *Juss.* Amaranth Family, *Suppl. f.* 164, 165.

Perianth 3- or 5-leaved, hypogynous, scariose, persistent, occasionally with two small bracteas at the base. Stamens hypogynous, either 5, or some multiple of that number, distinct or monadelphous, occasionally some are abortive: anthers either 2-celled, or 1-celled. Ovary single, superior,

† From μονος, *one*, and χλαμυς, a tunic or covering.

1- or few-seeded: ovules pendulous from a free central stalk: style 1, or none: stigma simple or compound. Fruit a membranous utricule. Seeds lentiform, pendulous: testa crustaceous. Albumen central, farinaceous, with the embryo curved round its circumference: radicle next the hilum: plumule inconspicuous.—*Herbs or shrubs, chiefly of hot climates. Leaves simple, opposite, or alternate, without stipules. Flowers in heads or spikes, usually coloured, occasionally separated, generally perfect. Pubescence simple, the hairs divided by internal partitions.*

Closely allied, along with the two following Orders, to *Caryophylleæ* among the THALAMIFLORÆ. Many of the species are used as potherbs.—Ex. *Amaranthus,** *Suppl. f.* 165. *Gomphrena. Celosia. Achyranthes, Suppl. f.* 164.

ORD. CLVIII. CHENOPODEÆ. *Vent.* Goose-foot Family, *Suppl. f.* 163.

Perianth monophyllous, deeply divided, sometimes tubular at the base, persistent, with an imbricated æstivation. Stamens inserted at the bottom of the perianth, and opposite to its segments, equal in number to them, or fewer. Ovary single, free, rarely adherent with the tube of the perianth, with a single ovule fixed to the bottom of the cavity: style divided, 2—4-fid, rarely simple: stigmas undivided. Pericarp membranous, valveless, sometimes a berry. Embryo curved round a farinaceous albumen; or spiral or bicrural, without albumen: radicle next the hilum: plumule inconspicuous. —*Generally distributed herbs or low shrubs, especially in temperate regions. Leaves alternate, without stipules, sometimes opposite. Flowers small, sometimes polygamous.*

Of this Order, likewise, many individuals are potherbs; some are tonic and antispasmodic; others, the saline species, yield a great quantity of carbonate of soda. *Chenopodium olidum* exhales pure ammonia.—Ex. *Basella. Salsola.** *Salicornia.** *Chenopodium;** *C. ambrosioides* and *C. Botrys* contain an essential oil. Wormseed oil, a powerful anthelmintic, is procured from *C. anthelminticum. Atriplex,** *Suppl. f.* 163; *A. hortensis,* the garden Orache. *Spinacia,* the Spinach. *Beta,** the Beet. *Blitum.*

Ord. CLIX. PHYTOLACCEÆ. *Br.* Virginian Poke-weed Family.

Perianth of 4 or 5 petaloid leaves. Stamens perigynous, either indefinite, or if equal to the number of divisions of the perianth, alternate with them. Ovary 1- many-celled; each cell containing 1 ascending ovule; styles and stigmas equal in number to the cells. Fruit baccate or dry, entire or deeply lobed, 1- many-celled. Seed ascending, solitary, with a cylindrical embryo, curved round a mealy albumen, with the radicle next the hilum.—*Herbaceous or somewhat shrubby, extra-European and chiefly tropical plants. Leaves alternate, entire, without stipules, often with pellucid dots. Flowers racemose.*

Ex. *Phytolacca;* introduced into Europe, it is said, for the purpose of colouring wine with its berries: its pulverized root is emetic. *Rivina.*

Ord. CLX. PETIVERIACEÆ. *Ag.* Petiveria Family.

Perianth of several distinct leaves. Stamens perigynous, either indefinite, or if equal to the segments of the perianth, alternate with them. Ovary free, 1-celled. Styles 3 or more: stigma lateral: ovule erect. Fruit 1-celled, indehiscent, dry. Seed erect, without albumen. Embryo straight: cotyledons convolute; radicle inferior.—*Herbaceous or somewhat shrubby plants, of the tropical parts of the New World, with an alliaceous odour. Leaves alternate, entire, with distinct stipules, often with minute pellucid dots. Flowers racemose.*

Scarcely different from *Phytolacceæ,* with which most botanists unite it.—Ex. *Petiveria. Seguiera.*

Ord. CLXI. POLYGONEÆ. *Juss.* Buck-Wheat Family, *Suppl. f.* 162.

Perianth monophyllous, divided, with an imbricated æstivation. Stamens definite, inserted at the bottom of the perianth: cells of the anthers opening longitudinally. Ovary free, 1-seeded, with a single erect ovule: styles and stigmas several. Albumen farinaceous, sometimes almost none. Embryo inverted, generally on one side. Plumule inconspicuous.—*Herbs, rarely shrubs, common to almost every part of the world. Leaves alternate, sheathing at the base or adnate with an intrafoliaceous sheath* (ochrea), *revolute when young. Flowers sometimes separated, generally racemose.*

The plants of this Order, generally speaking, possess an acid and astringent principle in their stems and leaves, while the roots are nauseous and purgative. The farinaceous or mealy albumen may be used as food.—Ex. *Polygonum ;* Suppl. f.* 162. Some species of this genus are so powerfully acrid as to raise blisters on the skin. *Coccoloba* is highly astringent. *Rumex :** the Dock and Sorrel; *R. acetosa* containing pure oxalic acid. *Rheum*, the Rhubarb; the true oriental drug, so called, is now ascertained to be the root of *R. Emodi. Oxyria :** the leaves of this are acid, and chewed in small quantities, are very agreeable for quenching thirst, like the foliage of *Oxalis Acetosella.*

Ord. CLXII. BEGONIACEÆ. *Br.* Begonia Family.

Flowers separated. Tube of the coloured perianth adnate with the ovary; limb, in the sterile flowers, of 4 pieces or leaves, 2 within the others and smaller: in the fertile, of 5 leaves, imbricated, 2 smaller than the rest. Stamens indefinite, distinct or combined into a solid column: anthers collected into a head, 2-celled, continuous with the filaments, clavate, the *connectivum* very thick, the cells minute, bursting longitudinally. Ovary winged, 3-celled, with 3 double polyspermous placentas in the axis; stigmas 3, 2-lobed, sessile, somewhat spiral. Fruit membranous, capsular, winged, 3-celled, with an indefinite number of minute seeds; bursting by slits at the base on each side of the wings. Seeds with a transparent thin testa, marked by reticulations, which are oblong at the sides and contracted at either extremity: embryo very cellular, without albumen, with a blunt round radicle next the hilum.—*Herbaceous or suffrutescent plants, common in the East and West Indies, and the warmer parts of South America. Leaves alternate, toothed, oblique at the base. Stipules scariose. Flowers cymose, pink or white.*

The situation of this Order is extremely doubtful, some authors placing it near *Umbelliferæ*. Mr. Lindley once considered it allied to *Hydrangeæ* in *Saxifragaceæ*, but he now ranges it next to *Polygoneæ*, in consequence of the acid juice, large membranous stipules, the frequently coloured perianth and 3-cornered fruit.—Ex. *Begonia ;* a genus remarkable for the curious obliquity or inequality of the 2 sides of its leaves, which are also frequently of different colours above and below, sometimes with spots like silver, arising from the absence of parenchyme immediately beneath a portion of the epidermis. The flowers also are showy.

Ord. CLXIII. LAURINEÆ. *Juss.* Laurel Family, *Suppl. f.* 161.

Perianth monophyllous, 4—6-cleft, with an imbricated æstivation; the limb sometimes obsolete. Stamens definite, perigynous, placed opposite the segments of the perianth and most frequently double, the 3 innermost which are opposite the 3 inner segments of the perianth, sterile or deficient, the 6 exterior generally perfect: anthers adnate, 2—4-celled, the cells bursting by a longitudinal and persistent valve, from the base to the extremity; the exterior ones with the valves on the inner face, the interior with the valves on the outer face. Glands are generally present at the base of the interior filaments. Ovary single, free, with the ovule pendulous; style simple; stigma obtuse. Fruit a berry or drupe, naked or covered. Seed without albumen. Embryo inverted: cotyledons large, plano-convex, peltate near the base: radicle very short, included, superior: plumule inconspicuous, of 2 leaves.—*Trees, often very lofty, chiefly tropical, unknown on the continent of Africa, (excepting the genus* Cassytha, *which is a parasitical (!) twining, leafless plant, with the flowers spiked, each flower with three bracteas.) Leaves without stipules, alternate, rarely opposite, entire, scarcely ever lobed. Inflorescence panicled or umbellate.*

An Order of very great importance, on account of its valuable products. Though in English, the name of Laurel is almost entirely confined to a species of Plum, *Prunus Lauro-cerasus*, and thus diverted from its proper application, those plants are the true species of Laurel which yield cinnamon, camphor, and cassia. The Sassafras nuts of the shops are the fruit of *Laurus Pucheri* (of Ruiz and Pavon): the Avocado, or Alligator Pear, that of *Laurus Persea* (of Willdenow). *L. Benzoin* is aromatic and tonic, its fruit stimulant. The Laurel Oil, lately introduced from the banks of the Oronoco, flows from the wounded trunk of a species of Laurel, probably *L.* (*Ocotea*) *cymbarum* of Humboldt.—Ex. *Laurus*, *Suppl. f.* 161, which some writers divide into the genera *Laurus*, *Persea* and *Cinnamomum*.

Ord. CLXIV. HERNANDIEÆ. *Blume.* Hernandia Family.

Flowers separate or perfect, with an involucellum to the perfect or fertile flowers. Perianth petaloid, free, tubular, 4—8-parted, deciduous. Stamens definite, inserted into the perianth in two rows, of which the outer is often sterile: anthers bursting longitudinally. Ovary free, 1-celled: ovule pendulous: style 1 or none: stigma peltate. Drupe fibrous, 1-seeded. Seed solitary, pendulous. Embryo without albumen, inverted: cotyledons somewhat lobed, shrivelled, oily.—*Trees of the Indian Archipelago and Guiana. Leaves alternate, entire. Spikes or corymbs axillary or terminal.*

An Order of very doubtful affinity, with which Blume unites *Inocarpus*, whose nuts are esculent.—Ex. *Hernandia.* The juice of its leaves removes the hair without causing pain.

Ord. CLXV. MYRISTICEÆ. *Br.* Nutmeg Family.

Flowers diœcious. Perianth monophyllous, trifid, with a valvate æstivation.—Sterile Fl. Filaments closely united into a column: anthers definite, 2—12, 2-celled, turned outwards, with the cells opening longitudinally, connate or distinct.—Fertile Fl. Perianth deciduous. Ovary free, sessile, 1-seeded, with an erect ovule: style very short: stigma somewhat lobed. Fruit a capsular, 2-valved berry (?) Seed nut-like, with a much divided arillus. Albumen ruminate, fatty and fleshy. Embryo small: cotyledons foliaceous: radicle inferior: plumule conspicuous.—*Tropical trees, yielding a reddish juice. Leaves alternate, without stipules or dots, entire, petioled, coriaceous; when full grown generally clothed beneath with a reddish appressed down. Inflorescence axillary or terminal, racemose, clustered or panicled. Flowers with a single cucullate, abbreviated, small bractea. Perianth coriaceous, often with a minute stellated, downy covering, glabrous within.*

Ex. *Myristica ; M. officinalis* (*moschata, Thunb.*) is the Nutmeg of commerce, the arillus of whose seed constitutes Mace.

Ord. CLXVI. PROTEACEÆ. *Juss.* Proteaceous Family, *Suppl. f.* 159, 160.

Perianth of four leaves or quadrifid, with a valvate æstivation. Stamens 4 (one or more sometimes sterile), opposite to the leaflets of the perianth. Ovary single, free: style simple: stigma nearly entire. Fruit various. Seed without albumen. Embryo di- (sometimes poly-) cotyledonous, straight: radicle inferior.—*Shrubs or small trees, chiefly abounding in Southern Africa and in Australia. Branches usually umbellate. Leaves hard, dry, undivided or divided, opposite or alternate, without stipules.*

Ex. *Protea, Suppl. f.* 159. *Banksia. Dryandra. Grevillea. Embothrium, Suppl. f.* 160. Many of these genera constitute the most striking ornaments of our Greenhouses. The splendid *Protea* (*Leucadendron*) *argentea* is the common firewood of the Cape. *Quadria ;* the fruit of *Q. heterophylla* is eaten in Chili and called *Avellana.*

Ord. CLXVII. ELÆAGNEÆ. *Juss* Oleaster Family.

Flowers diœcious, rarely perfect.—Sterile fl. Perianth 4-parted. Stamens 3, 4, or 8, sessile: anthers 2-celled. Fertile fl. Perianth inferior, tubular, persistent; the limb entire or 2—4-toothed. Ovary free, simple, 1-celled: ovule solitary, ascending, stalked; stigma simple, subulate, glandular. Fruit crustaceous, enclosed within the calyx which is become succulent. Seed erect. Embryo straight, surrounded by a very thin, fleshy albumen: radicle short, inferior: cotyledons fleshy.—*Trees or shrubs, of the northern hemisphere, covered with leprous scales. Leaves alternate or opposite, entire, without stipules. Flowers axillary, often fragrant.*

Ex. *Elæagnus. Hippophae,** or Sea Buckthorn, whose fruit is sometimes preserved and eaten.

Ord. CLXVIII. PENÆACEÆ. *Br.* Penæa Family.

Perianth inferior, with 2 or more bracteas at its base, hypocrateriform, with a 4-cleft limb, valvate in æstivation; or deeply 4-parted, imbricated in æstivation. Stamens either 4, arising from below the recesses of the limb with which they alternate, or 8 arising from near the base of the perianth: anthers 2-celled, turned inwards, usually with membranous valves, lying on the face of a thick, fleshy *connectivum.* Ovary superior, 4-celled, with a simple style and 4 stigmas: ovules either ascending, collateral, in pairs, or solitary and suspended; the foramen near the placenta. Fruit capsular, 4-celled, dehiscent, or indehiscent? Seed erect or inverted: testa brittle: nucleus a solid fleshy mass, with no distinction of albumen or embryo; radicular end next the hilum? hilum fungous.—*Shrubs of the Cape of Good Hope. Leaves opposite, imbricated, without stipules. Flowers terminal and axillary, usually red.*

A very anomalous Order, considered by Jussieu to be allied to *Epacrideæ,* and placed next to *Proteaceæ* by Prof. Lindley.—Ex. *Penæa,* yielding a nauseous gum-resin. *Geissoloma.*

Ord. CLXIX. THYMELEÆ. *Juss.* Mezereon Family, *Suppl. f.* 13.

Perianth free, tubular, coloured; the limb 4- rarely 5-fid, with an imbricated æstivation. Corolla none, but in some there are scales inserted at the mouth. Stamens definite, inserted at the mouth or in the tube, often 8, sometimes 4, rarely 2; when equal in number to the segments of the perianth or fewer, opposite to them: anthers 2-celled, with the cells opening longitudinally in the middle. Pericarp nut-like or drupaceous. Albumen none or thin, fleshy. Embryo straight, inverted: cotyledons plano-convex: radicle short, superior: plumule inconspicuous.—*Natives of the warm or temperate parts of the world. Stem shrubby,* (*rarely herbaceous*) *with a tenacious bark. Leaves without stipules, alternate or opposite, entire. Flowers capitate, spicate, terminal or axillary, sometimes solitary.*

Ex. *Daphne,* Suppl. f.* 13. The tough inner bark of some Indian species is employed to make paper. In the W. Indies a *Daphne,* (*D. Lagetto, L.*) or a genus nearly allied to it, has its inner bark composed of beautiful, reticulated fibres resembling lace. The berries of *D. Laureola* are esteemed poisonous. *Passerina. Pimelea.*

Ord. CLXX. SANTALACEÆ. *Br.* Sandal-wood Family, *Suppl. f.* 158.

Perianth superior, 4—5-fid, partly coloured, with a valvate æstivation. Stamens 4—5, opposite to the segments of the perianth and inserted at their base. Ovary 1-celled, 2—1-seeded, with the ovules pendulous from the apex of a central placenta: style 1: stigma often lobed. Pericarp 1-seeded, nut-like, or drupaceous. Albumen fleshy, of the same shape as the seed. Embryo dicotyledonous, in the axis, inverted, cylindrical.—*Widely dispersed shrubs or trees, sometimes suffrutescent. Leaves alternate or nearly opposite, without stipules, undivided, sometimes minute and stipuliform. Flowers subspicate, rarely umbellate, or solitary, small.*

Ex. *Santalum; S. album* is the true Sandal-wood of commerce: *S. Freycinetianum*, that of the Sandwich islands. *Nyssa*, whose bark is remarkably tough. *Thesium*,* *Suppl. f.* 158.

Ord. CLXXI. ARISTOLOCHIEÆ. *Juss.* Birthwort Family, *Suppl. f.* 157.

Flowers perfect. Perianth adherent with the ovary, of one piece, tubular, with the upper part 1-lipped, often 3-lobed; its æstivation valvate. Stamens definite, ternary; sometimes free and distinct, sometimes cohering with the style and stigma, and thus epigynous. Ovary 3—6-celled: style short; stigma divided. Capsule or berry coriaceous, 6-celled, many-seeded; the placentas lateral. Embryo minute, at the base of a cartilaginous albumen.—*Herbs or suffrutescent plants, most abundant in the tropical parts of the New World, frequently climbing, with alternate simple, petiolated leaves.*

Ex. *Aristolochia.** *Asarum*,* *Suppl. f.* 157. Both of them emmenagogues: the root is the most active part.

Div. II. Flowers separated; generally monœcious or diœcious.

Ord. CLXXII. CYTINEÆ. *Br.* Cytinus Family.

Flowers diœcious, monœcious or perfect. Perianth adherent with the ovary, the limb in several divisions, which are imbricated in æstivation. Stamens adhering in a solid, central column, from the apex of which sometimes arise horned processes: anthers adnate, either bursting longitudinally and externally, or having their inside cellular, and discharging their pollen by orifices at the apex. Ovary adnate with the tube of the perianth, 1- or many-celled, with broad, parietal placentas, which are covered with an indefinite number of minute ovules. Fruit an inferior, pulpy berry. Seeds extremely minute (their nucleus consisting of a mass of grumous matter, *Blume*).—*Parasitical, brown or colourless plants, of the south of Europe, or of the Eastern Archipelago, destitute of spiral vessels. Stem simple, covered with a few leaves in the form of scales, or none. Flowers in spikes or heads or solitary.*

Ex. *Cytinus*. *Rafflesia;* the most extraordinary vegetable production perhaps in the world, without stem, without leaves, a parasite on the stem of a vine ; and the whole plant is reduced to the flower, and this of the most gigantic size, $3\frac{1}{2}$ feet in diameter, and weighing 15 lbs. ! A native of Sumatra.

ORD. CLXXIII. NEPENTHEÆ. *Lindl.* Pitcher-plant Family.

Flowers diœcious. Perianth 4-leaved, free, oppositely imbricated in æstivation. Stamens cohering in a solid column, bearing at the apex about 16 anthers, collected in various directions in one head ; anthers 2-celled, opening longitudinally and externally. Ovary superior, 4-cornered, 4-celled, with an indefinite number of ascending ovules attached to the sides of the dissepiments; stigma sessile, simple. Fruit capsular, 4-celled, 4-valved, with the seeds attached to the sides of the dissepiments, which proceed from the middle of the valves. Seeds indefinite, very minute, fusiform, with a lax outer integument. Albumen oblong, much less than the seed, lying in about the middle of the outward integument. Embryo in the midst of a fleshy albumen, with 2 cotyledons placed face to face ; (radicle turned towards the hilum, *Brongn.* and *Nees;* turned to the extremity opposite the hilum, *Richard*).—*Herbaceous or somewhat shrubby caulescent plants, of the*

East Indies and Madagascar. Leaves alternate, slightly sheathing at the base, with a dilated foliaceous petiole, pitcher-shaped at the end, which is articulated with a lid-like lamina. Racemes terminal, dense, many-flowered.

Ex. *Nepenthes:* a genus remarkable for the pitcher-shaped extremity of the leaves, containing a peculiar fluid, closed while young with a lid which opens and remains attached by a sort of hinge. These pitchers destroy a vast quantity of insects, which are allured by and drowned in the fluid.

Ord. CLXXIV. DATISCEÆ. *Br.* Datisca Family.

Flowers diœcious. Perianth of the barren flowers divided into several pieces, that of the fertile ones free, toothed. Stamens several: anthers 2-celled, membranous, linear, bursting longitudinally. Ovary 1-celled, with polyspermous parietal placentas: stigmas equal in number to the placentas, recurved. Fruit capsular, opening at the top, 1-celled, with polyspermous parietal placentas. Seeds enveloped in a membranous finely reticulated integument. Embryo straight, without albumen; its radicle turned towards the hilum.—*Herbaceous, branched exotics. Leaves alternate, cut, compound, without stipules. Flowers in axillary racemes.*

Mr. Lindley places this Order near *Resedaceæ.*—Ex. *Datisca.*

Ord. CLXXV. EMPETREÆ. *Nutt.* Crowberry Family.

Flowers diœcious, separated, or polygamous. Perianth (?) of many imbricated scales, of which the 2—4 inner ones are sometimes larger, equal and petaloid. Stamens 2—4, alternating with the inner segments of the perianth: filaments long; anthers 2-celled, roundish, the cells bursting along their margin. Ovary free, situated on a small fleshy disk: cells variable. Ovules solitary, ascending. Style 1: stigma multifid, subpeltate. Fruit fleshy, surrounded by the persistent perianth, 3—9-celled, the coating of the cells bony. Seeds solitary, ascending: testa membranaceous. Embryo cylindrical, in the axis of a fleshy or somewhat horny albumen: radicle inferior: cotyledons much shorter than the radicle.—*Small heath-like shrubs, of Europe and N. America, and the Straits of Magellan. Leaves evergreen, alternate or verticillate, without stipules. Flowers small, axillary.*

Ex. *Empetrum.** *Ceratiola.*

Ord. CLXXVI. EUPHORBIACEÆ. *Juss.* Spurge or Euphorbium Family, *Suppl. f.* 268, 269.

Flowers separated, naked, or with a 3- or more cleft perianth. Barren Fl. Stamens definite or indefinite, distinct or monadelphous: anthers 2-celled.—Fertile Fl. Ovary free, single, sessile or stalked, 2—3- or more celled. Ovules solitary or in pairs, suspended from the inner angle of the cell: styles 2, 3 or many: stigmas simple, with many lobes or compound. Fruit of 2, 3, or more dehiscent cells (or *cocci*), separating with elasticity from their common axis. Seeds solitary or in pairs, suspended, arillate. Embryo in the axis of a fleshy albumen: radicle superior: cotyledons flat.—*Trees, shrubs or herbs, sometimes succulent and leafless, most common in the tropics, rare in cold and even temperate climates; abounding in an acrid and milky juice. Leaves alternate, opposite or whorled, rarely compound, often stipuled.*

This extensive and important Order affords a milky juice, which is acrid, caustic and frequently highly poisonous. Many individuals belonging to it yield Caoutchouc, some are important articles of food. The albumen of the seeds in *Euphorbiaceæ* is harmless and even eatable. The embryo is acrid and dangerous. Adrien de Jussieu, in his valuable Memoir of the Genera of this Order, has the following groupes or Tribes.

Tribe I. Buxeæ. *Bartl.* Box Tribe.—Cells with 2 ovules. Stamens definite, inserted beneath the sessile rudiment of the pistil.—Ex. *Buxus,** *Suppl. f.* 269, the Box; its leaves are purgative.

Tribe II. Phyllantheæ. *Bartl.* Phyllanthus Tribe.—Cells with 2 ovules. Stamens definite, inserted in the centre of the flower. Flowers glomerated or fascicled or solitary.—Ex. *Phyllanthus;* narcotic; used to intoxicate Fish. *Cicca,* whose fruit is esculent, and subacid; its seeds cathartic; its leaves sudorific.

TRIBE III. RICINEÆ. *Bartl.* Castor-oil Plant Tribe.—Cells with one ovule. Flowers often with an apparent corolla, fascicled, spiked, racemose or panicled, with definite or indefinite stamens.—Ex. *Croton;* the Cascarilla of Europe is supposed to be the *C. Eleuteria;* and is the *Quina blanca* of Vera Cruz. *C. Tiglium* yields the Oil of Tiglium, a drastic purgative; *C.* (*Crozophora, Neck.*) *tinctorium* affords Turnsol, a valuable dye, and is itself highly acrid and drastic. *Ricinus*, from whose seeds is extracted the well known Castor-oil. *Jatropha; J.* (or *Janipha*) *Manihot* affords Cassava in its roots, though when raw the juice is among the most powerful of poisons. *Aleurites;* the fruits of *A. triloba* are the "Candle-nuts," of the Sandwich islanders; which, besides being roasted and eaten, are formed into torches, by stringing a number of them on a rush, and enclosing them in the leaf of the *Dracæna terminalis. Siphonia* (*Hevea,* Aubl.); *S. elastica* affords the Caoutchouc of Guiana.

TRIBE IV. ACALYPHEÆ. *Bartl.* Acalypha Tribe.—Cells with one ovule. Flowers apetalous, clustered or spiked, rarely somewhat racemose. Stamens definite or indefinite.—Ex. *Acalypha. Mercurialis,** a dangerous purgative; yet it has, when boiled, been eaten as a potherb.

TRIBE V. HIPPOMANEÆ. *Bartl.* Manchineel Tribe.—Cells with one ovule. Flowers apetalous. Stamens definite. Bracteas large, many-flowered, spicate.—Ex. *Sapium. Styllingia. Hippomane;* one of the most dangerous of all plants, so powerful is its poison. *Hura; H. crepitans* bears the curious fruit, known as the "Sand-box;" the juice is very purgative.

TRIBE VI. EUPHORBIEÆ. *Bartl.* Spurge or Euphorbium Tribe.—Cells 1-seeded. Flowers naked, monœcious, enclosed in a common involucre.—Ex. *Euphorbia,** *Suppl. f.* 268; many of the species are employed as emetics, but especially *E. Ipecacuanha* in N. America, where it is a native. *E. officinarum, antiquorum* and *Canariensis* give the *Euphorbium* of the *Materia Medica.* Others are said to yield Caoutchouc. Professor Lindley states that the African Teak, now extensively used in our Dock-yards, is supposed to be an Euphorbiaceous Tree.

ORD. CLXXVII. URTICEÆ. *Juss.* Nettle Family, *Suppl. f.* 273, 274.

Flowers monœcious or diœcious, solitary, scattered or clustered, or surrounded by a 1-leaved involucre. Perianth of one piece, membranaceous, lobed, persistent. BARREN FL. Stamens definite, inserted into the base of the perianth and opposite its lobes: anthers curved inwards in æstivation, and often curving backwards with elasticity when bursting.—FERTILE FL. Ovary simple, free: ovule solitary, erect: stigma 1. Fruit an achenium, surrounded by the membranous or fleshy perianth. Embryo straight, curved or spiral, with or without albumen: radicle superior and thus remote from the hilum.—*Trees or shrubs, of almost every part of the world. Leaves alternate, sometimes opposite, with stipules often hispid and stinging, (sometimes very powerfully so) or rough.*

TRIBE I. URTICEÆ. Nettle Tribe.—Stamens incurved and irritable in æstivation. Embryo straight.—Ex. *Urtica,* Suppl. f.* 273; remarkable for its tenacious fibres which are made into cordage and paper. *Parietaria;** Pellitory of the Wall. *Trophis.*

TRIBE II. CANNABINEÆ. Hemp Tribe.—Stamens not incurved nor irritable in æstivation. Embryo curved or spiral.—Ex. *Cannabis,* the Hemp; which possesses powerfully narcotic qualities: as does *Humulus,** the Hop; *Suppl. f.* 274.

ORD. CLXXVIII. ARTOCARPEÆ. *Br.* Bread-Fruit Family, *Suppl. f.* 92—95, & *f.* 272.

Flowers monœcious or diœcious, in heads or catkins. Perianth usually divided and membranaceous, often tubular or entire. BARREN FL. Stamens uncertain in number, 1 or many, straight during æstivation.—FERTILE FL. Perianth none, or as in the sterile flowers. Ovary free, or slightly adherent with the perianth, 1—2-celled, with 1 or 2 ovules, which are suspended (erect, *Bartling*); style single, filiform; stigma bifid. Fruit usually a fleshy receptacle, covered with numerous pericarps, lying amongst the persistent perianths, or enclosing them within its cavity; occasionally consisting of a single nut, covered by a succulent involucre. Seed solitary, suspended, with or without albumen. Embryo curved; radicle directed towards the hilum.—*Trees, shrubs or herbs, chiefly inhabiting the tropics; with alternate, rarely opposite, petiolated, entire, toothed or lobed leaves, frequently covered with asperities. Stipules membranous, deciduous, convolute in vernation.*

Plants, containing very opposite properties; some affording wholesome fruits, others the most deadly poisons.—Ex. *Dorstenia: Suppl. f.* 272. One of the species is *D. Contrayerva. Ficus, Suppl. f.* 92—95, the Fig; a genus consisting of very numerous species: *F. Carica* is the esculent fig; *F. toxicaria,* as its name implies, is highly poisonous: *F. religiosa* is the Banyan or sacred Fig of India: *F. Sycamorus,* the Sycamine tree of Scripture. *Cecropia,* the Cannon-wood tree, like several others of the family, yields caoutchouc. *Artocarpus; A. incisa* is the Bread fruit: *A. integrifolia,* the Jack tree. *Morus,* the Mulberry; *M. tinctoria* yields the well known yellow dye called Fustic. *Broussonetia,* the Paper Mulberry. *Antiaris; A. Toxicodendron* is the Poison Upas of Java. *Brosimum:*—the *Galactodendron utile,* called Palo de Vacca, or Cow-Tree of South America, is referred by Mr. Don to this Genus. When the trunk is wounded, a milky fluid issues, which is nutritious, and eagerly sought after by the natives.

Ord. CLXXIX. ULMACEÆ. *Mirb.* Elm Family.

Flowers perfect, or polygamous, often clustered. Perianth free, monophyllous, campanulate, divided. Stamens definite, inserted into the base of the perianth, straight in æstivation. Ovary free, 2-celled: ovules solitary, pendulous; stigmas 2, distinct. Fruit 1—2-celled, indehiscent, membranous or drupaceous. Seed solitary, pendulous. Albumen little or none. Embryo straight; cotyledons foliaceous; radicle superior.—*Trees or shrubs of the colder or temperate parts of the northern hemisphere, with scabrous, alternate, simple, deciduous leaves and stipules.*

Ex. *Ulmus;** the Elm, whose bark is slightly bitter and astringent. *Celtis.*

Ord. CLXXX. MONIMIEÆ. *Juss.* Monimia Family.

Flowers separated, involucrate; involucre toothed or lobed. Perianth none. Stamens numerous, covering the whole interior of the involucre: anthers 2-celled, bursting longitudinally. Ovaries several, sessile, enclosed within the tube of the involucre. Ovule solitary, pendulous; style 1; stigma 1. Fruit consisting of several 1-seeded nuts, enclosed within the enlarged involucre. Seed pendulous. Embryo within a copious albumen; radicle superior.—*Trees or shrubs of South America, exhaling an aromatic odour, similar to that of Laurels and Myrtles. Leaves opposite, without stipules. Flowers axillary, in short racemes.*

Ex. *Monimia. Boldoa.*

Ord. CLXXXI. ATHEROSPERMEÆ. *Br.* Atherosperma Family.

Flowers separated or perfect. Perianth tubular, divided at the top into several segments, usually placed in two rows, the inner of which is somewhat petaloid; to these are superadded some scales, in the fertile or perfect flowers. Stamens, in the barren flowers, very numerous, in the bottom of the perianth, with scales among them; in the perfect, fewer, and arising from the orifice of the perianth; anthers adnate, 2-celled, bursting with a valve which separates from the base to the apex. Ovaries more than one, usually indefinite, each with a single erect ovule: styles simple, arising from the side or from the base: stigmas simple. Nuts terminated by the persistent style become feathery, enclosed in the enlarged tube of the perianth. Seed solitary, erect. Embryo short, erect, at the base of a soft fleshy albumen; radicle inferior.—*Aromatic trees and shrubs of Australia and S. America. Leaves opposite, without stipules. Flowers axillary, solitary.*

Ex. *Pavonia. Atherosperma.*

Ord. CLXXXII. LACISTEMEÆ. *Mart.* Lacistema Family.

Perianth in several narrow divisions, covered over by a dilated bractea. Stamens hypogynous, standing on one side of the ovary, with a thick 2-lobed *connectivum*, at the apex of each of the lobes of which is placed a single cell of an anther, bursting transversely. Ovary free, seated in a fleshy disk, 1-celled, with several ovules attached to parietal placentas: stigmas 2—3, sessile, or on a style. Fruit capsular, one-celled, splitting into 2 or 3 valves, each of which bears a placenta in the middle. Seed usually, by imperfection, solitary, suspended, with a fleshy arillus: testa crustaceous: albumen fleshy. Embryo inverted, with plane cotyledons, and a straight superior radicle.—*Small trees* *or shrubs, of tropical America. Leaves simple, alternate, stipuled. Flowers disposed in clustered axillary catkins.*

Ex. *Lacistema.*

Ord. CLXXXIII. PIPERACEÆ. *Rich.* Pepper Family.

Flowers naked, subtended by a bractea. Stamens definite, or indefinite, arranged on one side, or all round the ovary, to the base of which they are more or less attached: anthers 1—2-celled. Ovary free, simple, 1-celled, containing a single erect ovule: stigma simple, sessile, often peltate, rather oblique. Fruit somewhat fleshy, indehiscent, 1-celled, 1-seeded: seed erect, with the embryo lying in a fleshy sack, placed on the outside of the albumen, and at the opposite extremity to the hilum.—*Tropical shrubs or herbaceous plants, comparatively rare in Africa; often climbing. Leaves opposite, verticillate, or by imperfection alternate, without stipules. Flowers usually sessile, in catkins or spikes, which are terminal, or axillary, or opposite the leaves.*

By many this Order is arranged near *Aroideæ,* amongst the Monocotyledonous Plants.—Ex. *Piper,* a well known aromatic genus. *P. nigrum* is the Pepper of the shops: *P. Betle,* the Betel. *Peperomia.*

Ord. CLXXXIV. SAURURIEÆ. *Rich.* Saururus Family.

Flowers naked, perfect, seated upon a scale. Stamens 3—6, clavate, hypogynous, or cohering with the angles of the germen, persistent; filaments slender; anthers continuous with the filament, with a thick *connectivum,* and 2 lobes bursting longitudinally. Ovaries 4, each distinct, with 1 ascending ovule, and a sessile recurved stigma; or connate into a 3—4-celled pistil, with a few ascending ovules, and 3 or 4, sessile, recurved stigmas. Fruit consisting of 4 fleshy, indehiscent nuts; or a 3—4-celled capsule, opening at the apex, and containing several ascending seeds. Seeds with a membranous testa; embryo minute, enclosed in a fleshy sack, which is situated on the outside of a hard mealy albumen, at the opposite extremity from the hilum.—*Herbaceous plants of North America, Northern India, China, and the Cape of Good Hope ; growing in marshes, or in the water. Leaves alternate, with stipules. Flowers growing in spikes.*

This Order again seems intermediate between the MONOCOTYLEDONES and DICOTYLEDONES.—Ex. *Saururus, Aponogeton.* Mr. Arnott refers the genus *Houttuynia* to this Family, while others arrange it with the *Aroideæ.*

ORD. CLXXXV. CHLORANTHEÆ. *Br.* Chloranthus Family.

Flowers naked, spiked, perfect or separated, subtended by a scale. Stamens lateral; if more than 1, connate, definite: anthers 1-celled, bursting longitudinally, each adnate to a fleshy *connectivum*, which coheres laterally in various degrees, (2-celled, according to some:) filaments slightly adhering to the ovary. Ovary 1-celled: stigma simple, sessile: ovule pendulous. Fruit drupaceous, indehiscent. Seed pendulous; embryo minute, placed at the apex of a fleshy albumen, with the radicle inferior, and consequently remote from the hilum: cotyledons divaricate.—*Tropical, herbaceous plants or undershrubs; aromatic and stimulant. Stems jointed, swollen below the joints. Leaves opposite, simple, with sheathing petioles, and minute intervening stipules. Flowers in terminal spikes.*

An Order, differing from the two preceding in the absence of a sack to the embryo, in the pendulous ovule, and opposite leaves, with intermediate stipules.—Ex. *Chloranthus. Hedyosmum.*

ORD. CLXXXVI. STILAGINEÆ. *Ag.* Stilago Family.

Flowers separated. Perianth 3—4-partite. Stamens 2 or more, arising from a tumid receptacle. Filaments capillary: anthers innate, 2-lobed, with a fleshy *connectivum*, and vertical cells opening transversely. Ovary free: stigma sessile, 3—4-toothed. Fruit drupaceous, with 1 seed and an abortive ovule. Seed suspended. Embryo green, with foliaceous cotyledons, lying in the midst of a copious fleshy albumen.—*East Indian trees or shrubs. Leaves alternate, simple, with deciduous stipules.*

Ex. *Stilago. Antidesma.*

Ord. CLXXXVII. JUGLANDINEÆ. *DC.* Walnut and Hickory Family.

Flowers monœcious: Barren flowers amentaceous: Perianth scaly, laterally and more or less deeply 2- or 6-lobed. Stamens indefinite, hypogynous; filaments very short, distinct: anthers 2-celled, fixed by the base. Fertile flowers; Perianth double or single, adherent with the ovary, the external one 4-cleft, the internal, when present, of 4 pieces. Ovary 1-celled, with an erect ovule: styles sometimes 1 or 2, very short and with 2 thick stigmas; or none and with the stigma large, discoid, 4-lobed. Drupe fleshy, including a 2—4-valved, 1-celled nut. Seed 4-lobed, covered with a membranous integument. Albumen none. Embryo large: cotyledons fleshy, 2-lobed, wrinkled: radicle superior.—*Trees, chiefly of N. America and Northern India. Leaves alternate, imparipinnate; without stipules or pellucid dots. Fertile flowers lax.*

Ex. *Juglans;* the Walnut, a native of Persia and the Levant and of Caucasus. *Carya*, the Hickory, peculiar to North America. These genera are placed in *Terebinthaceæ* (to which they have considerable affinity) by many authors.

Ord. CLXXXVIII. AMENTACEÆ. *Juss.* Amentaceous Family, *Suppl. f.* 80—91.

Flowers diœcious, monœcious, or rarely perfect. Barren flowers capitate, or amentaceous, subtended with a scale or scale-like perianth. Stamens inserted upon the scale, almost always monadelphous; anthers 2-celled. Fertile flowers fascicled, solitary or in close catkins, subtended by a scale. Ovary free, simple or rarely compound. Stigmas several. Fruits as many as there are ovules, bony or membranaceous. Albumen none or thin. Embryo straight or curved, plane; radicle generally superior.—*Trees or shrubs, with mostly deciduous leaves, the younger ones with 2 stipules at the base.*

Suborder I. Salicineæ. *Rich.* Willow Tribe, *Suppl. f.* 85—91.—Flowers diœcious, solitary in the axil of each scale, amentaceous. Sterile Fl. arranged in a cylindrical catkin, with a gland at the base of each. Stamens 1—30, frequently 2, distinct, rarely monadelphous. FERTILE FL. in an ovate or cylindrical catkin, with a gland at their base. Ovary 1-celled; style simple; stigmas 2, often bifid. Capsule 1-celled, 2-valved, with many seeds. Seeds small, pendulous, without albumen, all over hairy or comate. Embryo straight: radicle directed to the hilum: cotyledons nearly plane, foliaceous.—*Trees or shrubs, rare in the tropics and warm climates, frequent in the north; with alternate, simple leaves, mostly furnished with stipules which are deciduous or persistent, membranaceous or foliaceous.*—To this tribe belong many valuable trees affording timber: their bark is astringent.—Ex. *Salix,* Suppl. f.* 85—87, the Willow, Sallow and Ozier. *Populus,* Suppl. f.* 88—91, the Poplar.

SUBORDER II. BETULINEÆ. *Rich.* Birch and Alder Tribe.—Flowers separated, monœcious, amentaceous. STERILE FL. sometimes with a membranous lobed perianth. Stamens distinct, rarely monadelphous; anthers 2-celled. FERTILE FL. Ovary free, 2-celled: ovules definite, pendulous; style single or none; stigmas 2. Fruit membranaceous or subcoriaceous, compressed, indehiscent, 2- or, by imperfection, 1-celled. Seeds pendulous, naked. Albumen none. Embryo straight: radicle superior.—*Trees or shrubs, chiefly of the northern parts of the Old World. Leaves alternate, simple, petioled; stipules deciduous.*—An Order chiefly valuable on account of its timber; the bark is astringent.—Ex. *Betula,** the Birch. *Alnus,** the Alder.

SUBORDER III. PLATANEÆ. *Juss.* Plane Tribe.—Flowers monœcious, collected into globose or oblong heads or catkins, and sometimes surrounded at the base by a 4-leaved involucre. STERILE FL.: scales linear, very small and numerous, mixed with the stamens. FERTILE FL.: scales mixed with the flowers or none. Ovaries terminated by a thick style, bearing the stigmatic surface on one side: ovules solitary, or 2, one above the other and suspended. Nuts, in consequence of mutual compression, clavate, with a persistent recurved style. Seeds solitary or rarely in pairs, pendulous, elongated: testa thick. Embryo long, cylindrical, lying in the axis of a fleshy albumen, with the radicle turned to the extremity next (opposite, *A. Rich.*) the hilum.—*Large timber-trees or shrubs, of the south of Europe and North America. Leaves alternate, palmate or toothed, with various sheathing stipules. Catkins globose, pendulous.*—Ex. *Platanus.*

SUBORDER IV. CUPULIFERÆ. *Rich.* Oak Tribe, *Suppl. f.* 80—84.—Flowers monœcious. BARREN ONES amentaceous. Stamens 5—20, inserted into the centre of the scales or perianth, generally distinct. FERTILE FL. aggregate or amentaceous. Perianth adnate with the ovary, with a small toothed limb, and with a coriaceous involucre (cupule) at the base, variously formed. Ovary with 2 or several cells and several ovules, the greater number of which are abortive: stigmas several, nearly sessile, distinct. Pericarp *(glans)* bony or coriaceous, 1-celled, more or less enclosed in the enlarged involucre. Seed solitary or 2—3, pendulous, without albumen. Embryo large, with plano-convex, fleshy cotyledons and a minute superior radicle.—*Trees and shrubs, mostly confined to the temperate parts of the northern hemisphere. Leaves alternate, with deciduous stipules.*

An extremely valuable family.—Ex. *Quercus,* Suppl. f.* 80—84, the Oak; independent of the importance of the timber, cork is afforded by an oak, *Q. Suber;* galls by our common Oaks; a dye by *Q. Ægilops,* or Velonia oak. *Castanea,** the sweet or Spanish Chestnut. *Fagus,** the Beech. *Corylus,** the Hasel and Filberd. *Carpinus,** the Hornbeam.

Ord. CLXXXIX. MYRICEÆ. *Rich.* Gale Family.

Flowers separated, amentaceous. Barren Fl. Stamens 1 or several, each with a hypogynous scale. Anthers 2—4-celled, opening lengthwise.—Fertile Fl. Ovary 1-celled, surrounded by several hypogynous scales: ovule solitary, erect, with a foramen in the apex: stigmas 2, subulate. Fruit often covered with waxy secretions, drupaceous, formed of the hypogynous scales of the ovary, become fleshy and adherent, or dry and dehiscent, with the scales distinct. Seed solitary, erect. Embryo without albumen; cotyledons plano-convex; radicle short, superior.—*Shrubs or trees of various countries, with minute glands and dots. Leaves alternate, simple, with or without stipules: sometimes leafless, with filiform and jointed branches, bearing membranous toothed sheaths at the articulations.*

Ex. *Myrica;** aromatic shrubs: *M. cerifera* yields a copious wax employed in the arts, and is astringent. *Comptonia. Casarina and Calythrix,* are two genera abundant in New Holland.

Ord. CXC. CONIFERÆ. *Juss.* Fir Family, *Suppl. f.* 275—277.

Flowers monœcious or diœcious. Sterile fl. monandrous or monadelphous; each floret consisting of a single stamen, or of a few united, collected in a deciduous catkin about a common rachis. Anthers 2-lobed or many-lobed, bursting outwardly; often terminated by a crest, which is an unconverted portion of the scale out of which each stamen is formed: pollen large, usually compound.—FERTILE FL. generally in cones, sometimes solitary. Ovary in the cones, spread open, and having the appearance of a flat scale destitute of style or stigma, and arising from the axil of a membranous bractea; in the solitary flower apparently wanting. Ovules naked; in the cones in pairs on the face of the ovary, having an inverted position, and consisting of 1 or 2 membranes open at the apex, and of a nucleus, in the solitary flower erect. Fruit consisting either of a solitary naked seed, or of a cone; the latter, formed of the scale-shaped ovaries, become enlarged and indurated, and occasionally of the bracteas also, which are sometimes obliterated, and sometimes extend beyond the scales in the form of a lobed appendage. Seeds with a hard crustaceous integument. Embryo in the midst of a fleshy and oily albumen, with 2 or many opposite cotyledons: the radicle next the apex of the seed, and having an organic connexion with the albumen.—*Resinous trees or shrubs, inhabitants of very different parts of the world. Leaves linear, acerose or lanceolate, rigid, entire at the margins or dilated and lobed, always with parallel veins, sometimes fascicled and sheathed at the base.*

I have adopted entirely Mr. Lindley's character of this important Order, whose structure has only recently been fully explained by Brown and Richard, and which, with the following, forms one of the two groupes into which Mr. Lindley divides all "Vascular or Flowering Plants;" the ANGIOSPERMÆ and the GYMNOSPERMÆ. To the latter the two Families in question belong; they alone possessing really naked ovules. The wood too of the "*Gymnospermæ*" is described as having "vessels with large apparent perforations, to which nothing similar has been seen elsewhere."

TRIBE I. ABIETINÆ. *Rich.* Pine Tribe.—*Pinus,** *Suppl. f.* 276, a genus of the temperate or colder parts of the northern hemisphere, often divided into *Pinus,* the true Fir or Pine: *Abies,* the Spruce: and *Larix,* the Larch;—from which, as is well known, we derive some of our most valuable timber, turpentine, &c. *P. sylvestris,* the only species of the Genus we have in Britain, is that which yields pitch and turpentine: its wood is the red or yellow deal of the north of Europe. From *P. Pumilio* we derive Hungarian balsam; from *P. Pinea,* whose seeds are esculent, Carpathian balsam; from *P. Pinaster*, Bordeaux turpentine: the *P. Lambertiana* of Mr. Douglas and the *P. Douglasii* of Mr. Sabine attain to a height of 230 feet and upwards on the western declivity of the Rocky Mountains: *Abies communis* is the Norway Spruce: *A. balsamea*, the Balm of Gilead Fir, and it also yields the Canadian balsam. Spruce Beer is made of an extract from the branches of the Hemlock Spruce, *A. Canadensis.* Venetian turpentine is the produce of *Larix communis: L. Cedrus*, the Cedar of Lebanon. *Cunninghamia; Dammara* and *Araucaria* are magnificent trees of this family, peculiar to the southern hemisphere.

Tribe II. Cupressineæ. *Rich.* Cypress Family.—*Thuja; T. occidentalis* is the *Arbor vitæ* of our Gardens: *T. articulata* (*quadrivalvis*), is supposed to produce the Gum (so called, or rather resin) Sandarach. *Cupressus:* the common or funereal Cypress is *C. sempervirens*, and its wood is of great durability. The doors of St. Peter's at Rome are made of it, which have lasted 1,100 years. *Juniperus:** the berries of our common Juniper, *J. communis*, are used to flavour gin: "Cedar pencils" are made of the wood of *J. Virginiana*, or red Cedar. Savin is from *J. Sabina.*

Tribe III. Taxineæ. *Rich.* Yew Tribe.—*Taxus,* Suppl. f.* 275. *Podocarpus. Dacrydium, Suppl. f.* 277. *Ephedra. Callitris.*

Ord. CXCI. CYCADEÆ. *Rich.* Cycas Family.

Flowers naked, diœcious, amentaceous. Sterile Fl. 2—5-androus, crowded on the back of the scales of an amentum. Anthers sessile, 1-celled, opening internally and longitudinally. Fertile Flowers. Spadices collected into cones, sometimes similar to the scales of the sterile flowers. Ovules solitary, naked, with no other pericarp or covering than the scales upon which they are situated. Seed with a bony integument. Albumen fleshy, solid. Embryo inverted, with a long stalk or funiculus by which the radicle is attached, imperfectly dicotyledonous, the cotyledons connate at the extremity: plumule a little scale, conspicuous before germination.—*Plants of tropical America, of Asia, and southern Africa, with the habit of Palms. Fronds pinnated, the pinnæ with a circinnate vernation. Catkins terminal, solitary, or in pairs. The caudex is proliferous after flowering.*

Different as the plants of the present Order appear at first sight from the preceding, the most learned Botanists are agreed as to their great affinity in structure, and to the propriety of placing them near each other.—Ex. *Cycas;* one species, *C. circinalis,* yields a kind of Sago in the pith of the young stem. *Zamia.*

CLASS II. MONOCOTYLEDONES,† seu ENDOGENÆ.

Monocotyledonous or Endogenous plants. *Trunk* formed of cellular tissue and tubular vessels, which are irregularly scattered, with no distinction into bark, wood and pith, and destitute of medullary rays: the oldest formation most external, the centre the newest and softest. *Leaves* mostly alternate, often sheathing, generally with parallel nerves. *Flowers* evident, the parts of which they are composed mostly arranged in a ternary manner; the *perianth* very frequently single. *Embryo* with 1 *cotyledon;* if with 2, then the accessory one is imperfect and alternate with the other. *Plumule* included within the cotyledon, of which the opposite extremity usually encloses the radicle, and through which it bursts on germination.

SUBCLASS I. PETALOIDEÆ. Flowers with the segments of the perianth verticillate, in one or two rows, or wanting and naked, not covered by imbricated bracteas.‡

A. Stamens hypogynous.

ORD. CXCII. COMMELINEÆ. *Br.* Spider-wort Family.

Perianth of 6 divisions, in a double series: outer tripartite, somewhat resembling a calyx; inner petaloid, with the claws of the petals sometimes connate. Stamens 6, or fewer, hypogynous, some often imperfect, and with the anthers distorted. Ovary 3-celled, few-seeded. Style 1: stigma 1. Capsule 2—3-celled, 2—3-valved; the valves bearing the dis-

† μονος, *one*, and κοτυληδων, *cotyledon*.

‡ Thus excluding the Grasses and Cyperaceous families, where the flowers are covered with membranaceous imbricated scales or bracteas, and hence *glumaceous*.

sepiments in the middle. Seeds often in pairs, inserted in the inner angle of the cell. Embryo flat and circular, immersed in the cavity of the densely fleshy albumen, remote from the hilum.—*Herbs, of the warm parts of the world, the leaves usually sheathing at the base.*

Ex. *Commelina. Tradescantia.*

Ord. CXCIII. ALISMACEÆ. *Br.* (in part) Water-Plantain Family.

Perianth of 6 divisions, in two rows; outer herbaceous, inner petaloid. Stamens definite or indefinite. Ovaries free, many, 1-celled; ovules erect or ascending, solitary, or two, attached to the suture, at a distance from each other: styles and stigmas as many as there are ovaries. Seed without albumen. Embryo shaped like a horse-shoe, with its radicle next the hilum.—*Aquatic or floating herbaceous plants. Leaves with parallel veins.*

Ex. *Sagittaria.* Alisma.* Actinocarpus.**

Ord. CXCIV. BUTOMEÆ. *Rich.* Flowering-Rush Family, *Suppl. f.* 14.

Perianth of 6 divisions, in two rows; outer sometimes herbaceous, inner petaloid. Stamens definite or indefinite. Ovaries 3—6, or more, more or less free or united: styles and stigmas of the same number. Follicles many-seeded, distinct and rostrate, or united into a single mass. Seeds very minute, attached to the whole of the inner surface of the pericarp. Albumen none. Embryo straight or curved; its radicle next the hilum.—*Aquatic plants, of Europe and South America, and the East Indies. Leaves trigonous or flat, and with parallel veins, in* Limnocharis *yielding a milky juice. Flowers in umbels, handsome, yellowish, or purple.*

Ex. *Butomus,* Suppl. f.* 14. *Limnocharis. Hydrocleys.*

Ord. CXCV. JUNCAGINEÆ. *Rich.* Arrow-grass Family.

Perianth of 6 divisions, in a double row both herbaceous, rarely wanting. Stamens 6. Ovaries 3—6, firmly cohering; ovules 1, or 2, approximated by their base, erect. Fruit dry, 1—2-seeded. Seeds erect. Albumen none. Embryo with a lateral cleft, for the emission of the plumule (as in *Aroideæ*); radicle straight, remote from the hilum.—*Marsh plants, generally dispersed. Leaves narrow. Flowers inconspicuous, in spikes or racemes.*

Ex. *Lilæa. Triglochin.* Scheuchzeria.**

Ord. CXCVI. PODOSTEMEÆ. *Rich.* Podostemon Family.

Flowers naked, perfect, bursting through an irregularly lacerated spatha. Stamens hypogynous, varying from 2 to an indefinite number, either placed all round the ovary or on one side of it, monadelphous, alternately sterile: anthers oblong, 2-celled, bursting longitudinally. Ovary 2-celled, with numerous ovules attached to a fleshy, central placenta: styles or stigmas 2 or 3, and sessile. Fruit slightly pedicellate, ribbed, capsular, opening by two valves, which fall off from the dissepiment, which is parallel with them. Seeds numerous, minute, their structure unknown, or (according to Von Martius) entirely simple.—*Herbaceous branched aquatic plants of N. and S. America, and the islands off the East coast of Africa. Leaves capillary or linear, or irregularly lacerated, or minute and densely imbricated, decurrent on the stem, with which they are not articulated. Flowers axillary or terminal, inconspicuous.*

The situation of this Order is by no means correctly known. Professor Lindley places it near *Piperaceæ*, among the Dicotyledonous Plants; while Achille Richard seems to be of opinion that it, as well as *Juncagineæ*, and *Butomeæ*, should be united to *Alismaceæ*.—Ex. *Podostemon.*

Ord. CXCVII. PANDANEÆ. *Br.* Screw-Pine Family.

Flowers diœcious or polygamous, naked, entirely covering a spadix. Sterile Fl. Filaments with 1- or 2-celled anthers.—Fertile Fl. Ovaries usually collected in parcels, 1-celled, with as many sessile, adnate stigmas as there are ovaries.

Drupes fibrous, usually united in parcels, each 1-seeded; or many-celled berries, the cells many-seeded. Albumen fleshy. Embryo in the axis, erect: plumule inconspicuous.—*Tropical plants, chiefly inhabiting the islands of the Indian Ocean, especially Mauritius and Bourbon, with arborescent stems, dichotomously branched, often sending down runners; or weak and decumbent. Leaves spirally arranged, elongated, linear-lanceolate, amplexicaul; the margins generally spiny. Floral leaves smaller, often coloured.*

The fruit and even flowers of *Pandanus odoratissimus* are eaten, while its leaves are employed for thatching and cordage and other economical purposes.—Ex. *Pandanus, Freycinetia.*

Ord. CXCVIII. AROIDEÆ. *Br. Juss.* (*including* Typhæ). Arum Family, *Suppl. f.* 137, 138.

Flowers arranged upon a spadix; sometimes separated, and most frequently naked; sometimes perfect, with a 4—6-rarely 3-partite perianth. Stamens in the naked flowers aggregate: in the covered ones opposite to the lobes of the perianth, most frequently equal to them in number: anthers turned outwards. Ovaries, in the separated flowers, aggregate and occupying the lower portion of the spadix: in the perfect ones, solitary within the perianth, free, 1—3-celled, 1- many-seeded; ovules erect, sometimes inverted or parietal. Style none or simple: stigma one. Pericarp indehiscent, berried, or nut-like. Seeds albuminose, rarely (germination having commenced?) without albumen. Embryo straight, in the axis of the albumen, with a cleft on one side in which the plumule lies; radicle obtuse, directed towards the hilum, or rarely opposite to it.—*Herbaceous or suffruticose plants, most abundant in the tropics. Roots frequently tuberous or thickened. Leaves sheathing, simple or compound, all of them often radical. Spadix terminal or lateral or radical, generally solitary, and enclosed in a spatha; sometimes naked.*

Tribe I. Arineæ. True Arum Tribe.—Flowers separated, perianth none.—Ex. *Arum.** This and the other plants of the groupe possess a highly acrid and poisonous juice, dissipated however by heat, and then the foliage and roots are generally esculent. The latter in particular contain a valuable fæcula capable of being converted into bread. *Caladium ; C. esculentum* and its affinities are commonly eaten in warm climates: *C. Seguinum* is called the Dumb Cane, because if only a small quantity of the juice be applied to the tongue, that organ swells so as to fill the mouth and to prevent the power of speech.

TRIBE II. ORONTIACEÆ. *Br.* Orontium Tribe.—Flowers perfect, furnished with a perianth.—Ex. *Orontium. Dracontium. Pothos. Acorus,* Suppl. f.* 137.

TRIBE III. TYPHEÆ. *Juss.* Reed-mace Tribe.—Flowers separated, triandrous, furnished with a perianth. Ovary 1-seeded: ovule pendulous. Seed albuminose.—Ex. *Sparganium.* Typha,* Suppl. f.* 138.

ORD. CXCIX. PISTIACEÆ. *Rich.* Pistia Family, *Suppl. f.* 136.

Flowers 2, naked, enclosed in a spatha.—STERILE FL. Stamens definite. FERTILE FL. Ovary 1-celled, with one or more erect ovules: style short: stigma simple. Fruit membranaceous or capsular, not opening, 1- or many-seeded. Seeds with a fungous testa, and a thickened indurated foramen. Embryo either in the axis of a fleshy albumen, and having a lateral cleft for the emission of the plumule, or at the apex of the nucleus.—*Aquatic floating plants, with very cellular lobed fronds, which bear the flowers from the margins.*

Ex. *Pistia. Lemna,* Suppl. f.* 136.

ORD. CC. NAIADES. *Juss.* Pond-weed Family, *Suppl. f.* 134, 135.

Flowers separated, monœcious or diœcious, sometimes perfect. Perianth of 2—4 divisions or pieces or scales. Stamens definite, hypogynous, opposite to the segments of the perianth. Ovary 1 or more, inserted upon the receptacle or spadix: ovule solitary; style 1 or none: stigma 1, entire or divided. Fruit dry, indehiscent, 1-celled. Seed solitary, pendulous or suspended. Albumen none. Embryo straight or curved, with a lateral cleft for the emission of the plumule, radicle very large, remote from the hilum.—*Aquatic floating herbs. Leaves frequently linear, with parallel veins, very cellular. Flowers minute, mostly arranged on a spadix, sometimes unilateral.*

Ex. *Naias. Zostera.** *Ruppia.** *Zannichellia.** *Potamogeton,** *Suppl. f.* 135. *Aponogeton, Suppl. f.* 134.

B. Stamens mostly perigynous, often inserted so near the base of the ovary as to appear hypogynous.

Ord. CCI. BROMELIACEÆ. *Juss.* Pine-Apple Family, *Suppl. f.* 147.

Perianth 6-parted or tubular, persistent, more or less cohering with the ovary, in two series, the outer persistent; inner coloured, withering or deciduous, equal or unequal. Stamens 6, inserted into the base of the segments of the perianth. Ovary 3-celled, many-seeded: style straight; stigma 3-lobed, often twisted. Fruit capsular or succulent, 3-celled, many-seeded. Seeds numerous: embryo cylindrical, recurved, lying in the base of a mealy albumen.—*Stemless or short-stemmed plants, of the hotter parts of the New World, with often rigid channelled leaves, sometimes minutely scaly, with entire or spiny edges.*

Ex. *Bromelia;* the Pine-Apple. *Pitcairnia. Agave, Suppl. f.* 147; the American Aloe, of which fences are made in many countries, from which a cordage is prepared, and a vinous spirit called Pulque, is distilled, is a species of *Agave. Tillandsia;* the *T. usneoides* forms such dense masses with its wiry stems and dense leaves on the trees of Louisiana as absolutely to darken the forests.

Ord. CCII. SMILACEÆ. *Br.* Smilax Family, *Suppl. f.* 143, 144.

Flowers perfect or diœcious. Perianth free, petaloid, 6-partite. Stamens 6, inserted near the base upon the laciniæ, rarely hypogynous. Ovary 3-celled, with the cells 1- or many-seeded: style mostly trifid: stigmas as many as there are styles, or divisions of the styles. (The parts of the flower are quaternary in *Paris.*) Berry globose. Seed with a membranaceous (not black nor crustaceous) testa. Albumen between fleshy and cartilaginous. Embryo frequently remote from the hilum.—*Herbaceous or somewhat shrubby plants, variously dispersed, sometimes climbing and with not unfrequently reticulated leaves.*

Ex. *Smilax;* the roots of *S. Sarsaparilla* (the true Sarsaparilla) and of *S. China* are both employed in medicine. *Paris,* Suppl. f.* 145. *Convallaria,* Suppl. f.* 144. *Ruscus.**

Ord. CCIII. ASPHODELEÆ. *Br.* Asphodel Family, *Suppl. f.* 149.

Perianth 6-partite or 6-cleft, petaloid, regular. Stamens 6, inserted upon the perianth, or hypogynous; the three that are opposite the outer leaflets sometimes dissimilar or wanting. Ovary free, 3-celled, with the cells many-, rarely 2-seeded: style 1; stigma undivided or shortly 3-lobed. Pericarp, in most, a 3-celled, 3-valved capsule, with the valves bearing the dissepiments: sometimes an undivided or rarely a tripartite berry. Seeds with a black crustaceous fragile testa. Albumen fleshy, including the embryo.

A bitter viscid juice prevails in many plants of this family.—Ex. *Asphodelus. Anthericum.* Allium,** the Onion kind. *Scilla;** the root of *S. maritima* yields the well known and powerful emetic, purgative and diuretic, called Squills. *Sowerbœa, Suppl. f.* 149. *Hyacinthus.* Muscari.* Ornithogalum.* Gagea.* Asparagus.* Xanthorrhœa,* the Yellow Gum-tree of N. S. Wales. *Yucca. Aloe;* affording Soccotrine Aloes in the *A. Soccotrina,* and Barbadoes Aloes in *A. perfoliata. Phormium;* yielding the valuable fibre known as New Zealand Flax. *Dracæna;* from *D. terminalis* is prepared the Ti, a favourite spirit of the Sandwich Islanders: Gum-Dragon is the concrete juice of *D. Draco.*

Ord. CCIV. LILIACEÆ. *Juss.* Lily Family, *Suppl. f.* 146, 148.

Perianth of 6 divisions or pieces, coloured, occasionally united below into a tube. Stamens 6, inserted upon the segments of the perianth. Ovary free, 3-celled, many-seeded: style 1; stigma simple or 3-lobed. Fruit dry, capsular, 3-celled, many-seeded, opening through the middle of the cells. Seeds flat, lying one over another in one or two rows, with a spongy and dilated, (never black nor crustaceous,) often winged testa. Embryo in the axis of a fleshy albumen, with the radicle pointing to the hilum.—*Generally bulbous plants, chiefly of the temperate parts of the northern hemisphere. Leaves with parallel veins. Flowers large, showy.*

Ex. *Lilium. Fritillaria.** *Blandfordia, Suppl. f.* 148. *Tulipa,** *Suppl. f.* 146; whose roots as well as others of this family are esculent. *Erythronium. Hemerocallis. Polyanthes,* the Tuberose.

Ord. CCV. GILLIESIEÆ. *Lindl.* Gilliesia Family.

Flowers perfect, surrounded by bracteas, the outer of which are petaloid and herbaceous, the inner depauperated and collateral. Perianth minute, either a single labelloid lobe, or an urceolate 6-toothed body. Stamens 6, either all fertile, or 3 sterile and nearly obliterated. Ovary free, 3-celled: style 1: stigma simple. Capsule 3-celled, 3-valved, dehiscing through the cells, many-seeded. Seeds attached to the axis, by means of a broad hollow neck: testa black and brittle. Embryo curved, in the midst of a fleshy albumen.—*Small, herbaceous, bulbous plants of Chili. Leaves grass-like. Flowers umbellate, somewhat spathaceous, inconspicuous.*

I here adopt Professor Lindley's views of the structure of this little tribe: though I have, in the Botanical Magazine (*t.* 2716), found reason to differ somewhat in regard to the genus *Gilliesia:* while Mr. Arnott considers the real nature of the flowers to be elucidated by that of *Amomeæ;* (see *Encycl. Brit. ed.* 7. *v.* 5. *p.* 134.)—Ex. *Gilliesia. Miersia.*

Ord. CCVI. MELANTHACEÆ. *Batsch.* Colchicum Family.

Perianth free, petaloid, 6-partite, tubular by the union of the claws, with the segments in æstivation often involute. Stamens 6: anthers often turned outwards. Ovary 3-celled, many-seeded: style trifid or tripartite: stigmas undivided. Capsule often separable into 3, sometimes with the valves bearing the dissepiment in the middle. Seeds with a membranaceous testa, (neither black nor crustaceous.) Albumen dense, fleshy.—*Herbaceous plants, of various parts of the world, with fibrous, sometimes fascicled, rarely bulbous roots. Flowers* *either arising immediately from the root, or in panicles on tall leafy stems, or in spikes or racemes upon naked scapes.*

An acrid and highly dangerous Family, powerfully narcotic, diuretic and cathartic.—Ex. *Colchicum;** from the *C. autumnale* the famous gout-medicine, called Eau médicinale, is prepared. *Veratrum. Melanthium. Bulbocodium.* Tofieldia.* Helonias. Calochortus.*

Ord. CCVII. PONTEDERIACEÆ. *Kunth.* Pontederia Family.

Perianth tubular, coloured, with six more or less regular divisions, and a circinnate æstivation. Stamens 3 or 6, unequal, inserted on the perianth. Ovary free, or rarely half-adnate with the perianth, 3-celled, many-seeded: style 1: stigma simple. Capsule 3-celled, 3-valved, bursting through the cells. Seeds definite, attached to a central axis: testa membranaceous. Embryo straight, in the axis of a somewhat farinaceous albumen, with the radicle pointing to the small hilum.—*Aquatic plants, natives of the tropics and of N. America. Roots with a little calyptriform covering in one species. Leaves (in one species with the petioles filled with large air-cells to enable the plants to float,) with parallel veins, sheathing at the base. Flowers frequently blue.*

Ex. *Pontederia. Heteranthera. Leptanthus.*

Ord. CCVIII. RESTIACEÆ. *Br.* (*in part*). Pipewort Family.

Perianth free, 2—6-partite, rarely wanting. Stamens definite, 1—6, when from 2 to 3, inserted upon the 4—6-partite perianth and opposite the inner segments; anthers usually 1-celled. Ovary 1-celled, the cells 1-seeded; ovules pendulous. Pericarp capsular, or nut-like. Seed inverted. Albumen of the same shape with the seed. Embryo lentiform, on the outside of the albumen, in the lower extremity of the seed, remote from the hilum.—*Herbaceous or somewhat shrubby plants, chiefly of warm countries. Leaves simple, narrow or none. Culms naked or often sheathing; the sheaths cleft on one side, with equitant margins. Flowers* *usually aggregated, spiked or capitate, separated with bracteas, and generally monœcious.*

Ex. *Restio. Elegia. Eriocaulon ;** an aquatic, of which one species grows in the cold lakes of the western islands of Scotland, and in Canada; while all the rest are natives of hot climates.

Ord. CCIX. XYRIDEÆ. *Kunth.* Xyris Family.

Perianth 6-partite, in two rows, the outer glumaceous; the inner petaloid, unguiculate. Fertile stamens 3, inserted on the claws of the inner series of the perianth, with 3 sterile ones upon the outer series: anthers turned outwards. Ovary single: style trifid, stigma obtuse, multifid or divided. Capsule 1-celled, 3-valved, many-seeded, with parietal placentas. Seed on the outside of the albumen, at the extremity remote from the hilum.—*Herbaceous plants of the hotter parts of the world, with fibrous roots. Leaves radical, ensiform, with dilated equitant scariose bases. Flowers in terminal, naked, imbricated heads.*

Ex. *Xyris.*

Ord. CCX. JUNCEÆ. *Juss.* (*in part.*) Rush Family, *Suppl. f.* 145.

Flowers perfect or separated. Perianth free, of 6 divisions, somewhat glumaceous. Stamens 6, inserted at the base of the segments of the perianth; sometimes 3, and opposite the exterior segments: anthers 2-celled. Ovary 1—3-celled, 1-many-seeded, or 1-celled and 3-seeded: stigmas generally 3, sometimes 1. Pericarp capsular, 3-valved, with the valves bearing the dissepiments in the middle, sometimes without valves, and by imperfection, 1-seeded. Seed with a testa, which is neither black nor crustaceous. Albumen dense and fleshy or cartilaginous. Embryo included.—*Herbaceous plants, very generally distributed, with fascicled or fibrous roots. Leaves flat, with parallel veins, or fistular and harsh. Flowers generally brown or greenish; yellow in* Narthecium.

Mr. Brown observes that the *Junceæ* are intermediate between *Restiaceæ* and *Asphodeleæ*, differing from the former in having an included and often a centripetal radicle, with stamens, when only 3, opposite to the exterior leaflets of the perianth :—from the latter, by the texture of the integument of the seed and of the perianth. —Ex. *Juncus* ;* Rushes are used for a variety of economical purposes. *Luzula*,* *Suppl. f.* 145. *Narthecium*.* *Kingia*. *Xerotes*. *Aphyllanthes*. *Philydrum* and *Flagellaria*, doubtfully referred here by Mr. Brown, are removed to *Commelineæ* by Bartling.

Ord. CCXI. PALMÆ. *Juss.* Palm Family, *Suppl. f.* 142.

Flowers perfect or often polygamous. Perianth with 6 divisions in a double row, persistent, the 3 outer segments generally smaller; the inner sometimes connate at the base. Stamens inserted at the bottom of the perianth, generally definite, opposite to the segments, and equal with them in number; rarely 3; sometimes, (in certain polygamous individuals) indefinite. Ovary 1, rarely 1-seeded, 3-celled, or deeply 3-lobed; the lobes or cells 1-seeded, with an erect ovule. Style 1; stigmas 1—3. Pericarp baccate, or a fibrous drupe. Albumen cartilaginous, and either ruminated, or with a central or rarely anterior cavity. Embryo lodged in a peculiar cavity of the albumen, generally remote from the hilum, dorsal, and indicated by a papilla, cylindrical or compressed and rounded (*trochlea*, or pully-shaped, *Br.*); plumule included, scarcely perceptible; the cotyledonous extremity enlarged in germination, and filling up a pre-existing cavity, or one formed by the deliquescing of the centre of the albumen.—*Magnificent Vegetables, chiefly inhabiting the tropics, and having their maximum in S. America. Caudex arborescent, simple, rarely shrubby and branched, rough with the dilated and somewhat sheathing bases of the petioles or their scars. Leaves terminal, clustered, very large, pinnated or flabelliform, plicate in vernation. Spadix terminal, generally branched, included in a* 1- *or many-valved spatha. Flowers small, bracteolated. Fruit sometimes very large.*

This Family is well entitled by Linnæus the "Princes" of the Vegetable Kingdom, including, as it does, individuals of the most graceful and stately growth,† and rendering the most important services to

† A species of *Calamus* is described as having its caudex or stem 500 feet long, and as slender as a reed.

the natives of the countries which they inhabit, supplying them with food and drink, and material for their clothing and dwellings. One species, *Ceroxylon andicola*, *Humb.*, has its trunk covered with a waxy substance.

TRIBE I. SABALINÆ. *Mart.* Sabal Tribe.—Ex. *Chamædorea. Sabal. Licuala.*

TRIBE II. CORYPHINÆ. *Mart.* Fan-Palm Tribe.—Ex. *Rhapis. Chamærops*, inhabiting the south of Europe, and the southern states of N. America. *Corypha*, or the Talipot-tree, whose fan-like leaf is 20 feet long, and sufficient to shelter 15 or 20 men from the heat of the burning sun. *Phœnix*, *Suppl. f.* 142 ; the Date Palm is *P. dactylifera*, and it affords a considerable proportion of the diet of the Arabians.

TRIBE III. LEPIDOCARYÆ. *Mart.* Lepidocaryum Tribe.—Ex. *Lepidocaryum. Mauritia. Calamus ;* from *C. Draco* the East Indian Dragon's-Blood is obtained. *Sagus ; S. farinifera*, as well as some other Palms, affords Sgao.

TRIBE IV. BORASSEÆ. *Mart.* Borassus Tribe.—Ex. *Borassus. Lodoicea*, of which the fruit is the "double Cocoa-nut" of the Seychelles islands. (See *Bot. Mag. t.* 2734, 5, 6, 7, 8.)

TRIBE V. ARECINÆ. *Mart.* Cabbage-Palm Tribe.—Ex. *Areca ; C. oleracea* is the Cabbage-Palm, of which the part eaten is the heart or young substance of the top : the nuts of *A. Catechu*, wrapped in the aromatic leaves of the Betel Pepper, are chewed in the East like Tobacco, and generally mixed with Chunam. *Elate. Cocos ;* the Cocoa-nut, whose 365 virtues are sung by Hindoo Poets, is the *C. nucifera. Caryota;* the young shoots of *C. urens* are eaten, and a copious and wholesome fluid is collected from the trunk.

C. Stamens inserted above the ovary, in consequence of the adherence of the latter with the tube of the perianth, and hence epigynous.

ORD. CCXII. BALANOPHOREÆ. *Rich.* Cynomorium Family.

Flowers monœcious, collected in dense heads, which are roundish or oblong, usually bearing both kinds of flowers, but occasionally having them distinct ; the receptacle covered with scales or setæ, variable in form, here and there bearing also peltate thick scales, rarely naked. STERILE FL.

pedicellate; perianth deeply 3-parted, equal, spreading, with somewhat concave segments; in *Cynomorium* there is a thick, truncate, obconical scale in room of a perianth. Stamens 1—3 (seldom none), epigynous, with both united filaments and anthers; the latter 3, in *Cynomorium* 1 only, connate, 2-celled, each cell being divided into 2 cavities, sometimes turned inwards, sometimes outwards, opening by a longitudinal slit. FERTILE FL. Ovary inferior, 1-celled, 1-seeded, crowned by the limb of the perianth, which is either marginal and nearly inverted, or consisting of from 2 to 4 unequal leaflets; ovules pendulous: style 1, seldom 2, filiform, cylindrical: stigma simple, terminal, rather convex. Fruit a roundish *caryopsis*, crowned by the remains of the limb of the perianth. Pericarp rather thick; albumen globose, fleshy, cellular, whitish, very large. Embryo very minute in proportion to the albumen, roundish, whitish, enclosed in a superficial excavation, undivided.—*Fungus-like plants, of warm climates, parasitical upon roots; roots fleshy, horizontal, branched; stem naked, or covered by imbricated scales.*

A highly curious Family, of very doubtful affinity.—Ex. *Balanophora. Cynomorium*, the *Fungus Melittensis*, was formerly much used in medicine.

ORD. CCXIII. HYDROCHARIDEÆ. *Juss.* Frog-bit Family, *Suppl. f.* 156.

Flowers perfect or separated. Perianth semipetaloid, 3—6-cleft, in the fertile flowers adherent with the ovary. Stamens definite or indefinite. Ovary 1: stigmas many. Pericarp baccate or capsular, without valves, 1-many-celled. Seeds without albumen. Plumule inconspicuous.—*Aquatic, herbaceous plants, of various parts of the world. Leaves with parallel veins. Flowers spathaceous.*

EX. *Hydrocharis,* Suppl. f.* 156. *Stratiotes.* Vallisneria*, the economy of whose fructification is detailed at *p.* 168.

Ord. CCXIV. ORCHIDEÆ. *Juss.* Orchis Family, *Suppl. f.* 70—72, & 77, 78.

Perianth superior, ringent, of 6 segments in two rows, the 3 outer usually coloured, of which the odd one is uppermost, in consequence of a twisting of the ovary; 3 inner also usually coloured, of which 2 are uppermost, in consequence of the twisting of the ovary, and one called the lip (*labellum,*) is undermost; this latter is frequently lobed, of a different form from the others, and very often spurred at the base. Stamens 3, united in a central column, the two lateral usually abortive, and the central perfect, or the central abortive and the 2 lateral perfect, rarely all perfect; anther either persistent or deciduous, 2- or 4- or 8-celled; pollen either powdery or cohering in definite or indefinite waxy masses, either constantly adhering to a gland or becoming loose in their cells. Ovary 1-celled, with 3 parietal placentas; style forming part of the column of the stamens; stigma a viscid space in front of the column, communicating directly with the ovary by a distinct open canal. Impregnation taking effect by absorption from the pollen-masses through the gland into the stigmatic canal. Capsule inferior, bursting with 3 valves and 3 ribs, very rarely baccate. Seeds parietal, very numerous; testa loose, reticulated, contracted at each end, except in one or two genera; albumen none. Embryo a solid, undivided, fleshy mass.—*Herbaceous plants, either destitute of a stem, or forming a kind of tuber above-ground* (*pseudobulbus*) *by the cohesion of the bases of the leaves, or truly caulescent. Roots in the herbaceous species fleshy, divided or undivided, or fasciculate; in the caulescent species tortuous, green, and proceeding from the stem. Leaves simple, quite entire, often articulated with the stem. Pubescence rare; when present, sometimes glandular. Flowers in terminal or radical spikes, racemes, or panicles; sometimes solitary.*

Of this extensive and highly interesting and beautiful Family, the greater proportion are natives of the tropics, and they gradually diminish towards the arctic regions, where they disappear. Vanilla is the fragrant seed-vessel of *Vanilla aromatica.* Salep is made from the roots of *Orchis mascula*, and other terrestrial European species. *Cyrtopodium Andersonii* is called the Cobbler's wax-plant in Brazil, because it contains a viscid juice that is said to be employed in lieu of that substance. Professor Lindley has the following divisions of *Orchideæ* in his "*Orchidearum Sceletos*."

I. Pollen simple, or consisting of granules in a lax state of cohesion.

TRIBE I. NEOTTIEÆ.—Ex. *Goodyera.** *Neottia.** *Listera.**

TRIBE II. ARETHUSEÆ.—Ex. *Pogonia. Epipactis.** *Corallorhiza.**

II. Pollen cohering in granules, which finally become waxy and are indefinite in number.

TRIBE III. GASTRODIEÆ.—Ex. *Gastrodia. Vanilla.*

TRIBE IV. OPHRYDEÆ.—Ex. *Orchis.** *Gymnadenia.** *Habenaria.** *Aceras.** *Herminium.** *Ophrys,** *Suppl. f.* 70, 71, 72.

III. Pollen cohering in grains, which finally become waxy and are definite in number.

TRIBE V. VANDEÆ.—Ex. *Oncidium. Brassia.*

TRIBE VI. EPIDENDREÆ.—Ex. *Bletia. Epidendrum.*

TRIBE VII. MALAXIDEÆ.—Ex. *Malaxis.** *Liparis.** *Dendrobium, Suppl. f.* 77, 78.

IV. Lateral anthers fertile; the middle one sterile and petaloid.

TRIBE VIII. CYPRIPEDIEÆ.—Ex. *Cypripedium.**

ORD. CCXV. SCITAMINEÆ. *Br.* Ginger Family, *Suppl. f.* 1.

Calyx adherent with the ovary, tubular, 3-lobed, short; corolla tubular, irregular, with 6 segments in 2 rows; the outer 3-parted, nearly equal, or with the odd segment sometimes differently shaped; the inner (sterile stamens) 3-parted, with the intermediate segment (*labellum*) larger than the rest, and often 3-lobed, the lateral segments sometimes nearly abortive. Stamens 3, distinct, of which the 2 lateral are abortive, and the intermediate 1 fertile; this placed opposite the labellum, and arising from the base of the intermediate segment of the outer series of the corolla: filament not petaloid, often extended beyond the anther in the shape of a lobed or entire appendage: anther 2-celled, opening longitudinally, its lobes often embracing the upper part of the style: pollen globose, smooth. Ovary 3-celled, sometimes imperfectly so; ovules several, attached to a placenta in the axis; style filiform; stigma dilated, hollow. Fruit usually capsular, 3-celled, many-seeded; occasionally berried (the dissepiments generally central, proceeding from the axis of the valves, at last usually separate from the latter, and of a different texture. *R. Br.*). Seeds roundish, or angular, with or without an arillus; (albumen floury, its substance radiating, and deficient near the hilum, *R. Br.*). Embryo enclosed within a peculiar membrane (*vitellus*, *R. Br. Prodr.;* membrane of the *amnios*, ibid. in King's Voyage, 21), with which it does not cohere.—*Aromatic, tropical, herbaceous plants. Rhizoma creeping, often jointed. Stem formed of the cohering bases of the leaves, never branching. Leaves simple, sheathing, their lamina often separated from the sheath by a taper neck, and having a single midrib, from which very numerous, simple, crowded veins diverge at an acute angle. Inflorescence either a dense spike, or a raceme, or a sort of panicle, terminal or radical. Flowers arising from among spathaceous membranous bracteas, in which they usually lie in pairs.*

The *Scitamineæ* are remarkable for their pungent and aromatic quality, especially residing in the roots and seeds; hence those parts are employed as condiments and in the Materia Medica.—Ex. *Amomum*, whose several kinds afford the Cardamoms of the shops. *Zinziber;* the Ginger. *Alpinia;* the Galingale. *Curcuma;* the Zedoary. *Kæmpferia;* the Turmeric. *Globba*, *Suppl. f.*1.

Ord. CCXVI. MARANTACEÆ. *Br.* Arrow-root Tribe.

Calyx adherent with the ovary, of 3 sepals, short. Corolla tubular, irregular, with the segments in 2 whorls, the outer 3-parted, nearly equal; the inner very irregular; one of the lateral segments usually coloured and formed differently from the rest; sometimes by abortion fewer than 3. Stamens 3, petaloid, distinct, of which one of the lateral and the intermediate one are either barren or abortive, and the other lateral one fertile: filament petaloid, either entire or 2-lobed, one of the lobes bearing the anthers on its edge. Anther 1-celled, opening longitudinally: pollen round (papillose in *Canna coccinea*, smooth in *Calathea zebrina*). Ovary 3-celled: ovules solitary and erect, or numerous and attached to the axis of each cell; style petaloid or swollen; stigma, either the mere denuded apex of the style, or hollow, cucullate, and incurved. Fruit capsular, as in the *Scitamineæ*. Seeds round, without arillus: albumen hard, somewhat floury. Embryo straight, naked, its radicle lying against the hilum.—*Herbaceous tropical plants, destitute of aroma. Rhizoma creeping, abounding in a nutritive fæcula. Stem often branching. Leaves, inflorescence, and flowers as in* Scitamineæ.

Not possessing the aroma of the preceding Order (to which it is closely allied), the present is valued for the abundant fecula existing in some species, especially those of the Genus *Maranta*. Hence, from the roots of *M. arundinacea*, Arrow-root is prepared. —Ex. *Canna. Maranta. Phrynium.*

Ord. CCXVII. MUSACEÆ. *Juss.* Banana Family, *Suppl. f.* 154, 155.

Flowers spathaceous. Perianth adherent with the ovary, 6-parted, petaloid, in two distinct rows, more or less irregular. Stamens 6, inserted upon the middle of the divisions, some often becoming abortive: anthers linear, turned inwards, 2-celled, often having a petaloid crest. Ovary inferior, 2-celled, many-seeded, rarely 3-seeded: style simple: stigma usually 3-lobed. Fruit either a 3-celled capsule, with a loculicidal dehiscence, or succulent and indehiscent. Seeds sometimes surrounded by hairs, with an integument which is usually crustaceous. Embryo in the axis of a mealy albumen. —*Stemless or nearly stemless plants of the Cape of Good Hope, Japan, and the tropics. Leaves sheathing at the base, and forming a kind of leafless stem; often very large, their limb separated from the petiole by a rounded tumor, and having fine parallel veins, diverging regularly from the midrib towards the margin.*

Splendid plants, both in regard to their foliage and flowers. The fruit of *Musa* is abundantly eaten under the name of Plantain and Banana.—Ex. *Musa. Heliconia. Urania, Suppl. f.* 155. *Strelitzia, Suppl. f.* 154.

Ord. CCXVIII. IRIDEÆ. *Juss.* Corn-Flag Family, *Suppl. f.* 151, 152.

Perianth petaloid, of 6 divisions (parted or tubular), sometimes irregular; with the 3 inner segments sometimes small, deciduous. Stamens 3, inserted upon the base of the outer segments; filaments distinct or connate: anthers turned outwards, fixed by the base, 2-celled, opening longitudinally. Ovary 3-celled, with the cells many-seeded: style 1; stigmas 3, often lamellate, or petaloid, rarely 2-lipped, sometimes obsoletely 3-lobed. Capsule 3-celled, 3-valved; the valves bearing the dissepiments on their middle. Seeds fixed to the internal angle of the cell, sometimes to a central, at length free, columnar receptacle. Albumen horny or densely fleshy. Embryo included.—*Chiefly European, N. American, and especially South African, herbaceous* (*rarely somewhat frutescent*), *generally glabrous plants. Root tuberous or fibrous. Leaves vertical, equitant, distichous* (*except in* Crocus). *Inflorescence terminal, spicate, corymbose, somewhat panicled or often clustered. Common spatha 2-valved, slightly foliaceous; partial ones generally scariose. Perianth coloured on both sides, the outer segments rarely somewhat herbaceous.*

Ex. *Iris,* Suppl. f.* 152. Orris-root is the root of *I. Florentina;* a few species are cathartic. Of the leaves of *Iris tenax* baskets and hats are woven. *Ixia;* and other allied and extensive bulbous Cape genera. *Sisyrinchium, Suppl. f.* 151. *Crocus;** the stigmas of *C. sativus* constitute Saffron. *Trichonema.**

Ord. CCXIX. BURMANNIEÆ. *Spreng. Lindl.* Burmannia Family.

Flowers perfect. Perianth adnate with the ovary, coloured, membranaceous, with 6 teeth, the 3 inner of which are minute, the 3 outer larger and having a wing or keel at the back. Stamens 3, inserted into the tube, opposite the inner segments: anthers sessile, 2-celled, opening transversely, with a fleshy *connectivum:* sometimes 3 sterile stamens alternate with them. Ovary inferior, 3-celled, many-seeded, the dissepiments alternate with the wings of the perianth: style single: stigma 3-lobed. Capsule covered by the withered perianth, 3-celled, 3-valved, bursting irregularly. Seeds very numerous and minute, striated.—*Herbaceous, mostly tropical plants, with tufted, radical, acute leaves, a slender nearly naked stem, and terminal flowers, sessile upon a 2- or 3-branched rachis, or solitary.*

Although Brown has placed this Order as of doubtful affinity among the *Junceæ*, he has, nevertheless, with his accustomed sagacity, noticed its approach to the *Irideæ;* observing that *Burmannia* ought not to be joined to the latter, "on account of its fertile stamens being opposite to the inner segments of the perianth, with as many sterile ones alternating with them; the cells of the anthers opening transversely; and the structure of the seed."—Ex. *Burmannia.*

Ord. CCXX. HÆMODORACEÆ. *Br.* Hæmodorum Family, *Suppl. f.* 153.

Perianth 6-partite (occasionally free). Stamens inserted upon the perianth, 6, or 3 and opposite the inner segments of the perianth: anthers opening inwards. Ovary with the cells 1—2- or many-seeded: style simple: stigma undivided. Pericarp capsular, valvate, or rarely valveless, somewhat nucumentaceous. Seeds definite and peltate or indefinite.—*Herbaceous or shrubby plants, of the New World, South Africa, and N. Holland, whose roots afford a red colour. Leaves equitant.*

Ex. *Hæmodorum. Dilatris, Suppl. f.* 153. *Conostylis. Barbacenia,* which constitutes a distinct Order with Mr. Arnott. *Wachendorfia.*

Ord. CCXXI. AMARYLLIDEÆ. *Br.* Amaryllis Family, *Suppl. f.* 10, 11, & *f.* 150.

Perianth of 6 divisions, regular, with an imbricated æstivation, the 3 outer segments overlapping the inner. Stamens 6, inserted at the bottom of the segments of the perianth: filaments sometimes combined at the base: anthers opening inwards. Ovary 3-celled, with the cells many-seeded; sometimes (in the baccate fruits) 1—2-seeded: style 1: stigma 3-lobed. Pericarp either a 3-celled, 3-valved, many-seeded capsule, with the valves bearing the dissepiments in the middle, or sometimes a 1—3-seeded berry. Seeds with a testa which is neither black nor crustaceous. Albumen fleshy. Embryo nearly straight: radicle directed to the hilum.—*Bulbous or fibrous-rooted plants, chiefly of warm countries.*

Ex. *Amaryllis. Crinum. Hæmanthus;* of which one species contains a poisonous juice, employed by the Hottentots to render the wounds of their arrows mortal. *Narcissus,* Suppl. f.* 150, whose roots are emetic. *Galanthus,* Suppl. f.* 10, 11. *Leucojum.* Doryanthes;* the superb New Holland Lily.

Ord. CCXXII. HYPOXIDEÆ. *Br.* Hypoxis Family.

Perianth petaloid, regular, 6-partite, with an equitant æstivation. Stamens 6, inserted into the base of the segments of the perianth. Ovary 3-celled, many-seeded: style single: stigma 3-lobed. Capsule indehiscent, sometimes succulent and many-seeded. Seeds with a black crustaceous testa, and a lateral rostelliform hilum. Embryo in the axis of a fleshy albumen; its radicle having no certain direction.—*Herbaceous, stemless or nearly stemless plants of warm countries, with plaited leaves, and yellow or white flowers.*

Ex. *Hypoxis. Curculigo.*

Ord. CCXXIII. DIOSCOREÆ. *Br.* Yam Family.

Flowers diœcious. Perianth 6-partite.—Sterile Fl. Stamens 6, inserted at the base of the segments of the perianth. Fertile Fl. Ovary 3-celled, with the cells 1—2-seeded: style deeply trifid: stigmas undivided. Capsule foliaceous and compressed (rarely a Berry, as in *Tamus*), with 2 of the cells sometimes abortive. Seeds plano-compressed. Embryo small, included in a large cavity of the cartilaginous albumen, near the hilum.—*Climbing shrubs of the tropics* (Tamus *excepted, which is extratropical*). *Leaves alternate or opposite, mostly reticulated with veins, as in the Dicotyledonous plants. Flowers spicate, small, with* 1—3 *bracteas.*

Ex. *Dioscorea;* the Yam, which is abundantly eaten throughout the tropics. *Rajana*. *Tamus*;* of the Order *Tameæ* of Mr. Gray and Mr. Arnott; and of which Dr. Brown justly observes that it has the inferior fruit of *Dioscoreæ*, and the baccate fruit of *Smilaceæ*.

SUBCLASS II. GLUMACEÆ. Flowers without any perianth (unless the bristles in some *Cyperaceæ* or the curious urceolate covering to the ovary in *Carex* can be considered such); but enclosed within imbricated, membranous or chaffy scales or bracteas.

ORD. CCXXIV. GRAMINEÆ. *Juss.* Grass Family, *Suppl. f.* 3, 4, & 141.

Flowers perfect, sometimes monœcious or polygamous. Glume (*calyx L.*) generally 2-valved, 1—2-flowered, or many-flowered in a distichous manner, upon a common rachis. *Paleæ* (Perianth, *Br.* Corolla, L.) resembling the glume, generally 2- rarely 1-valved: the valves dissimilar, the outer often keeled, 1—3 or many-nerved, awned or awnless, the inner one generally 2-nerved and awnless, rarely with 2 awns; sometimes wanting. Scales 2, (or 1,) hypogynous, succulent, minute, generally collateral, and situated between the exterior valve of the *paleæ* and the stamens, sometimes opposite, and alternating with the valves; sometimes wanting. Stamens hypogynous, definite (*Pariana* excepted), generally 3, sometimes 1—2, or 6, rarely 4: anthers 2-celled, forked at each extremity. Ovary 1, 1-seeded. Styles generally 2, distinct or combined below, sometimes 1—3. Stigmas feathery or hispid. Pericarp adnate with the seed (*caryopsis*, Rich.), membranaceous. Albumen farinaceous. Embryo in the base of the outside of the albumen, monocotyledonous: the cotyledon scutelliform, fleshy. Plumule naked, included in a peculiar sheath, its primary leaflets gradually changing into perfect leaves.—*Plants of every part of the world where there is any phænogamous vegetation, with fibrous roots. Culms cylindrical, fistulose, articulated, often simple and herbaceous, occasionally branched, rarely frutescent. Leaves alternate, from each joint, sheathing, the sheath cleft on one side. Flowers small, panicled or spiked.*

A highly important groupe, perhaps the most valuable of all the Natural Orders: none renders such numerous services to mankind. Bread-corn is the "staff of life." The foliage of grasses is the chief food of our cattle. The Bamboo (*Arundo Bambos, L.*), the giant of the Family, whose stems or culms attain to a height of a 100 feet in the short space of a few months, furnishes materials for houses and various utensils: the Sugar Cane (*Saccharum officinarum*) gives us sugar. One grass, and one only, is said to be injurious, when its seeds are accidentally mixed up with bread, *Lolium temulentum.* Rice is an hexandrous Gras (*Oryza sativa*). Maize; the grain of *Zea Mays:* millet, that of different species of *Panicum.* "Job's tears" are the singular fruit of *Coix Lachryma Jobis, Suppl. f.* 141.—Ex. (I here confine myself to the British Genera).—*Anthoxanthum,** a diandrous grass, which gives the agreeable scent to new-made hay. *Nardus,** a monogynous grass. *Alopecurus;** fox-tail grass. *Phalaris;** the Canary seed. *Ammophila.** *Phleum.** *Lagurus.** *Milium.** *Gastridium.** *Stipa;** the "feather grass." *Polypogon.** *Calamagrostis.** *Agrostis.** *Catabrosa.** *Aira.** *Melica.** *Holcus.** *Arrhenantherum.** *Hierochloe.** *Sesleria.** *Panicum.** *Setaria.** *Poa,** *Suppl. f.* 3, 4. *Triodia.** *Briza.** *Dactylis.** *Cynosurus.** *Festuca.** *Bromus.** *Avena;** the Oat. *Arundo.** *Elymus.** *Hordeum;** Barley. *Triticum;** Wheat. *Brachypodium.** *Lolium;** Darnel and Rye-grass. *Rotböllia.** *Knappia.** *Spartina.** *Cynodon.** *Digitaria.**

Ord. CCXXV. CYPERACEÆ. *Juss.* Sedge Family, *Suppl. f.* 79, 139, 140.

Flowers perfect or separated, each with a glume or chaffy scale. Perianth none or resembling bristles, rarely membranaceous, 1—3-valved. Stamens hypogynous, definite, generally 3, (sometimes 1—2, or 4—6, scarcely ever 12:) anthers inserted by the base, entire, 2-celled. Ovary 1-seeded, with the ovule fixed to the bottom of the cell: style 1, trifid, rarely bifid. Stigmas undivided, sometimes bifid. Fruit a crustaceous or bony nut. Albumen of the same form as the nucleus. Embryo lenticular, homogeneous, placed at the base of the seed, on the outside of the albumen. Plumule inconspicuous.—*Herbaceous plants, as extensively distributed as the grasses. Stems (Culms,* Br.*) rounded or triquetrous, sometimes many-angled, generally without joints, occasionally jointed and branched. Leaves sheathing, the sheath entire, sometimes cleft in age: the floral ones often sessile. Glumes spicate, the lower sometimes empty.*

Ex. *Scleria. Cladium.* * *Cyperus;* * of which some species produce esculent tubers; *C. Papyrus* is the Papyrus of the ancients. *Schœnus.* * *Rhynchosphora.* * *Scirpus.* * *Blysmus.* * *Eleocharis,* * *Suppl. f.* 140. *Eriophorum.* * *Carex,* * *Suppl. f.* 79, 139. *Elyna.* *

Class III. ACOTYLEDONES† seu Cellulares.

Acotyledonous or cellular plants. Whole plant with a simply cellular structure except in the *Filices;* and probably some allied Orders, which have tubular vessels among the cells, and hence approach the 2d Class. There are no real *flowers,* nothing that can be considered as stamen or pistil. The *seeds* or *organs of reproduction* are without any distinct embryo, consequently without any cotyledon.—This Order corresponds with the 24th Class, Cryptogamia, of Linnæus.

Ord. CCXXVI. FILICES. *Juss.* Fern Family, *Suppl. f.* 99—104.

Fructification or organs of reproduction only of one kind. Capsules spiked or racemed, or generally collected into clusters of various shapes *(sori),* mostly upon the back or margin of the frond, naked or covered with an involucre, with or without an elastic ring. Seeds or sporules minute.—*Perennial plants, most abundant in moist and mountainous countries within the tropics, gradually diminishing towards the poles. Fronds leafy, with a circinate vernation; in perfection during a great part of the year, especially in the summer months.*

Some species are used for food, others in medicine: but their virtues do not appear to be very powerful.

Tribe I. Polypodiaceæ. Polypody Tribe.—Ex. *Grammitis.* * *Polypodium.* * *Aspidium,* * *Suppl. f.* 99—101. *Scolopendrium,*‡ *Suppl. f.* 102—4. *Pteris.* *

Tribe II. Osmundaceæ. Osmund-Royal Tribe.—Ex. *Osmunda.* * *Botrychium.* * *Ophioglossum.* *

† From α, without, and κοτυληδων, a cotyledon.

‡ The very numerous Genera, even of British origin, in many of the Acotyledonous Class, render it impracticable to give more than a few examples.

ORD. CCXXVII. LYCOPODIACEÆ. *Sw.* Wolf's-foot Family.

Fructification sessile in the axils of the leaves or branches. Capsules without a ring, some 2-valved, filled with a powder; others 2—3-valved, containing larger globular bodies.—*Leafy plants common to very different climates, and with very varied aspects.*

Ex. *Lycopodium;** the seeds or sporules of *L. Selago*, are thrown up in the air and ignited with a candle, and thus artificial lightning is produced on the stage.

ORD. CCXXVIII. MARSILEACEÆ. *Br.* Pepperwort Family.

Fructification of 2 kinds enclosed in a one- or more-celled involucre near the root.—*Aquatic plants of various regions.*

Ex. *Isoetis.* Pilularia.* Salvinia. Marsilea. Azolla.*

ORD. CCXXIX. EQUISETACEÆ. *Rich.* Horse-tail Family, *Suppl. f.* 96—98.

Fructification terminal, in spikes or catkins, consisting of peltate, polygonous scales, on the underside of which are from 4—7 involucres, which open longitudinally and contain numerous globose bodies, (capsule?) enfolded by 4 elastic filaments, clavate at their extremities, (which some take for stamens.)—*Widely dispersed plants, growing in dry or in wet places, sometimes aquatic. Stems rigid, leafless, jointed, striated, the articulations sheathed at the base; the cuticle abounding in silex; branches, if any, mostly whorled, and as many will be found as there are striæ upon the stem and teeth to the sheath, if the teeth do not continue more or less combined.*

Ex. *Equisetum,* Suppl. f.* 96—98; the flinty stems of *E. hyemale* are so rough from the copious silex as to act like a file, and are hence employed for polishing brass, ivory, &c.

ORD. CCXXX. MUSCI. *Linn.* Moss Family, *Suppl. f.* 105—113.

Fructification of 2 kinds, mixed together or separated:

anthers? concealed among the leaves, and capsules covered in an early stage, with a calyptra which bursts transversely and regularly at the base (*Sphagnum* and *Andræa* alone excepted), and rises up with the mostly pedunculated and operculated capsule. The *operculum* or lid, deciduous in most instances. Mouth of the capsule naked or furnished with a single or double fringe or peristome: the teeth or cilia in each row 4, 8, 16, 32 or 64. The seeds surround, and probably in an early stage are attached to, a columella, and are enclosed in a membranous bag, unaccompanied by spiral filaments.—*Plants universally distributed, especially in moist and mountainous countries, often parasitic, rarely aquatic. Some are peculiar to the dung of sheep, oxen, &c., and other animal substances. They are of a more or less compactly cellular nature, readily reviving, after being dry, by the application of moisture, bearing leaves, which are very rarely indeed divided, often marked with a central nerve or costa, entire or toothed, or serrated at the margin.*

SUBORDER I. ACROCARPI. Seta or fruitstalk terminal.

TRIBE I. ASTOMI.—Ex. *Andræa.* Phascum.**

TRIBE II. GYMNOSTOMI.—Ex. *Sphagnum.* Gymnostomum.**

TRIBE III. PERISTOMI.—SUBTRIBE I. APLOPERISTOMI.—Ex. *Tetraphis.* Weissia.* Grimmia.* Tortula.* Polytrichum.* Didymodon,* Suppl. f.* 105—108.—SUBTRIBE II. DIPLOPERISTOMI. *Funaria.* Orthotrichum.**

SUBORDER II. PLEUROCARPI. Seta or fruitstalk lateral.

TRIBE I. GYMNOSTOMI.—Ex. *Hedwigia.**

TRIBE II. PERISTOMI.—SUBTRIBE I. APLOPERISTOMI.—Ex. *Pterogonium.* Leucodon.**—SUBTRIBE II. DIPLOPERISTOMI.—Ex. *Neckera.* Daltonia.* Hypnum.* Hookeria,* Suppl. f.* 109—113.

ORD. CCXXXI. HEPATICÆ. *Juss.* Liverwort Family, *Suppl. f.* 114, 115.

Fructification generally of 2 kinds: 1st, capsules in an early stage covered with a calyptra, which is tipped with an apparent style, often surrounded by a perianth or calyx, at length bursting the calyptra irregularly and rising on a peduncle, and opening from the extremity into 2 or 4 or many valves, destitute of operculum, bearing within numerous seeds, mixed (except in *Riccia* and perhaps *Sphærocarpus*,) with spiral filaments:—2dly, oblong, or mostly rounded and often shortly pedunculated bodies, (anthers of some authors,) containing a very minutely granulated substance, which escapes by an aperture at the extremity.—*Minute plants, widely dispersed, frequently frondose, sometimes, in* Jungermannia *for instance, leaf-bearing: the leaves often divided, never really nerved. From various parts of the fronds or leaves,* gemmæ *are produced in many instances. The substance of the* Hepaticæ *is loosely cellular, in general easily reviving after being dried, by the application of moisture. Sometimes the areolæ of the cells have an evident pore, as in* Marchantia *and* Targionia, *and then the plants, after being once dried, are found to revive very slowly.*

Ex. *Riccia.* Marchantia.* Jungermannia,* Suppl. f.* 114, 115.

Ord. CCXXXII. LICHENES. *Ach.* Lichen Family, *Suppl. f.* 116—122.

Fructification apparently of 2 kinds, a powdery substance, forming indeterminate masses, or collected into more or less evident receptacles; and, what is considered a higher state of fructification, *apothecia*, or partial receptacles, which have received different names according to their forms:—*scutella*, or shields, as in *Lecanora* and *Parmelia; patellulæ* (spangles, *Sm.*) as in *Lecidea; lirellæ*, clefts, as in *Opegrapha*, *mycinæ*, as in *Bæomyces; pilidia* (puffs, *Sm.*) as in *Calicium; orbillæ*, as in *Usnea; peltæ*, targets, as in *Peltidea; tricæ* or *gyromata*, (buttons, *Sm.*) as in *Gyrophora; tubercula*, tubercles, as in *Verrucaria; cistulæ*, (cellules, *Sm.*) as in *Sphærophoron; cephalodia*, (knobs, *Sm.*) as in *Scyphophorus*, (where the stalk which bears them is called *podetium;*) *pulvinuli* (naked sporules) as in *Spiloma; variolæ* (pustules), as in *Variolaria*,—these, in many instances, are sessile, perennial, and contain a somewhat waxy plate or layer, (*lamina proligera, Ach.*) in which are imbedded seeds, or sporules, enclosed in little membranous tubes or *thecæ.*—*Perennial plants, varying exceedingly in their form, appearance and texture, always constituting a thallus, crust, or frond* (*universal receptacle, Ach.*) *which frequently spreads horizontally upon soil, rocks, stones, the bark of trees and dead wood, and is pulverulent, membranaceous, coriaceous, gelatinous, or filamentose, and variously lobed or divided: sometimes it is erect, fruticulose and much branched; at other times pendent, variously coloured, rarely green: often the substance is simply composed of cellules, at other times the cellules are mixed with fibres. Imperfect roots are sometimes formed, but rather for the purpose of fixing the plant to its place of growth than of deriving nutriment, which appears to be afforded solely by the air.*

A polymorphous and most extensive family, inhabiting every variety of the surface of the globe; rarely aquatic. An esculent species, *Lecanora esculenta,* is found on the most arid calcareous deserts of Tartary. Few are used in medicine. Many yield valuable dyes when treated with Ammonia; and in Glasgow, alone, vast warehouses are filled with Cudbear, *Lecanora tartarea,* and Archil, *Roccella tinctoria;* and the manufactory of those articles is there carried on upon a most extensive scale.

TRIBE I. BÆOMYCEÆ.—Ex. *Bæomyces.**

TRIBE II. CALICIOIDEÆ.—Ex. *Calicium.**

TRIBE III. GRAPHIDEÆ.—Ex. *Arthonia.* Opegrapha,* Suppl. f.* 116, 117.

TRIBE IV. VERRUCARIEÆ.—Ex. *Verrucaria.* Endocarpon.**

TRIBE V. LEPRARIEÆ.—Ex. *Lepraria.* Spiloma.**

TRIBE VI. VARIOLARIEÆ.—Ex. *Variolaria.**

TRIBE VII. LECANOREÆ.—Ex. *Lecidea.* Lecanora.**

TRIBE VIII. SQAMARIEÆ.—Ex. *Psora.* Squamaria,* Suppl. f.* 118, 119, 120.

TRIBE IX. PARMELIACEÆ.—Ex. *Parmelia.* Sticta.**

TRIBE X. COLLEMATEÆ.—Ex. *Collema.**

TRIBE XI. PELTIGEREÆ.—Ex. *Solorina.* Peltidea,* Suppl. f.* 121, 122.

TRIBE XII. UMBILICARIEÆ.—Ex. *Gyrophora:** the different species of which are the *Tripe de Roche* of the Canadian Hunters, who, in times of difficulty, use it as a substitute for more nutritive food.

TRIBE XIII. RAMALINEÆ.—Ex. *Cetraria.** *Roccella.** *Borrera.**

TRIBE XIV. USNEÆ.—Ex. *Usnea.**

TRIBE XV. CORNICULARIEÆ.—Ex. *Alectoria.** *Cornicularia.**

TRIBE XVI. SPHÆROPHOREÆ.—Ex. *Isidium.** *Sphærophoron.** *Stereocaulon.**

TRIBE XVII. CLADONIEÆ.—Ex. *Cladonia.** *Scyphophorus.** *Pycnothelia.**

ORD. CCXXXIII. CHARACEÆ. *Rich.* Chara Family.

Organs of fructification of two kinds, on the same or on different plants; in the latter case approximate or remote from each other, always produced on, or at the base of, the lesser ramuli or bracteas:—1. Globules of a reddish or orange colour (stamens of many authors), in maturity formed of triangular scales, each of which, in *Chara vulgaris*, "has a vacant portion in its centre, but the margin (which has a fluted appearance under a small magnifier,) consists of a number of parallel, linear-oblong, hyaline, hollow tubes, placed at small intervals from each other, those forming the angles of the scale being branched. Within these tubes are a profusion of globular, minute, orange bodies, (exactly similar to the sporules of other cryptogamic plants,) arranged in no order, and escaping on the least injury of the tubes. It is these little bodies which give the orange colour to the globule." (*Grev.*) The globule is filled with a mucilage and extremely delicate convoluted filaments, arising from minute campanulate bodies and often articulated:—2. Nucules, which are ovate, consisting of a hard, spirally twisted, crustaceous integument, often crowned with 5 projecting points, filled with minute granules which, however, perhaps, in maturity constitute but one body; for

M. Vaucher† has clearly ascertained (and indeed has favoured me with specimens in proof of the correctness of his observations,) that in germination, these nucules give birth only to one plant.—*Aquatic plants, always submerged, formed of simple or compound, membranaceous, sometimes brittle tubes, smooth or spirally striated, often invested with a calcareous covering, jointed at the insertion of the branches, which are dichotomous and whorled.*

Ex. *Chara.** For further remarks on this singular genus, see *British Flora, v.* 2. *p.* 243.

Ord. CCXXXIV. ALGÆ. *Juss.* Sea-weed Family, *Suppl. f.* 123—128.

Fructification: seeds or sporules consisting of minute granules, internal, clustered or scattered, or imbedded in tubercles or peculiar processes arising from the frond. Often two or three different kinds or rather forms of fructification exist in the same species, but each apparently in itself is capable of becoming a new plant. There is nothing that can be compared to the stamens in phænogamous plants.—*Aquatic plants, with very few exceptions, of highly varied form and texture; a single globule or a series of globules or joints placed one at the extremity of the other, so as to form a simple or branched filament (in some genera enveloped in gelatine); or united and extended in various directions, and thus constituting a membranous or coriaceous, almost horny, more or less distinctly cellular frond, rounded, compressed or flat, simple or branched; the branches often foliaceous, nerveless, or costate and nerved,*

† "If," says this acute naturalist, "we place the ripe capsules (*nucules*) of *Chara*, in water in the autumn, they will survive the winter without undergoing any perceptible alteration; but on the approach of warm weather, towards the end of April, from the upper extremity, between the five valves or points, will be seen a little prolongation, which, as it becomes more and more developed, soon gives origin to the first whorl of branches, these to a second; below these branches, the stem swells, and there appear some tufts of small roots; the capsule rests for a long time adherent to the base of the stem, even till the latter begins to bear fructification. During this development no trace of cotyledons is seen." Thus, if looked upon in the light of a capsule, this body, though in an early stage containing many minute granules, can only be considered as *monospermous.*

entire or serrated; the main-stems in the coarser species almost woody and very fibrous; floating in the water or attached by a fibrous or scutate base to substances from which they appear to receive no nutriment, that being derived from the element by which they are surrounded. Their colour is various, different shades of green, brown, red, &c. After having been kept dry for a great length of time, they will revive by immersion in water; but only that portion of plant which is immersed imbibes the fluid.

As we recede from the more perfectly formed (as they are termed), or more highly organized Acotyledonous or Cryptogamic plants which stand at the head of this arrangement, we find it more and more difficult to characterize in a few words the respective Orders or Families, and to distinguish them from the neighbouring ones. But the eye, when a little practised, will soon enable the student to recognise them; and though the present extensive Natural Order is reckoned among the lowest of the vegetable creation, we shall find that it is scarcely exceeded by any in the form and colour and texture of its species; so that no cryptogamic plants have been more general objects of admiration and research; and if their value is to be estimated by the service that mankind derives from them, they will hold a high rank in the scale. Many kinds are eaten in different parts of the world, especially in the north of Europe, and some are esteemed great delicacies. Cattle, at certain seasons of the year, repair to the shores at low tide, and devour the sea-weed with great eagerness. From the marine Algæ, iodine, a new principle, and possessed of very remarkable properties, is derived. It has been successfully employed in the cure of goitres; a disease which Dr. Gillies informs us, has yielded in South America to the application of the stem of a certain *Fucus*, long before iodine was employed in civilized Europe. In the manufactory of kelp, these same plants are of vast importance, and the value of land rose in Scotland, (during the war on the Continent, and when we were deprived of the means of obtaining a pure alkali from the south of Europe,) in a most extraordinary degree; so that the iron-bound coasts of our island yielded a great revenue to the different proprietors; as well as to our government, by the duty that was paid on the article produced. *Acanthophora muscoides* and *Gigartina Helminthochorton* held a place in the pharmacopeia as vermifuges. *Chondrus crispus* has been of late largely collected in Ireland, after it has lain and become bleached upon the beach, and is used very generally as a substitute for isinglass in making blanc-mange. The famous "edible nests" (the nest of the swallow called *Hirundo esculenta*) are said to be made from a species of sea-weed: and lastly, I may mention that sea-weed is employed to a vast extent in the manuring of land in the vicinity of the coast, either thrown on fresh, or first laid in a heap to ferment, and mixed with other vegetable manures.

The British Genera are included in the following divisions and subdivisions according to the arrangements of Dr. Greville and Mr. Harvey, as given in the British Flora.

Suborder I. INARTICULATÆ.

TRIBE I. FUCOIDEÆ.—Ex. *Sargassum,** the Gulf-weed, *Suppl. f.* 116—126. *Fucus;** the species of this Genus are most valued in the preparation of kelp.

TRIBE II. LICHINEÆ.—Ex. *Lichina.**

TRIBE III. LAMINARIEÆ.—Ex. *Alaria.** *Laminaria.**

TRIBE IV. SPOROCHNIDEÆ.—Ex. *Dichloria.** *Sporochnus.**

TRIBE V. CHORDARIEÆ.—Ex. *Chordaria.**

TRIBE VI. DICTYOTEÆ.—Ex. *Chorda.** *Dictyota.**

TRIBE VII. FURCELLARIEÆ.—Ex. *Furcellaria.**

TRIBE VIII. SPONGIOCARPEÆ.—Ex. *Polyides.**

TRIBE IX. FLORIDEÆ.—Ex. *Delesseria.** *Rhodomela.** *Plocamium.** *Chondrus.**

TRIBE X. GASTROCARPEÆ.—Ex. *Iridæa.** *Halymenia,** the Dulse.

TRIBE XI. ULVACEÆ.—Ex. *Porphyra.** *Ulva,* the Laver, which is pickled and eaten.

TRIBE XII. SIPHONEÆ.—Ex. *Codium.** *Vaucheria.**

TRIBE XIII. LEMANIEÆ.—Ex. *Lemania.* *

Suborder II. CONFERVOIDEÆ.

TRIBE XIV. ECTOCARPEÆ.—Ex. *Cladostephus.** *Ectocarpus.**

TRIBE XV. CERAMIEÆ.—Ex. *Polysiphonia.** *Ceramium.** *Griffithsia,** *Suppl. f.* 127, 128.

TRIBE XVI. CONFERVEÆ. Ex. *Conferva.** *Hydrodictyon.**

TRIBE XVII. OSCILLATORIEÆ.—Ex. *Scytonema.** *Oscillatoria.**

TRIBE XVIII. BYSSOIDEÆ.—Ex. *Byssocladium.** *Protonema.**

Suborder III. GLOIOCLADEÆ.

TRIBE XIX. BATRACHOSPERMEÆ.—Ex. *Mesogloia.** *Batrachospermum.** *Chætophora.**

TRIBE XX. RIVULARIEÆ.—Ex. *Rivularia.**

TRIBE XXI. NOSTOCHINEÆ.—Ex. *Protococcus ;** the "Red snow" of Arctic Voyagers. *Palmella.** *Echinella.**

SUBORDER IV. DIATOMACEÆ.

TRIBE XXII. DESMIDIEÆ.—Ex. *Meloseira.** *Desmidium.**

TRIBE XXIII. FRAGILARIEÆ.—Ex. *Fragilaria.** *Diatoma.**

TRIBE XXIV. STYLLARIEÆ.—Ex. *Styllaria.** *Meridion.**

TRIBE XXV. CYMBELLEÆ.—Ex. *Berkeleya.** *Schizonema.** *Cymbella.**

ORD. CCXXXV. FUNGI. *Linn.* Fungus or Mushroom Family, *Suppl. f.* 129, 133.

The lowest in the scale of vegetables, yet very varied in appearance: growing upon the ground, or parasitic on other vegetable substances; rarely, if ever, aquatic, and scarcely ever green; filamentous, gelatinous, corky, coriaceous, fleshy or membranaceous. In the larger sense of the word, the whole plant may be considered as fructification; since, distinct from it, there is no true stem; there are no branches; no leaves. After being once dried the Fungi do not revive by the application of moisture like the greater number of plants in this class; and generally speaking, they are of very short duration, soon decaying, and frequently becoming putrid in decay.

Of this extensive Order, more extensive perhaps than all the other Acotyledonous families taken together, I shall only mention one or two examples, previously observing that Persoon, an eminent writer upon this subject, has constituted 2 Primary Divisions of them which alone will be here noticed.

SUBCLASS I. ANGIOCARPI. Seeds and sporules internal.—Ex. *Æcidium, Suppl. f.* 133. *Uredo ;* of this genus there are two destructive species: 1. *U. Segetum ;* an apparent black dust, residing within the fruit or glumes of grasses, especially of Wheat, Barley, and Oats; thus destroying the kernel and doing vast injury to our crops, converting the part affected into a black powder, and known by the name of brand, dust-brand, smut, burnt-corn. This kind has no particular scent.—2. *U. Caries, DC.*; a brownish-black dust, consisting of larger grains than the last, and filling the kernel itself of wheat, &c., with a fetid greasy powder. This is far more injurious than the former species, and not externally conspicuous, but causing the seed to swell, and thus to look diseased. In the operation of thrashing the breaking of these grains affects the whole mass. This is known to farmers as balls, bladder or pepper-brand, stinking-brand. *Puccinia*; *P. graminis, Pers.*, forming long blackish-brown parallel lines on the stem and leaves of the grass-tribe. It constitutes the blight, mildew, and rust in corn. In the same groupe of Fungi are found the Mucors, or mould of cheese, &c., the Tubers or Truffles, and the curious genera *Geastrum* and *Phallus*.

SUBCLASS II. GYMNOCARPI. Such as bear seeds on an exposed membrane, or *hymenium*.—Ex. *Amanita*. *A. muscaria, Pers., Suppl. f.* 129, pileus orange-red or brown, at length nearly plane, the warts, gills, and annulate stipes white.—Frequent in woods, where it is rendered conspicuous by its bright colour. Said to be poisonous. *Agaricus*; *A. campestris*; the true Mushroom; distinguished by the purplish-brown colour of its gills, from many other species that are esteemed at our tables, and from many that are known to be poisonous. *Merulius cantharellus* is a favourite article of food upon the Continent, as well as in England. *M. lachrymans* produces the dry rot in timber. *Boletus fomentarius* forms Amadou, or German tinder. *Morchella*; *M. esculenta* is the Morell. Several species of *Rhizomorpha* insinuate themselves between the bark and wood of trees, and hasten the decay of the timber. Peziza, *Suppl. f.* 130. *Ascobolus*; *A. furfuracens, Suppl. f.* 131, 132, as I take that figure to be, although Sir J. E. Smith in his introduction (*p.* 255 of this edition,) has referred to that figure for the Genus *Nidularia*. The works of Fries will be the best guide to the student of *Fungi*.

CHAP. XXVI.—*On the preparation and use of an Herbarium.*

I HAVE only to add a few practical remarks on the preparation and use of an Herbarium, or *Hortus siccus*. The advantages of preserving specimens of Plants, as far as it can be done, for examination at all times and seasons, is abundantly obvious. Notwithstanding the multitude of books filled with descriptions and figures of plants, and however ample or perfect such may be, they can teach no more than their authors observed; but when we have the works of Nature before us we can investigate them for ourselves, pursuing any train of inquiry to its utmost extent, nor are we liable to be misled by the errors or misconceptions of others. A good practical botanist must be educated among the wild scenes of nature, while a finished theoretical one requires the additional assistance of gardens and books, to which must be superadded the frequent use of a good herbarium. When plants are well dried, the original forms and positions of even their minutest parts, though not their colours, may at any time be restored by immersion in hot water. By this means the productions of the most distant and various countries, such as no garden could possibly supply, are brought together at once under our eyes, at any season of the year. If this be assisted with drawings and descriptions, nothing less than an actual survey of the whole vegetable world in a state of nature, could excel such a store of information.

Some persons recommend the preservation of specimens in weak spirits of wine, and this mode is by far the most eligible for such as are very juicy. But it totally destroys their colours, and often renders their parts less fit for examination than the above-mentioned mode. It is besides incommodious for frequent study, and a very expensive and bulky way of making an herbarium.

The greater part of plants dry with facility between the leaves of books, or other paper, the smoother the better. If there be plenty of paper, they often dry best without shifting; but if the specimens are crowded, they must be taken out frequently, and the paper dried before they are replaced. The great point to be attended to is that the process should meet with no check. Several vegetables are so tenacious of their vital principle, that they will grow between papers, the consequence of which is a destruction of their proper habit and colours. It is necessary to destroy the life of such, either by immersion in boiling water, or by the application of a hot iron, such as is used for linen, after which they are easily dried. I cannot however approve of the practice of applying such an iron, as some persons do, with great labour and perseverance, till the plants are quite dry, and all their parts incorporated into a smooth flat mass. This renders them unfit for subsequent examination, and destroys their natural habit, the most important thing to be preserved. Even in spreading plants between papers, we should refrain from that precise and artificial disposition of their branches, leaves, and other parts, which takes away from their natural aspect, except for the purpose of displaying the internal parts of some one or two of their flowers, for ready observation.

After all we can do, plants dry very variously. The blue colours of their flowers generally fade, nor are reds always permanent. Yellows are much more so, but very few white flowers retain their natural aspect. The Snowdrop and *Parnassia*, if well dried, continue white. Some greens are much more permanent than others; for there are some natural families whose leaves as well as flowers turn almost black by drying, as *Melampyrum*, *Bartsia*, and their allies, several Willows, and most of the *Orchideæ*. The Heaths and Firs in general cast off their leaves between papers, which appears to be an effort of the living principle, for it is prevented by immersion of the fresh specimen in boiling water. *Nandina domestica*, a Japanese shrub, introduced among us by Lady Amelia Hume and Mr. Evans of Stepney, is very remarkable in this respect. Every leaflet of its very compound leaves separates from its stalk in drying, and even those stalks all fall to pieces at their joints.

Dried specimens are best preserved by being fastened, with weak carpenter's glue, to paper, so that they may be turned over without damage. Thick and heavy stalks require the additional support of a few transverse strips of paper to bind them more firmly down. A half-sheet of a convenient folio size, should be allotted to each species, and all the species of a genus may be placed in one or more whole sheets. On the latter the name of the genus should externally be written, while the name of every species, with its place of growth, time of gathering, the finder's name, or any other concise piece of information, may be inscribed on its appropriate paper. This is the plan of the Linnæan Herbarium, in which every species, which its original possessor had before him, when he wrote his great work, the *Species Plantarum*, is numbered both in pencil and in ink, as well as named, the former kind of numbers having been temporary till the book to which they refer was printed, after which they were confirmed with a pen, and a copy of the book, now also in my hands, was marked in reference to them. Here, therefore, we do not depend on the *opinion* merely, even of Linnæus, for we have always before our eyes the very object which was under his inspection. We have similar indications of the plants described in his subsequent works, the Herbarium being most defective in those of his second *Mantissa*, his least accurate publication. We often find remarks there, made from specimens acquired after the *Species Plantarum* was published. These the Herbarium occasionally shows to be of a different species from the original one, and it thus enables us to correct such errors.

The specimens thus pasted, are conveniently kept in lockers, or on the shelves of a proper cabinet. Linnæus in the *Philosophia Botanica* exhibits a figure of one divided into appropriate spaces for each class, which he supposed would hold his whole collection. But he lived to fill two more of equal size, and his Herbarium has been perhaps doubled since his death by the acquisitions of his son and of its present possessor.

One great and mortifying impediment to the perfect preservation of an herbarium arises from the attacks of insects. A little beetle, called *Ptinus Fur*, is, more especially, the pest of collectors, laying its eggs in the germens or receptacles of flowers, and others of the more solid parts, which are speedily devoured by the maggots when hatched, and by their devastations paper and plants are alike involved in ruin. The most bitter and acrid tribes, as *Euphorbia*, *Gentiana*, *Prunus*, the Syngenesious class, and especially Willows, are preferred by these vermin. The last-mentioned family can scarcely be thoroughly dried before it is devoured. Ferns are scarcely ever attacked, and grasses but seldom.—To remedy this inconvenience I have found a solution of corrosive sublimate of mercury in rectified spirits of wine, about two drachms to a pint, with a little camphor, perfectly efficacious. It is easily applied with a camel-hair pencil when the specimens are perfectly dry, not before; and if they are not too tender, it is best done before they are glued, as the spirit extracts a yellow dye from many plants, and stains the paper.* A few drops of this solution should be mixed with the glue used for pasting. This application not only destroys or keeps off all vermin, but it greatly revives the colours of most plants, giving the collection a most pleasing air of freshness and neatness. After several years' experience, I can find no inconvenience from it whatever, nor do I see that any dried plants can long be preserved without it.

The Herbarium is best kept in a dry room without a constant fire. Linnæus had a stone building for his museum, remote from his dwelling-house, into which, I have been told, neither fire nor candle was ever admitted, yet nothing can be more free than his collection from the injuries of dampness, or other causes of decay.

The above directions for the collecting and preservation of specimens of Plants, are perhaps scarcely sufficient for those who travel in distant countries, where the novelty and rarity of the vegetable productions demand that the process should be undertaken upon a very extensive scale; but where at the same time, the difficulties of conveying luggage are very considerable. Nor do I think, though we have some eminent exceptions, that the Naturalists of our country excel in the preparation of plants for the Hortus Siccus. Our specimens in general, will not bear the comparison with those of the Germans and of our transatlantic brethren: and yet it

* On this latter account, I have found spirit of turpentine preferable to spirits of wine.—*Ed.*

must be acknowledged, that the difficulty of examining and determining genera and species, in the dried state, is increased or diminished in proportion to the condition of the specimens under our notice. The following " *Directions for collecting plants for a Hortus Siccus or for cultivation*," which I long ago printed for private distribution, may perhaps not be unacceptable, nor entirely useless to the reader of this Introduction.

" The process is a much simpler one than is generally imagined by those unpractised in it; and many travellers have been deterred from collecting specimens by the time and trouble requisite for securing them in the way that is generally recommended.

" The main circumstances to be attended to, are, to preserve specimens of plants in such a manner that the moisture may be quickly absorbed, the colours as much as possible preserved, and such a degree of pressure given to them, as that they may not curl up in the act of drying.

" For this purpose, let a quantity of separate sheets of paper be obtained, of a folio size, and of an absorbent nature. Common cartridge or gray paper is perhaps the best. Brown paper does well enough for coarse plants, and blotting paper for the more delicate kinds. Two boards should be provided, one for the top and the other for the bottom of the mass of papers. For pressure at home, or when stationary for any length of time in a given spot, nothing serves better, as a press, than a weight of any kind, a large stone, a great book, &c., put upon the topmost board; and the great advantage in this is, that the weight follows the shrinking of the plants beneath. Whilst travelling, the more convenient plan is to use three leathern straps with buckles—two to bind the boards transversely, and one longitudinally. It will be farther desirable to have a number of pieces of pasteboard, of the same size as the paper, to separate different portions of the collection, either such as are in a different state of dryness, or such as, by their hard or stout woody nature, might otherwise press upon more delicate ones that are in papers adjoining, and be the means of injuring them.

" Thus provided, gather your specimens: if the plants be small, root and stem; if large, cut off portions of the branches of a foot or a foot and a half long, selecting always such as are in flower, and others in a more or less advanced state of fruit. Place them side by side, but never one upon another, on the same sheet, and lay upon them one, two, or three sheets, according to the thickness of your paper or of your plants, and so on, layer above layer of paper and specimens, subjecting them then to pressure. As soon as you find that the paper has absorbed a considerable portion of the moisture, (which will be according to the more or less succulent nature of the plants, and the heat and dryness of the season or climate,) remove the specimens into fresh papers; and let the old papers be dried for use again, either in the open air and sun, or in a heated room, or before the fire.

" As to the spreading out of the leaves and flowers with small weights, penny-pieces, &c. it is quite needless. The leaves and flowers are best displayed by nature in the state in which you gather them; and they will require little or no assistance with the hand, when laid out upon papers, to appear to the best advantage; especially if put in carefully, on being fresh gathered. If the specimens cannot be laid down immediately upon being collected, they should be preserved in a *tin box*, where they will keep fresh for a day or two, if the atmosphere be not very much heated.

" Some very succulent plants, such as CACTI, SEMPERVIVA, SEDA, ORCHIDEOUS PLANTS, &c., some plants with very fine but rigid leaves, such as the FIR tribe and the HEATHS, and some with compound pinnated leaves, require to have the specimens plunged into boiling water for a few seconds before they are pressed; this greatly facilitates the operation, by destroying the vegetative principle, and preventing the leaves of many from falling off in the act of drying. In this case, the superabundant moisture should be absorbed by a cloth or by applying, temporarily, pieces of blotting paper.

" In most parts of Europe, and in all countries not oppressively hot, it is a good plan, and saves much paper, to lay out the specimens on their respective sheets, on the floor of a chamber during the night, or for five or six hours during the day, putting them up again and submitting them to pressure, as before, on the same papers. By this means, much humidity both from the plants and the paper is absorbed by the atmosphere, and the colour is better preserved. If, however, the climate be hot, a far shorter time will suffice, or the leaves will shrivel.

"When sufficiently dry,* which, with the greater number of plants, and in warm climates, will take place in the course of a few days, (and with two, or at most, four shiftings of the specimens,) they should be placed between dry papers, one sheet of folio between each layer of plants; and they are then ready for transportation, either packed up in boxes, or well secured as a parcel, covered with oil cloth. A great many specimens may thus be sent in a very small compass.

"PALMS having their fructification and their leaves very large, are with difficulty subjected to pressure. A few of their flowers should be pressed; and the cluster of fruit and a leaf may be simply dried in the air, and afterwards packed in a box, for transportation.

"FERNS and MOSSES, and the larger proportion of CRYPTOGAMIC PLANTS, may be dried in the common way; such Mosses as grow in tufts being separated by the hand.

"SEA-WEEDS should be immersed for some hours in fresh water before they are dried: and common blotting paper is the best for absorbing the moisture from these plants.

"If the FRUITS of plants are of small size, so as to be preserved in an Herbarium, they should be gathered with the leaves and branches, as are the flowers. If of a large size, they should be kept separate. DRY FRUITS demand no care, except those which split open by means of their valves, and which require to be tied round with a little packthread.

"PULPY FRUITS are only to be preserved in spirits of some kind, and they should have a number attached to them, referring to the flowering specimens.

SEEDS AND PLANTS FOR CULTIVATION.

"THE best way to introduce plants from abroad into our

* The being sufficiently dry may be ascertained by the stiffness of the stems and leaves, and by the specimens not shrinking or curling on being removed.

country is by Seeds. These should be gathered when perfectly ripe; and if a number of each kind be folded in a separate piece of paper and kept dry in a box, they in general reach this country in a good state for vegetation.

"OILY SEEDS, such as those of the TEA, COFFEE, most kinds of ACORNS, &c., soon lose their germinative property. For such, it is necessary to provide a box and a quantity of loose sandy or peat mould. Put into the box a layer of this earth and then a layer of seeds, and so on alternately till the box be full.

"BULBS of all kinds and many ROOTS, not actually in a state of vegetation, cuttings of SUCCULENT PLANTS, ALOES, CACTI, and many other thick-leaved PARASITIC ORCHIDEOUS PLANTS, called AIR-PLANTS, may be put into a box with dry sand, peat, or saw-dust; and these (as well as the Seeds and Bulbs) must be kept free from damp.

"Plants that it is desirable to remove with the ROOT, should be carefully placed together, but not too crowded, with common soil, in wooden boxes, the top of which is formed with two sloping sides like the roof of a house; one of these constitutes a lid that can be opened or shut at pleasure, so as to admit the air and water, and especially so as to exclude the spray of the sea, which would be highly prejudicial. The earth must be kept moderately moist, and the boxes always placed either on an exposed part of the deck of the vessel, or slung from the *tops*. In the latter situation they are liable to the least injury; only the person who has the charge of them must not forget to supply them with fresh water when they may require it.

"With the plants and seeds, whether in a living or dry state, if they are not well known to naturalists, there should be pieces of paper, on which are to be indicated the uses of the kind, as far as these have been ascertained, the particular country where it is gathered, the soil, the size, the elevation at which it grows above the level of the sea, and the name it is generally known by.

"As soon as a sufficient number of plants are collected, no time should be lost in transporting them to their place of destination; since the dried specimens and the seeds are liable to the attack of insects in warm climates; and the captain of the vessel should be particularly requested to keep them in a dry and airy part of his vessel.

" Specimens of the Woods are also highly desirable; of the Gums, Resins, and the various products of the trees, if employed in the arts or in medicine; and it may here finally be remarked, that those plants which are employed *as useful* in any way whatever by the natives, are what it is of most importance to possess in our gardens: nevertheless, the more common kinds, the very weeds of foreign countries, the Grasses, the Mosses, the Sea-weeds, and Lichens will prove extremely valuable to the scientific Botanist."—*Ed.*

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I. INDEX

OF THE WORDS USED SUBSTANTIVELY IN THE ELEMENTARY PART OF THIS WORK; TO WHICH ARE ADDED OTHER TERMS NOT EXPLAINED BY SIR J. E. SMITH.

II. INDEX

TO THE EXPLANATION AND ILLUSTRATION OF TECHNICAL TERMS, USED ADJECTIVELY.

III. INDEX

TO THE CLASSES, ORDERS, GENERA AND SPECIES, TOGETHER WITH THE SUBSTANCES AFFORDED BY PLANTS, WHICH ARE MENTIONED IN THE *ILLUSTRATIONS OF THE NATURAL METHOD*, CHAPTER XXV.

* Where the word is by mistake spelt *Cassia*.

EXPLANATION

OF THE

FIRST FIFTEEN PLATES,

ILLUSTRATIVE OF THE INTRODUCTORY PAGES OF THIS WORK.

TAB. 1. *fig.* 1, Anatomy of wood, after Mirbel; *f.* 2, Embryo of *Pinus Cembra*, as seen in a section of the seed; also separate; and likewise magnified, from Mr. Lambert's work.—*f.* 3, Seedling plant of the *Dombeya*, (*Araucaria*,) or Norfolk Island Pine, with its four cotyledons, and young leafy branches, of the natural size.—*f.* 4, A garden Bean, *Vicia Faba*, (or *Faba vulgaris*,) laid open, showing its two cotyledons; *f.* the radicle or young root; *g.* the germ or *corculum*. Above is a bean which has made some progress in vegetation, showing the descending root, the ascending *plumula*, and the skin of the seed bursting irregularly.

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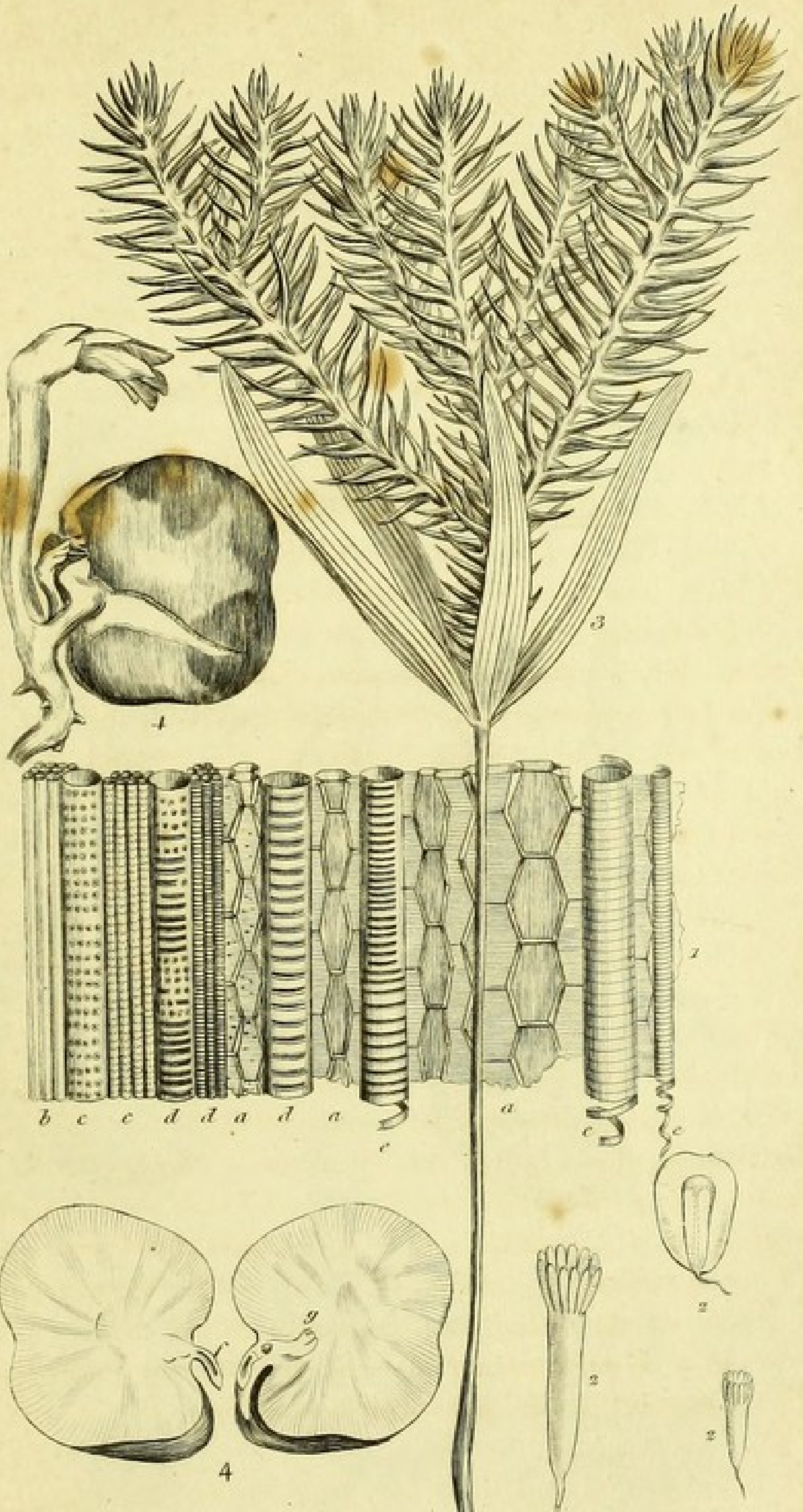

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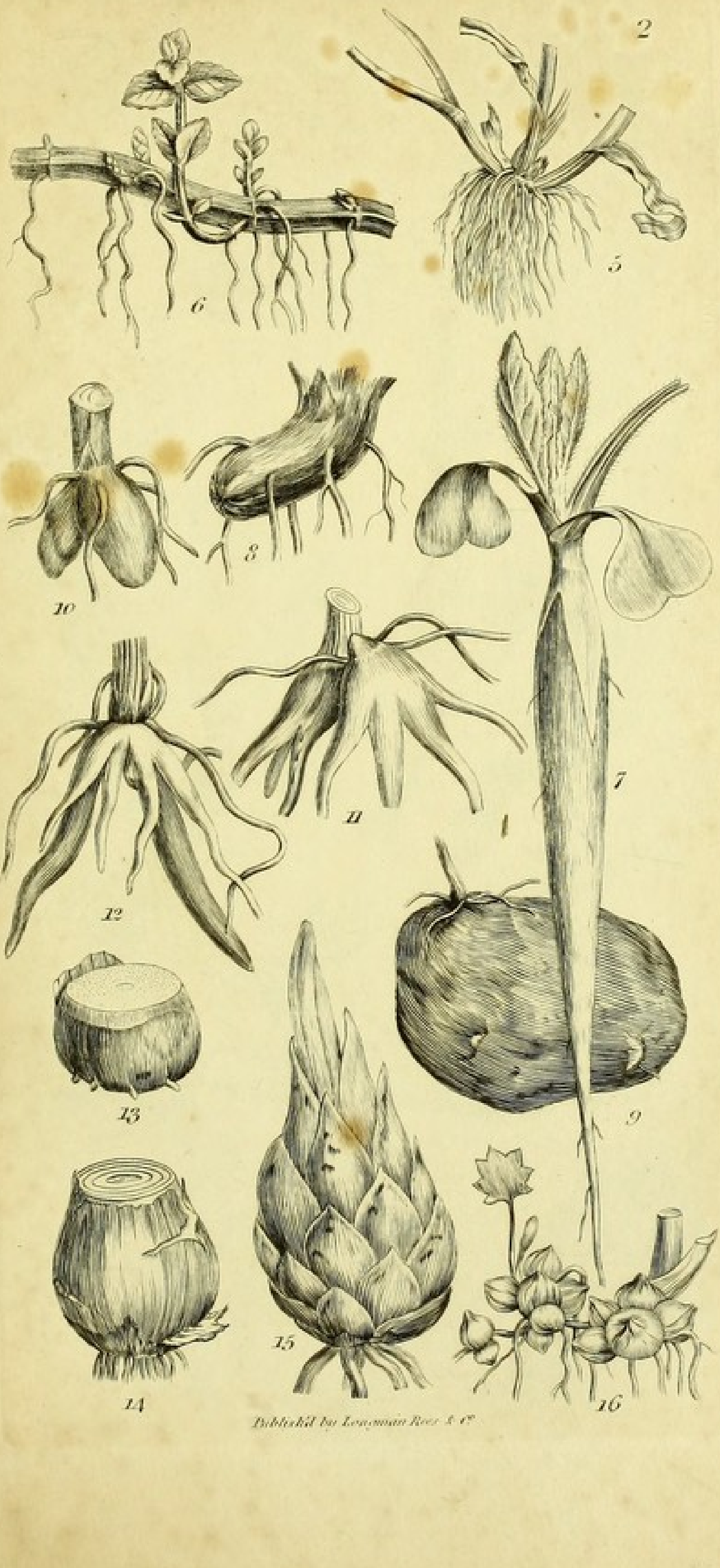

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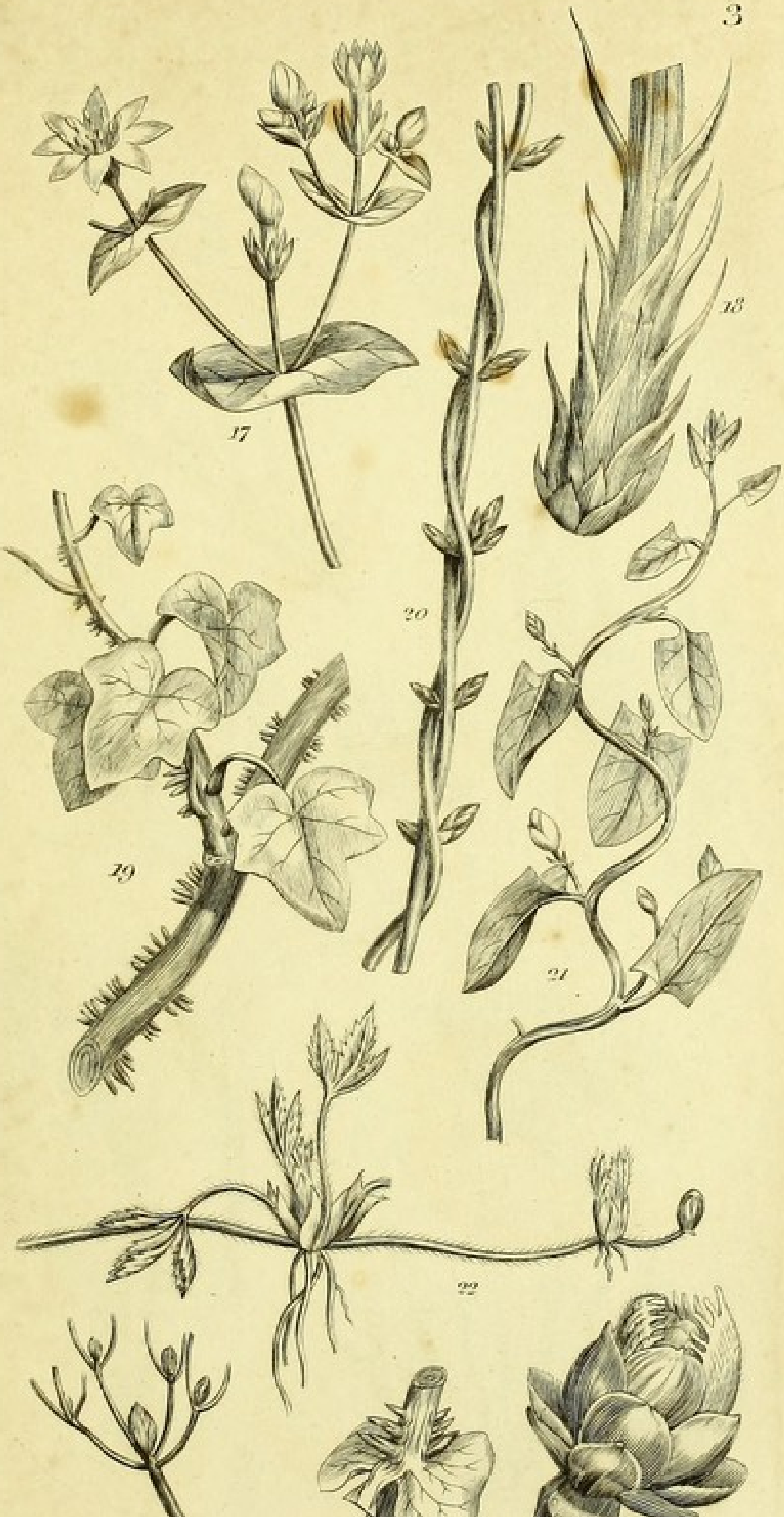

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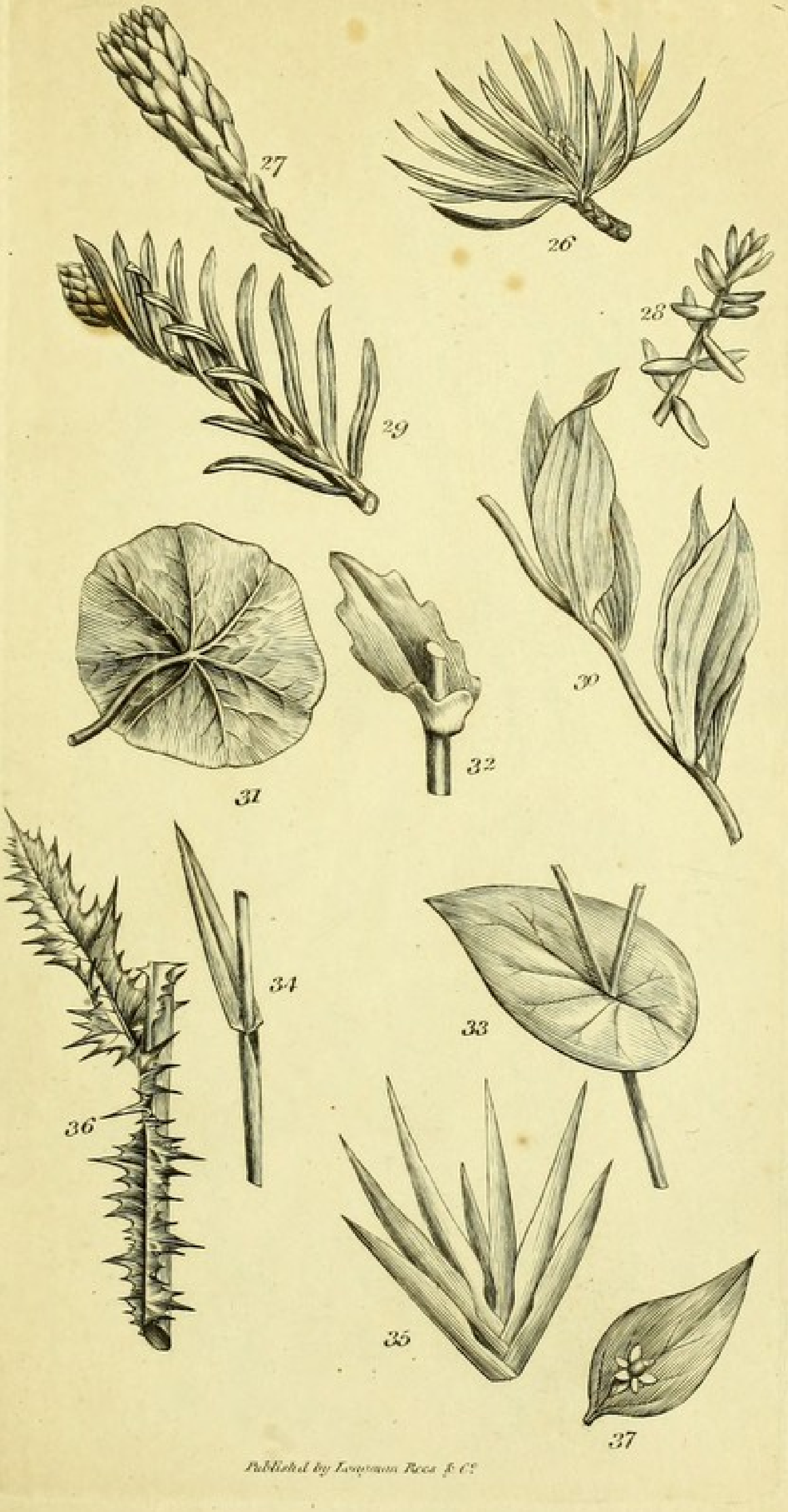

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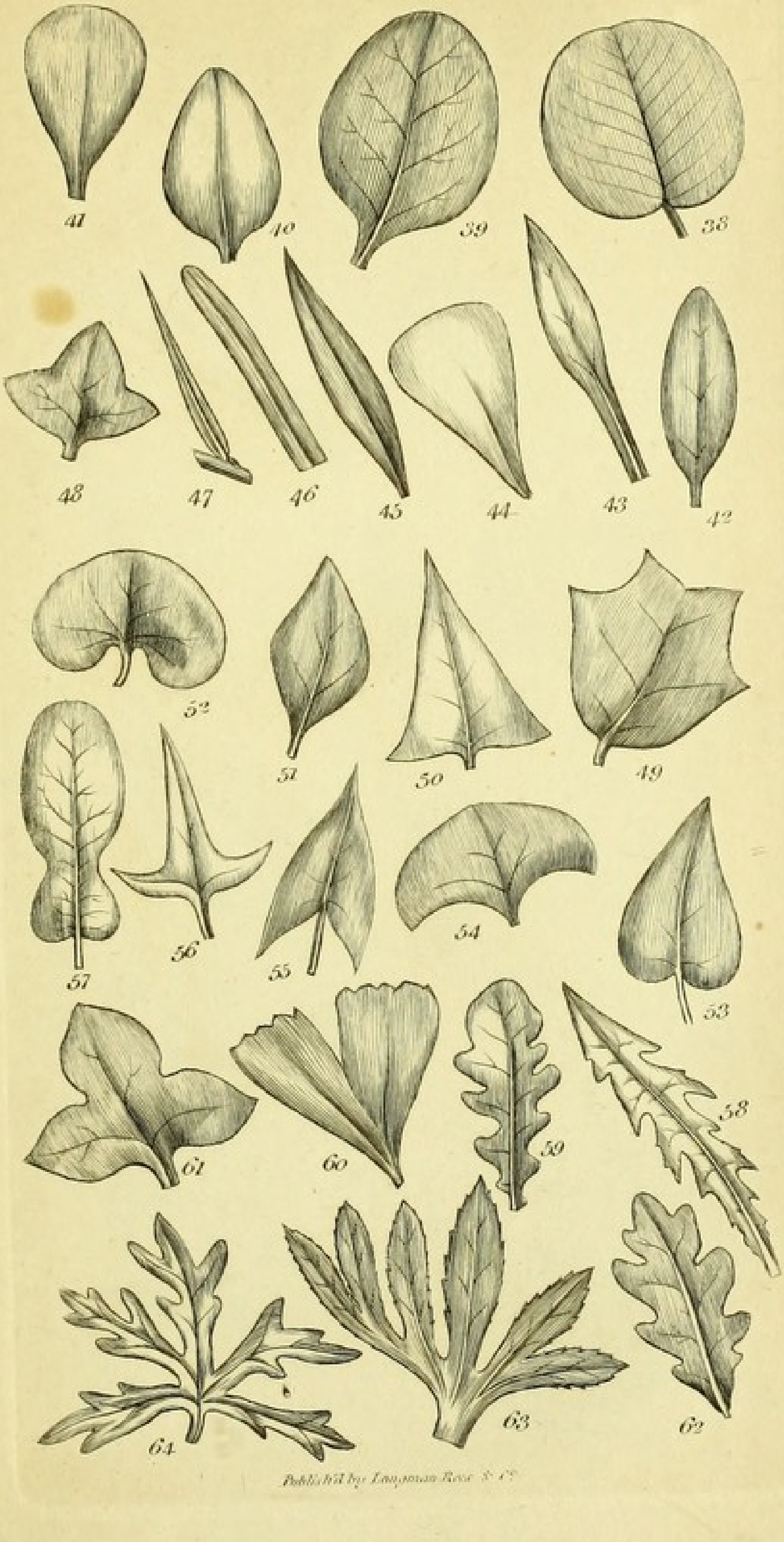

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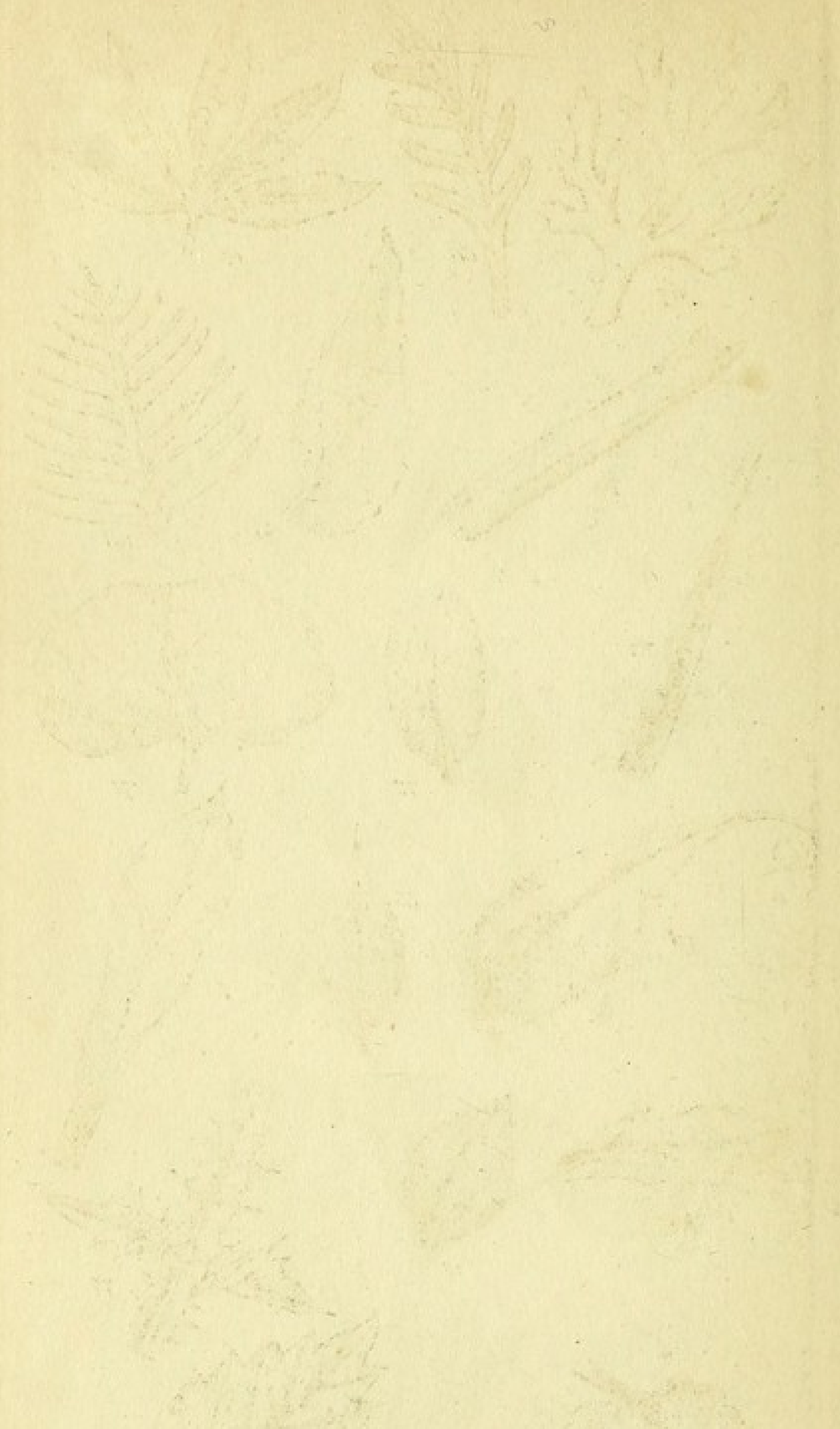

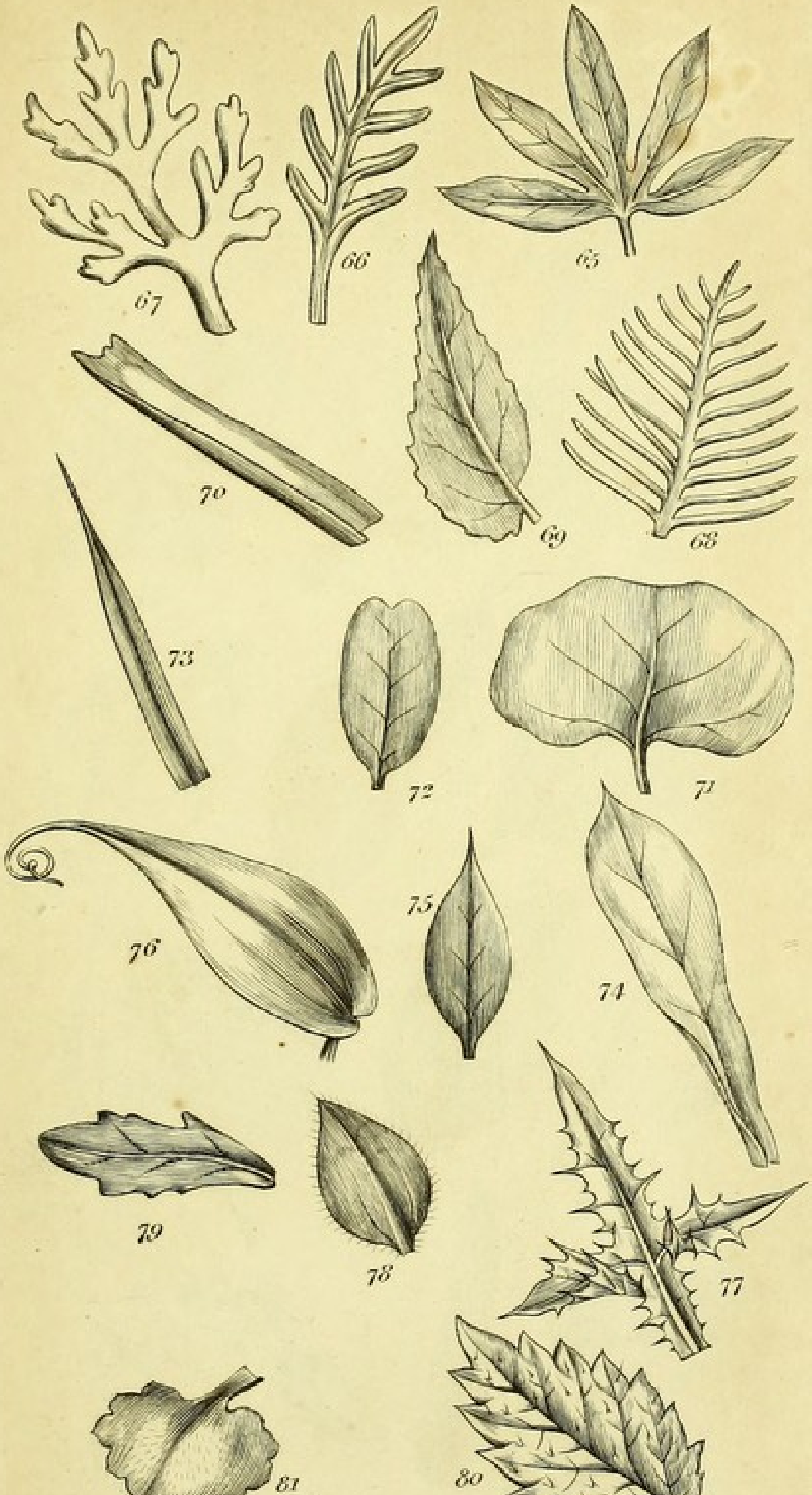

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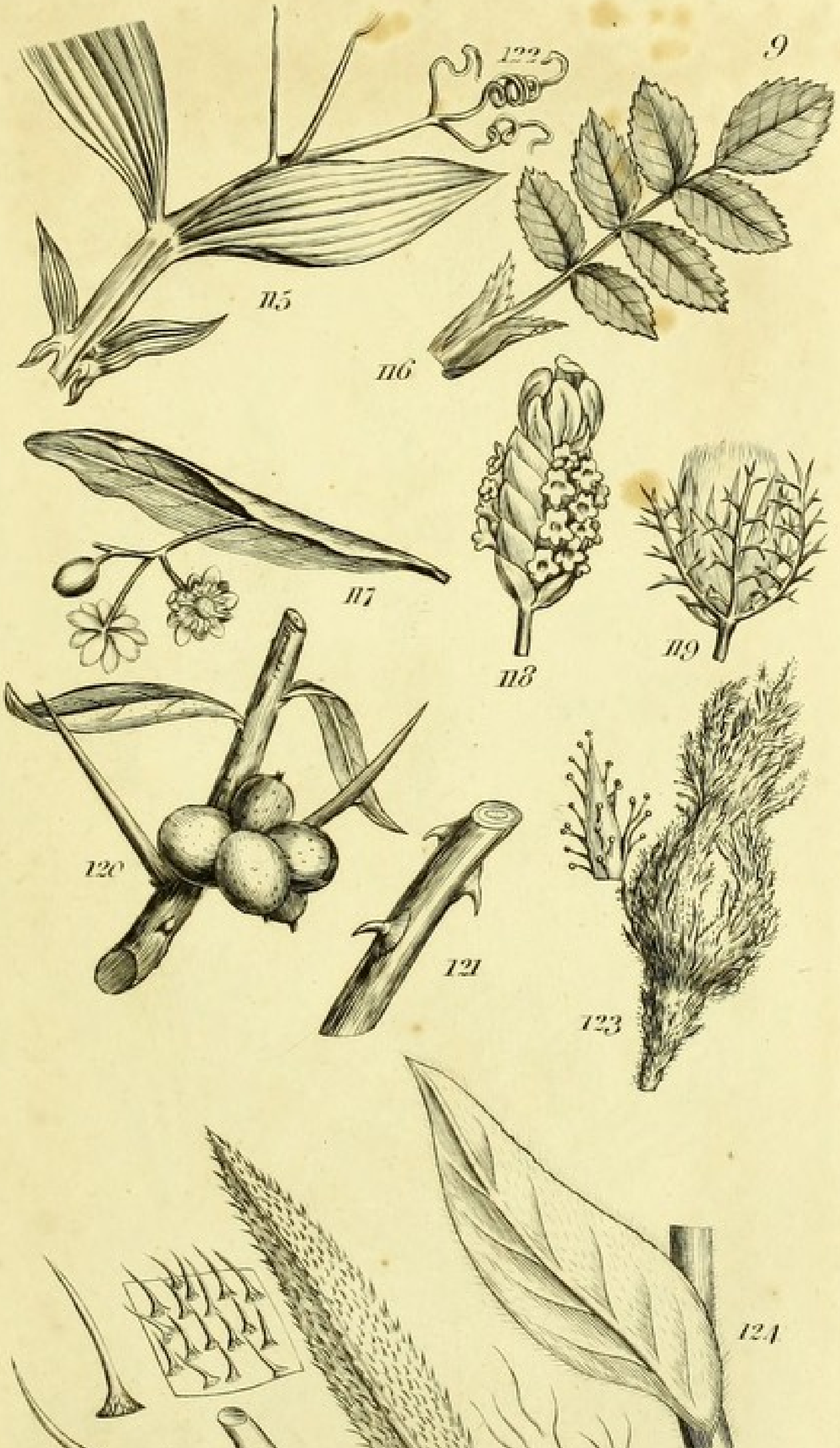

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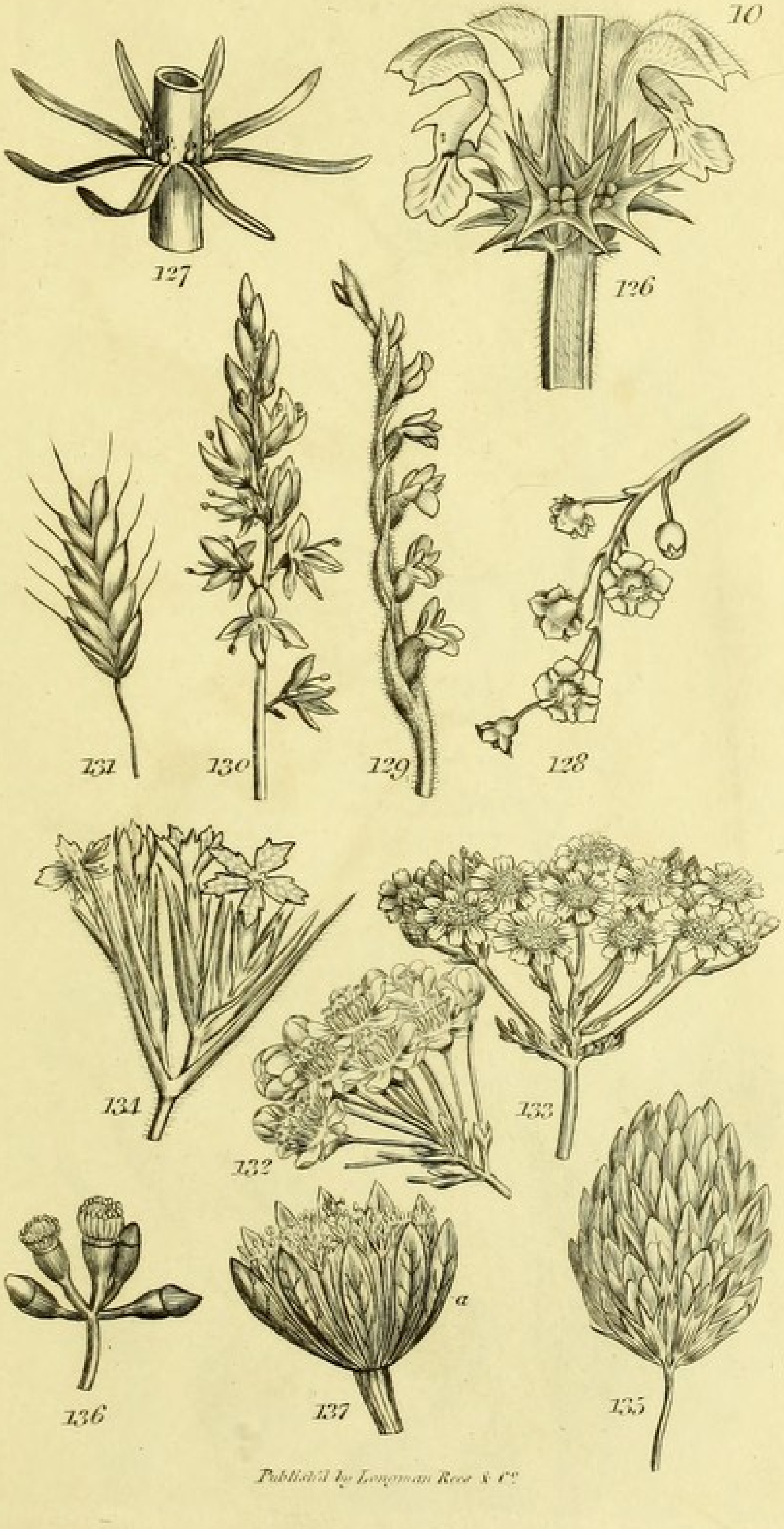

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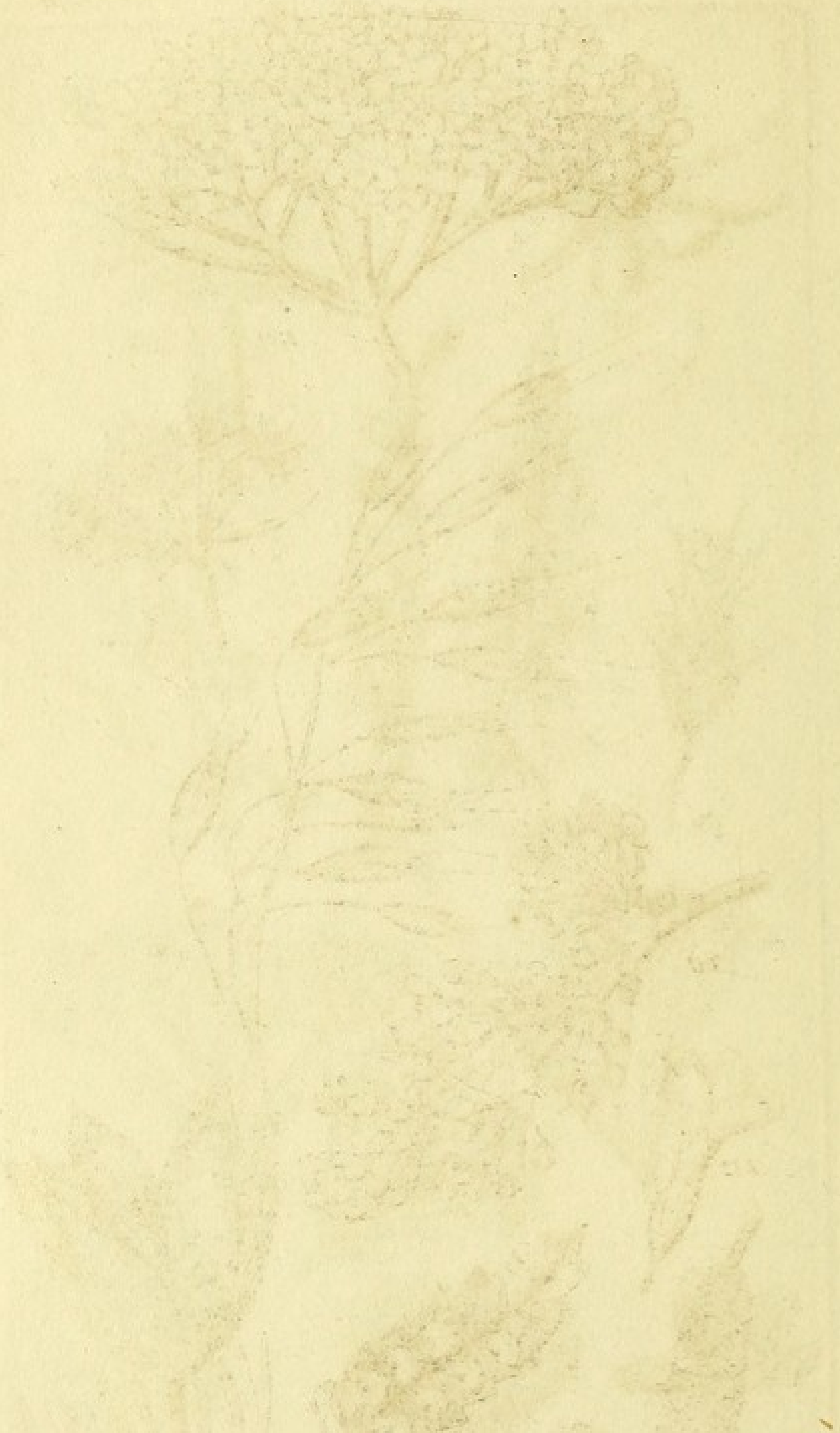

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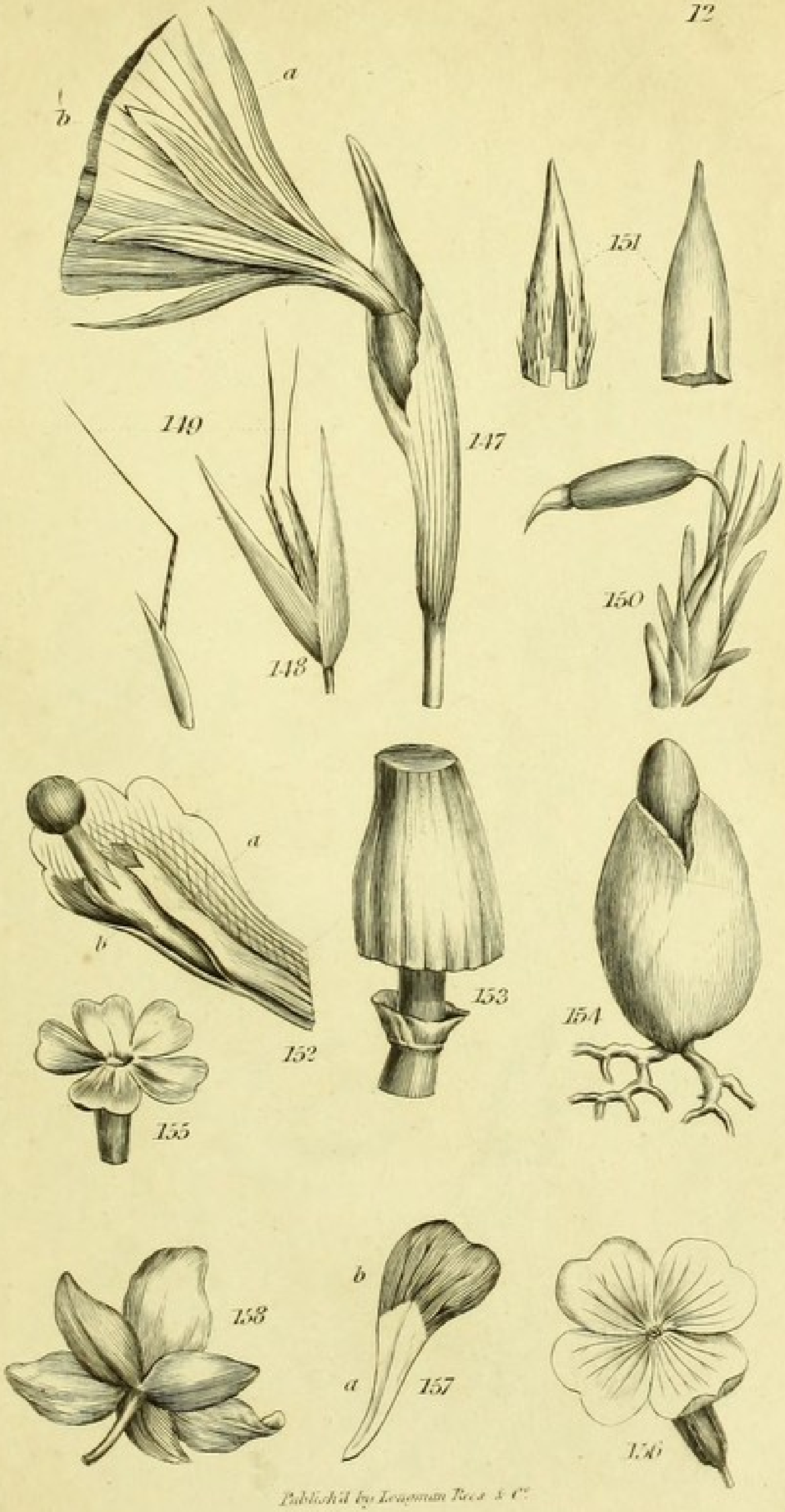

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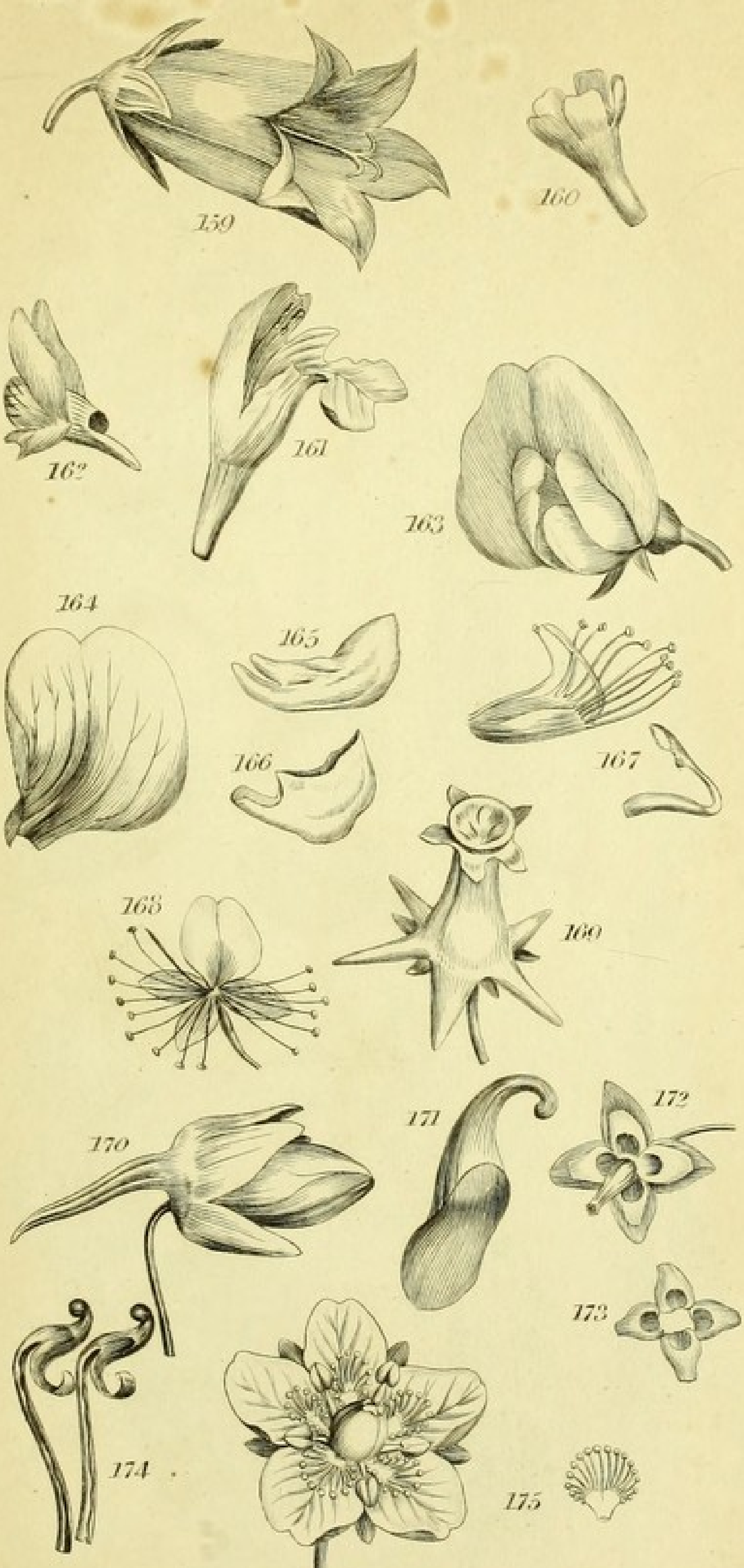

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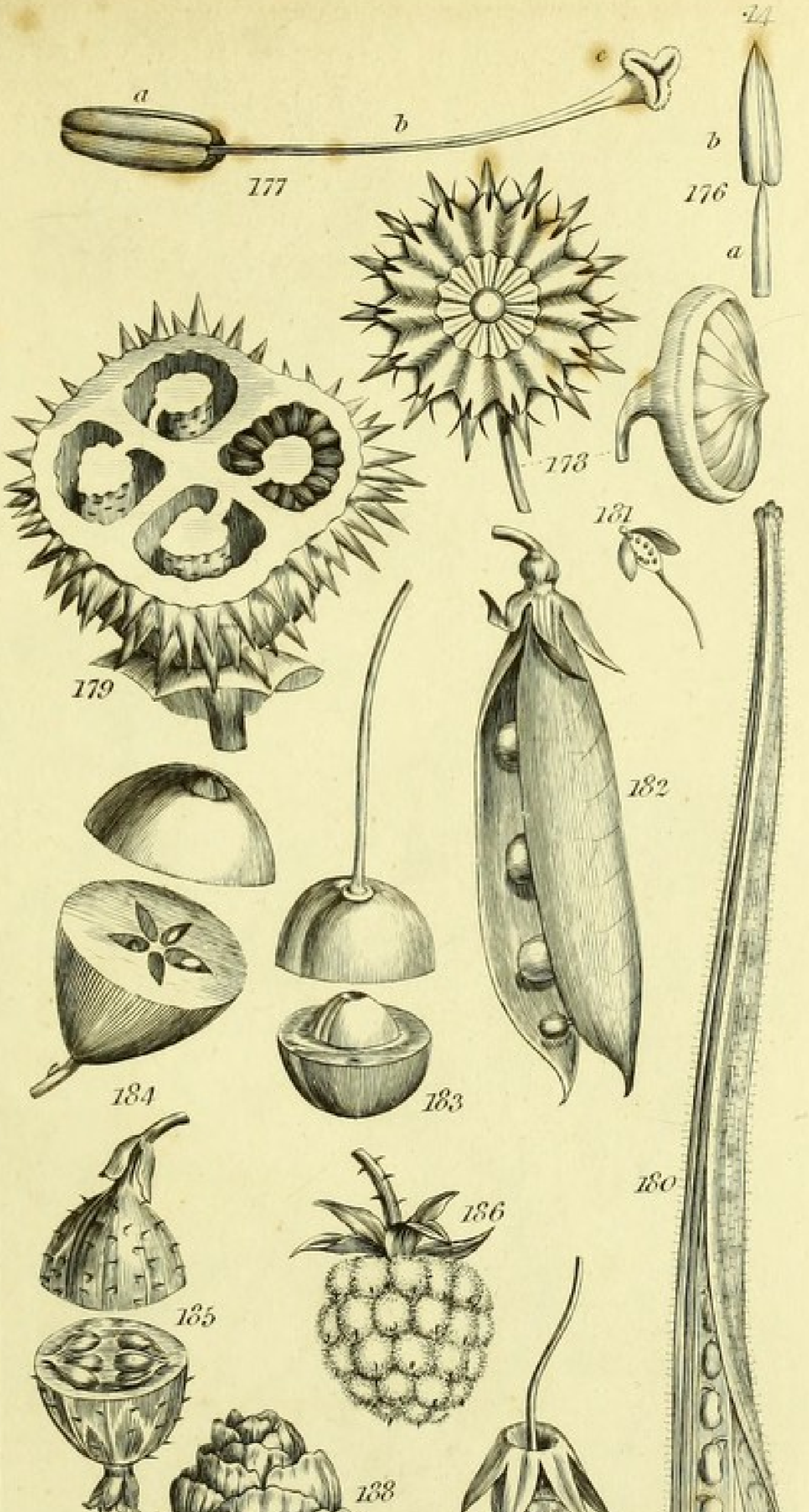

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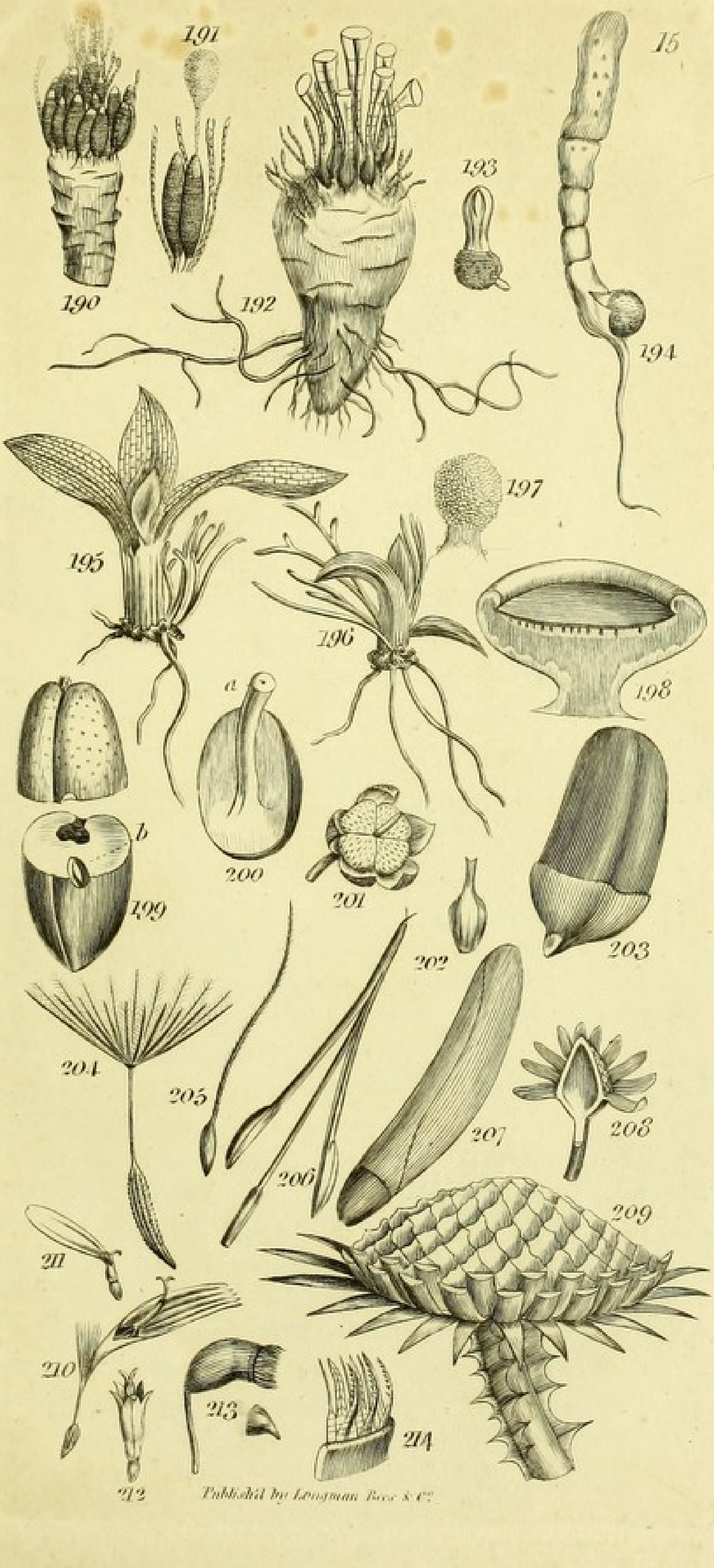

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EXPLANATION

OF THE

SUPPLEMENTARY PLATES,

(SUPPL. 1—21,) CHIEFLY ILLUSTRATIVE OF THE NATURAL ORDERS.

TAB. 1. *fig.* 1. *Globba racemosa.* *a.* Calyx. *b.* Tube of the Corolla. *c, c, c.* Outer limb. *d, d.* Two segments of the inner limb. *e.* Third segment of the same, or lip. *f.* Filament. *g.* Anther. *h.* Style. *i.* Germen. *k.* Stigma.—2. *Veronica spicata.*—3. *Glyceria* (*Poa, L.*) *fluitans,* magnified. 4. A floret more magnified.—5, 6, 7. *Scabiosa* (*Knautia*) *arvensis.*—8, 9. *Epacris obtusifolia.*—10, 11. *Galanthus nivalis.* *a.* Spatha.—12. *Æsculus Hippocastanum.*—13. *Daphne collina.*—14. *Butomus umbellatus.*—15, 16. *Dianthus cæsius.*—17. *Reseda lutea.* *a.* Two upper petals, magnified. *b, b.* Two middle ones. *c.* Two lowermost. *d.* Nectary.—18, 19. *Mespilus grandiflora* (*Smithii, DC.*).

TAB. 2. *fig.* 20. *Capparis spinosa.* *a.* Germen on a long stalk.—21. Corolla, stamens and style of *Lamium album.* 22. Calyx and seeds of the same.—23. Stamens, pistil, and 1 petal, of *Thlaspi* (*Capsella*) *Bursa pastoris.* 24. Calyx-leaf and pouch.—25. *Teesdalia nudicaulis, Compend. Fl. Br.* 110. 26. Stamens and pistil, magnified. 27. A stamen, with its scale.—28. Calyx and 1 petal of *Cardamine amara.* 29. Stamens and pistil. 30. Ripe pod and seeds.—31. Stamens of *Geranium sylvaticum.* 32. Calyx. 33. A Petal. 34. Pistil. 35. Capsule and its beak.—36. Calyx of *Althæa* *officinalis.* 37. Petals, stamens, &c. *a.* Pistil.—38. *Fumaria* (*Corydalis*) *solida.* 39. Stamens, in two sets, with the pistil.—40. *Spartium* (*Cytisus*) *scoparium*, stripped of its petals.

TAB. 3. *fig.* 41. Stamens and pistil of *Ulex Europæus.*—42. Stamens and style of *Pisum* (*Lathyrus, Br. Fl.*) *maritimum.* 43. Calyx of the same. 44. Standard. 45. A wing. 46. One petal of the keel.—47. Pistil.—48. Stamens and pistil of *Hypericum elodes.* 49. Calyx magnified. 50. Back of the whole flower.—51. *Stuartia pentagyna.* 52. A petal separate, with part of the stamens. *a.* Pistils.—53. *Melaleuca thymifolia.* 54. Bundles of stamens. 55. Calyx and pistil. 56. Separate petal.

TAB. 4. *fig.* 57. *Picris* (*Helminthia*) *echioides.* 58. Calyx and receptacle of the same. 59. Floret. 60. Seed and its down.—61. *Carduus nutans.* 62. Section of the receptacle with the young seeds, down, &c. 63. Floret.—64. Floret of the radius of *Centaurea Cyanus.* 65. Floret of the disk of the same.—66. *Inula* (*Pulicaria,*) *dysenterica.* 67. One of its radiant florets. 68. One of those of the disk, with (*a*) the anthers and stigma separate. Receptacle. *a.* A portion magnified.—70. *Ophrys apifera. a, a, a.* Calyx leaves. *b, b.* Petals. *c.* Lip of the nectary. 71. *d.* A stalked mass of pollen, projecting from one of the cells of the anther. *e. f.* Base of the column, in front of which is the stigma. 72, Mass of pollen separate. *g.* Its glandular, or viscid, base. —73. *Stylidium graminifolium, Br. Prodr.* 568. 74. Germen, calyx, and column, magnified. 75, 76. Anthers with the stigma between them.—77. *Dendrobium linguiforme. a.* Lid of the Anther. 78. The same stripped of its calyx and petals. *a.* Lid. *b.* Column. *c, c.* Stigma. *d.* Germen. *e.* Anther stripped of its lid.

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Tab. 10. *fig.* 135. *Potamogeton crispum. a.* Flower magnified. *b.* One of the pistils.—136. *Lemna trisulca. a.* Flower.—137. *Acorus gramineus. a.* Flower.—138. *Typha latifolia. a.* Stamens. *b.* Styles.—139. *Carex depauperata. a.* Barren flower. *b.* Fruit. *c.* Scale. *d.* Seed.—140. *Scirpus* (*Eleocharis*) *fluitans. a.* Scale. *b.* Stamens and pistil.—141. *Coix Lachryma. a.* Barren flowers. *b.* Fertile ones.

Tab. 11. *fig.* 142. *Phœnix farinifera, Roxb. Corom.* v. 1. *t.* 74. *a.* Barren flower. *b, b.* Fertile ones.—143. *Paris quadrifolia. a.* Calyx. *b.* Petal.—144. *Convallaria majalis. a.* Corolla expanded, to show the stamens. *b.* Pistil. *c.* Half-ripe berry.—145. *Luciola* (or *Luzula*) *Forsteri, Engl. Fl. a.* Flower magnified. *b.* Ripe capsule bursting. *c.* Seed.—146. *Tulipa sylvestris. a.* Pistil.— 147. *Agave lurida. a.* Germen, style, and stigma.

Tab. 12. *fig.* 148. *Blandfordia nobilis, Sm. Exot. Bot.* 5. *t.* 4. *a.* Flower split open. *b.* Capsule also laid open. *c.* Seed.—149.

Sowerbæa juncea. *a*. Stamens and pistil. *b*. Pistil alone. *c*. Capsule cut across. *d*. Seed.—150. *Narcissus biflorus*. *a*. Pistil. *b*. *Spatha*, or sheath.—151. *Sisyrinchium striatum*. *a*. Stamens and Pistil. —152. *Iris fœtidissima*. *a*. Stamens and Stigmas.—143. *Dilatris corymbosa*.

Tab. 13. *fig*. 154. *Strelitzia reginæ*. *a*. Spatha. *b*. Petals. *c*, *c*. Nectary cut open to show the stamens and style.—155. Seed of *Urania*, *Schreb. Gen*. with its blue tunic.—156. *Hydrocharis Morsus-ranæ*. *a*. Stamens. *b*. Calyx.—157. *Asarum Europæum*. *a*. Section of the flower. *b*. A stamen. *c*. Stigma. *d*. Seed.—158. *Thesium linophyllum*. *a*. Flower somewhat magnified. *b*. Fruit.—159. *Protea rosacea*.—160. *Embothrium* (*Grevillea*) *buxifolium*. *a*, *a*. Stigma. *b*. Anthers.—161. *Laurus nobilis*. *a*. Drupa.—162. *Polygonum Bistorta*. *a*. Back of the flower. *b*. Pistil.—163. *Atriplex portulacoides*. *a*. Barren flower. *b*. Perfect flower. *c*. Its pistil.—164. *Achyranthes argentea*. *a*. Fringed segments of the Nectary.—165. *Amaranthus Blitum*. *a*. Barren flower. *b*. Fertile one.—166. *Plantago lanceolata*. *a*. Pistil.

Tab. 14. *fig*. 167. *Mirabilis longiflora*. *a*. Perianth. *b*. Longitudinal section of the seed.—168. *Statice reticulata*. *a*. Petal and stamen enlarged. *b*. Pistil. *c*. Calyx of the fruit.—169. *Anagallis tenella*. *a*. Ripe capsule bursting, with the seeds.—170. *Utricularia vulgaris*. *a*. Calyx and pistil. *b*. Corolla separate, the latter marking its base, or point of attachment. *c*. Stamens.—171. *Bartsia viscosa*. *a*. Calyx and style. *b*. Corolla and stamens.—172. *Justicia coccinea*. *a*. Pistil.—173. *Olea Europæa*. *a*. Calyx and pistil enlarged. *b*. Drupa.—174. *Verbena officinalis*. *a*. Corolla. *b*. Stamens.—175. *Antirrhinum* (*Linaria*) *Cymbalaria*. *a*. Corolla forced open to show the stamens. *b*. Pistil. *c*. Ripe capsule burst. *d*. Seed.—176. *Sibthorpia Europæa*, magnified. *a*. Calyx and Pistil.—177. *Solanum stelligerum*. *a*. Lids of the anther. *b*. Berry, and permanent calyx.—178. *Lithospermum purpuro-cæruleum*. *a*. Corolla split open, bearing the stamens.—179. *Convolvulus arvensis*. *a*. Calyx and pistil.—180. *Ipomopsis* (*Gilia*) *elegans*. *a*. Calyx and pistil.

Tab. 15. *fig*. 181. *Bignonia undulata*, *Exot. Bot. t.* 19, showing its fifth filament, which has no anther.—182. *Gentiana verna*. *a*. Pistil.—183. *Exacum filiforme*. *a*. Corolla laid open, with the stamens. *b*. Pistil.—184. *Menyanthes nymphœoides*; (*Villarsia* of Ventenat.) *a*. Calyx and pistil.—185. *Pergularia odoratissima*. *a*.

Calyx. *b.* Corolla laid open. *c.* One of the five leaves of the crown, with its internal appendage. *d, d.* A stamen seen externally; and internally, with the anther, and double masses of pollen. *e.* Pistil, with the masses of pollen deposited upon it. *f.* Double germen, surrounded by nectariferous glands of the receptacle.—186. *Vinca major.* *a.* Tube of the corolla, bearing the stamens. *b.* A stamen magnified. *c.* Pistil, of the natural size. *d.* Follicle and seeds.

TAB. 16. *fig.* 187. *Bassia latifolia, Roxb. Corom. v.* 1. *t.* 19. *a.* Corolla laid open, bearing the stamens. *b.* Pistil. *c.* Germen swelling, and Calyx. *d.* Fruit.—188. *Myrsine retusa.* *a.* Flower magnified. *b.* Pistil.—189. *Diospyros melanoxylon, Roxb. Corom. t.* 49. *a.* Stamens and pistil. *b.* Fruit.—190. *Rhodedendron arboreum, Sm. Exot. Bot. t.* 6. *a.* Stamens. *b.* Pistil.—191. *Erica Tetralix.* *a.* Stamens and pistil. *b.* Stamen enlarged. *c.* Pistil.—192. *Vaccinium Oxycoccus.* *a.* Stamen enlarged. *b.* Germen half ripe, with the style. *c.* Transverse section of the same.—193. *Campanula Trachelium.*—194. *Scævola hispida, Brown, Prodr.* 586. *a.* Stamen. *b.* Anther magnified. *c.* Style and stigma.—195. *Lobelia Dortmanna.* *a.* Corolla. *b.* Stamens, with combined anthers. *c.* Calyx and pistil.—196. *Sherardia arvensis,* thrice the natural size.—197. *Cinchona officinalis.* *a.* Corolla laid open, showing the stamens. *b.* Pistil.—198. *Coffea Arabica.* *a.* Perianth crowning the Germen. *b.* Berry, unripe. *c.* Section of the same, showing the tunic of the seed. *d.* Embryo separate.—199. *Hamellia patens.* *a.* Stipules. *b.* Corolla laid open, showing the stamens. *c.* Calyx and pistil.—200. *Linnæa borealis.* *a.* Corolla laid open, bearing the stamens. *b.* Double calyx, and pistil.—201. *Viburnum Opulus.* *a.* Corolla and stamens. *b.* Calyx and pistil, magnified. *c.* Berry.—202. *Panax quinquefolium.* *a.* Germen, calyx and styles.

TAB. 17. *fig.* 203. *Peucedanum officinale.* *a.* Seeds, each supported by its proper capillary stalk.—204. *Artedia squamata.* *a.* Flower of the circumference. *b.* Seed.—205. *Eriocalia minor, Exot. Bot. t.* 79; see *f.* 209.—206. *Astrantia minor*, magnified. *a.* Barren Flower, with a leaf of the involucrum. *b.* Perfect flower. *c.* Fruit.—207. *Smyrnium Olusatrum.* *a.* Pistil. *b.* Germen cut across. *c.* Fruit.—208. *Caucalis latifolia.* *a.* Flower of the circumference. *b.* Pistil and calyx.—209. *Eriocalia minor*, magnified, *Exot. Bot. t.* 79. *a.* Germen much enlarged, cut across.

—210. *Scandix Pecten-Veneris.* *a.* Seeds nearly ripe.—211. *Sison Amomum.* *a.* Half-ripe fruit.—212. *Eryngium campestre.* *a.* Petal. *b.* Styles.—213. *Clematis Vitalba.* *a.* Stamen. *b, b.* Pistils. *c.* Ripe seed, with its feathery tail.—214. *Ranunculus parviflorus.* *a.* Seed.—215. *Helleborus viridis.* *a.* Capsules half-ripe. —216. *Caltha radicans.* *a.* Petal. *b.* Stamen.—217. *Actæa spicata.* *a.* Calyx-leaf. *b.* Petal. *c.* Stamen. *d.* Pistil.—218. *Papaver Argemone.* *a.* Petal. *b.* Stamen. *c.* Pistil.—219. *Nuphar minima.* *a.* Petal. *b.* *Stigma.*—220. *Sapindus rubiginosa, Roxb. Corom. v.* 1. *t.* 62. *a.* Pistil. *b.* Fruit cut across.

Tab. 18. *fig.* 221. *Acer campestre.* *a.* Perfect flower. *b.* Fertile flower. *c.* Fruit.—222. *Malpighia glandulosa.* *a.* Flower. *b.* Fruit.—223. *Xanthochymus pictorius, Roxb.*, showing the five sets of stamens, with five intermediate nectaries.—224. *Citrus Aurantium.* *a.* Young berry.—225. *Turræa virens.* *a.* Pistil. *b.* Capsule. *c.* Seed.—226. *Vitis vinifera.* *a.* Combined petals, elevated by the stamens.—227. *Pelargonium crithmifolium.* *a.* Pistil.—228. *Tropæolum peregrinum.* *a.* Stamen. *b.* Pistil.—229. *Magnolia fuscata.*—230. *Dillenia aurea, Exot. Bot. t.* 29, the pistil and stamens.—231. Portion of the ripe fruit of the same, being an assemblage of succulent-coated capsules.—232. *Uvaria suberosa, Roxb. Corom. v.* 1. *t.* 34. *a.* Calyx and petals. *b.* Receptacle. *c.* Germen cut across.—223. *Menispermum cordifolium,* (*Willd.*) *a.* Barren flower in front. *b.* Back of the same. *c.* Ripe Drupa. *d.* Section of the same.—234. *Epimedium alpinum,* *a.* Stamen. *b.* The same, with the anther burst. *c.* Pistil. *d.* Calyx. *e.* Nectary.

Tab. 19. *fig.* 235. *Tilia Europæa.* *a.* Capsule.—236. *Cistus Helianthemum,* (*Helianthemum vulgare*). *a.* Calyx. *b.* Stamen. *c.* Pistil.—237. *Boronia serrulata.* 238. Dissection of the same *Boronia.* *a.* Flowers stripped of its petals. *b, b.* Pistil. *c.* Stamen, showing the crested appendage of the anther. *d.* Ripe capsule, after the seeds are gone. *e.* Elastic tunic. *f.* Seed.—239. *Holosteum umbellatum.* *a.* Calyx and ripe capsule. *b.* Receptacle of the seeds.—240. *Stellaria holostea.*—241. *Frankenia lævis.* *a.* Stamens and pistil. *b.* Pistil magnified.—242. *Sempervivum tectorum.*—243. *Saxifraga granulata.*—244. *Ceratopetalum gummiferum.* *a.* Petal and stamen. *b.* Stamen magnified. *c.* Capsule and seed.—245. *Ribes nigrum.* *a.* Calyx laid open, bearing the petals and stamens. *b.* Pistil. *c.* Ripe berry.—246.

Cactus (*Opuntia*) *Tuna*, showing the germen, and under-side of flower.—247. *Montia fontana*. *a*. Pistil. *b*. Capsule. *c*. Seed. —248. *Mesembryanthemum tenuifolium*. *a*. Calyx and pistil. *b*. Petals in three rows, with some of the stamens.—249. *Epilobium tetragonum*. *a*. Calyx, with stamens, style, and stigma, all magnified. *b*. Capsule and seeds.—250. *Fuchsia coccinea*. *a*. Berry. —251. *Myriophyllum spicatum*. *a*. Barren flower, with its bractea. *b*. Calyx and stamens of the same. *c*. Fertile flower and its bractea.—252. *Hippuris vulgaris*. *a*. Flower in an early state, magnified. *b*. The same after the pollen is discharged. —253. *Eucalyptus robusta*. *a*. Calyx and pistil. *b*. A stamen enlarged. *c*. Lid lifted off.

Tab. 20. *fig*. 254. *Blakea trinervis*. *a*. Stamens. *b*, *b*. Some of the same separate. *c*. Outer and inner calyx, with the pistil. —255. *Lythrum Salicaria*. *a*. Calyx and style. *b*. Petals and stamens, showing their insertion into the calyx. *c*. Pistils separate.—256. *Rosa spinosissima*. 257. Fruit of the same. *a*. Seed.—258. *Sibbaldia procumbens*. *a*. Back of the calyx. *b*. Petal. *c*. Stamen. *d*. One of the pistils.—259. *Fragaria vesca*. *a*. Ripe fruit.—260. *Spiræa Filipendula*. *a*. Petal. *b*. Stamen. *c*. One of the pistils.—261. *Prunus Cerasus*. (*Cerasus vulgaris*). *a*. Drupa.—262. *Viminaria denudata*. *a*. Stamens, all distinct. *b*. Pistil. *c*. Legume, and permanent calyx.—263. *Astragalus hypoglottis*. *a*. Stamens and pistil. *b*. Legume. *c*. Seed.—264. *Semecarpus Anacardium*. *a*. Barren flower. *b*. Perfect one.

Tab. 21. *fig*. 265. *Euonymus Europæus*. *a*. Ripe Capsule. *b*. Tunic cut across to show the seed. *c*. Seed naked.—266. *Rhamnus catharticus*. *a*. Segment of the limb of the calyx. *b*. Petal and abortive stamen. *c*. Pistil of a fertile flower. *d*. Rudiment of pistil in a barren one. *e*. Berry.—267. *Lasiopetalum ferrugineum*. *a*. Pistil enlarged, with the petals. *b*. Stamen.—268. *Euphorbia hiberna*, magnified, showing the joints of the stamens, where, according to Mr. Brown, those parts unite with their partial stalks.—269. Pistil of *Buxus sempervirens*. *a*. Transverse section of the germen.—270. *Bryonia dioica*. *a*. Barren flower. *b*. Berry.—271. *Passiflora suberosa*. *a*. Ripe berry, with the permanent calyx and styles. *b*. Seed.—272. *Dorstenia cordifolia*. *a*. Part of the receptacle magnified, with barren and fertile flowers.—273. *Urtica urens*. *a*. Barren flower, with its central nectary. *b.* Calyx in fruit. *c.* Seed.—274. *Humulus Lupulus.* *a.* Barren flower. *b.* Stamen magnified. *c.* Fertile flower. *d.* Pistil with the tunic magnified.—275. *Taxus baccata.* *a.* Barren flower. *b.* Fertile flower. *c.* Ripe fruit.—276. *Pinus sylvestris.* *a.* Anther magnified. *b.* Scale of an unripe cone, the natural size. *c.* Ripe seed.—277. *Dacrydium cupressinum*, from Lambert's *Pinus*, tab. 41. *a.* Tip of a branch, with the solitary fertile flower. *b.* Scale of a barren flower, with the double anther magnified.

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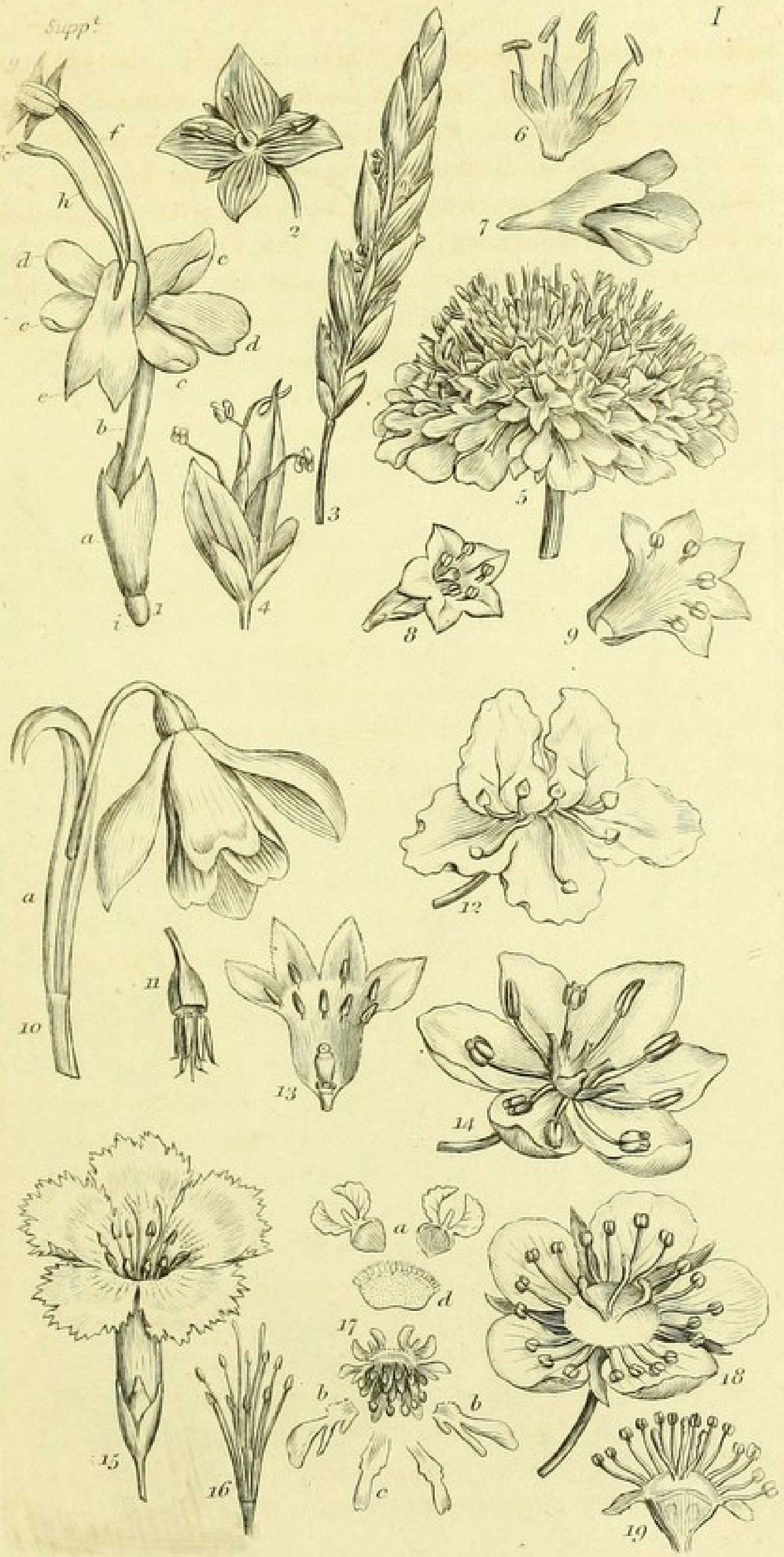


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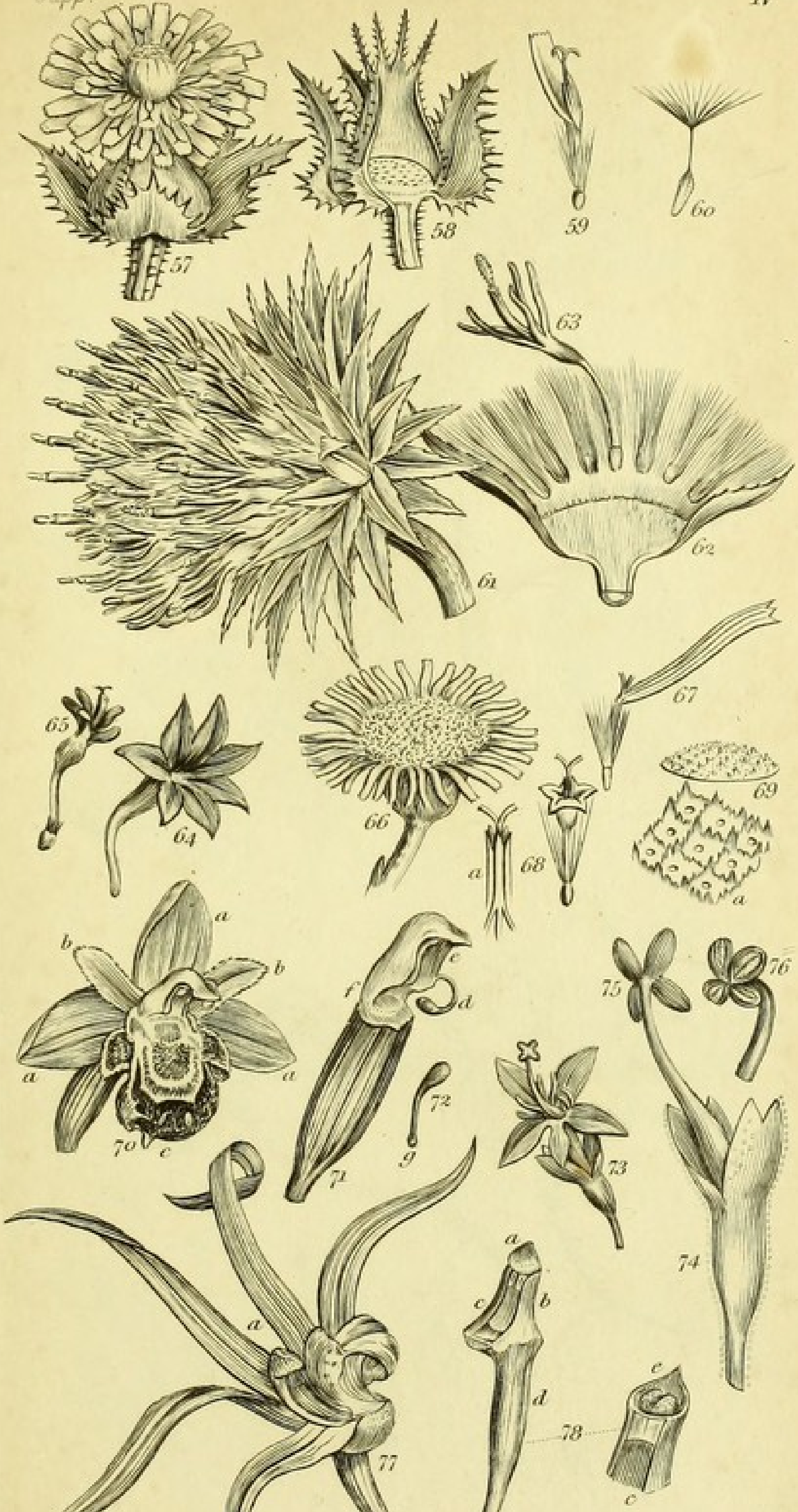
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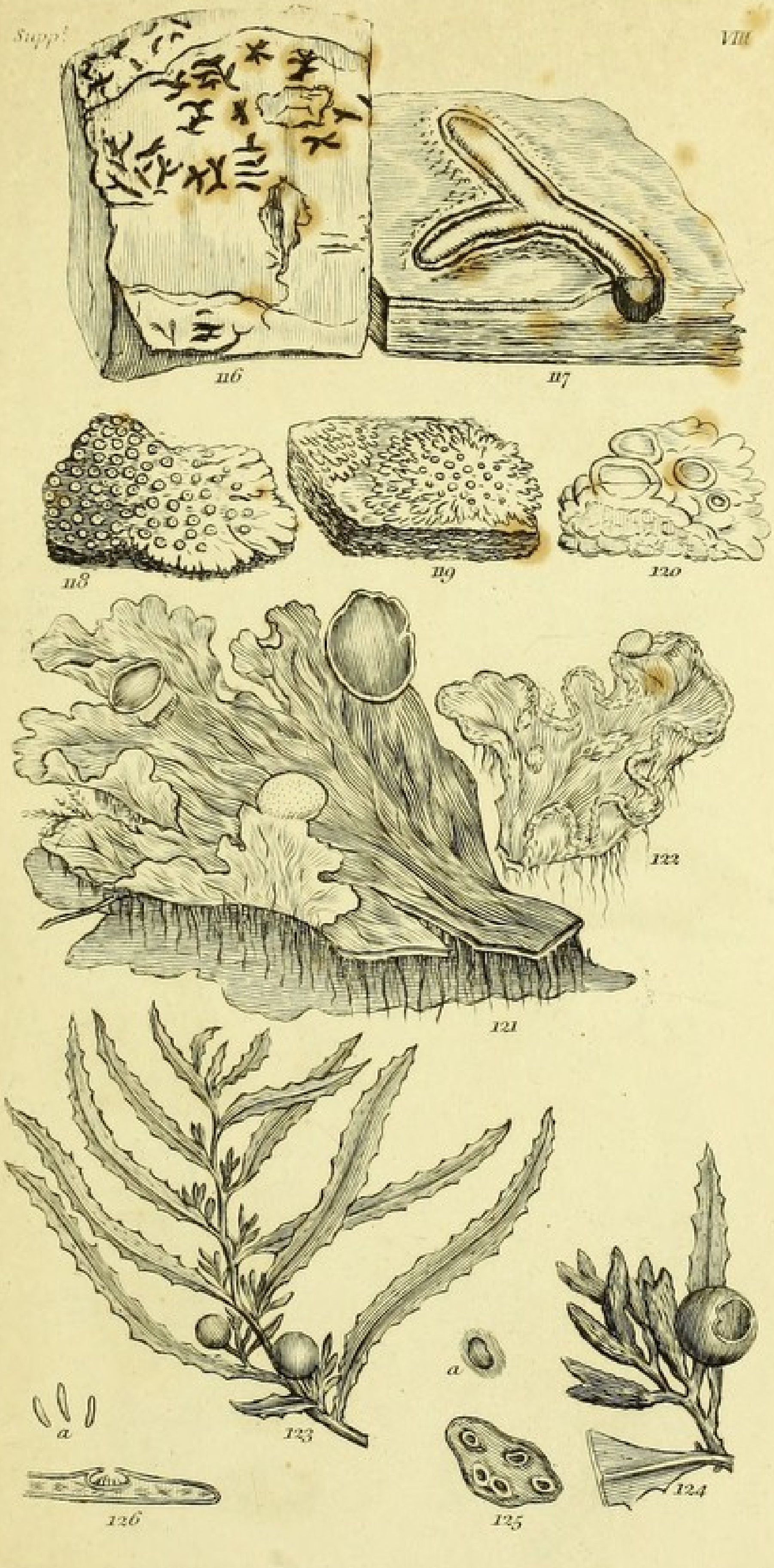
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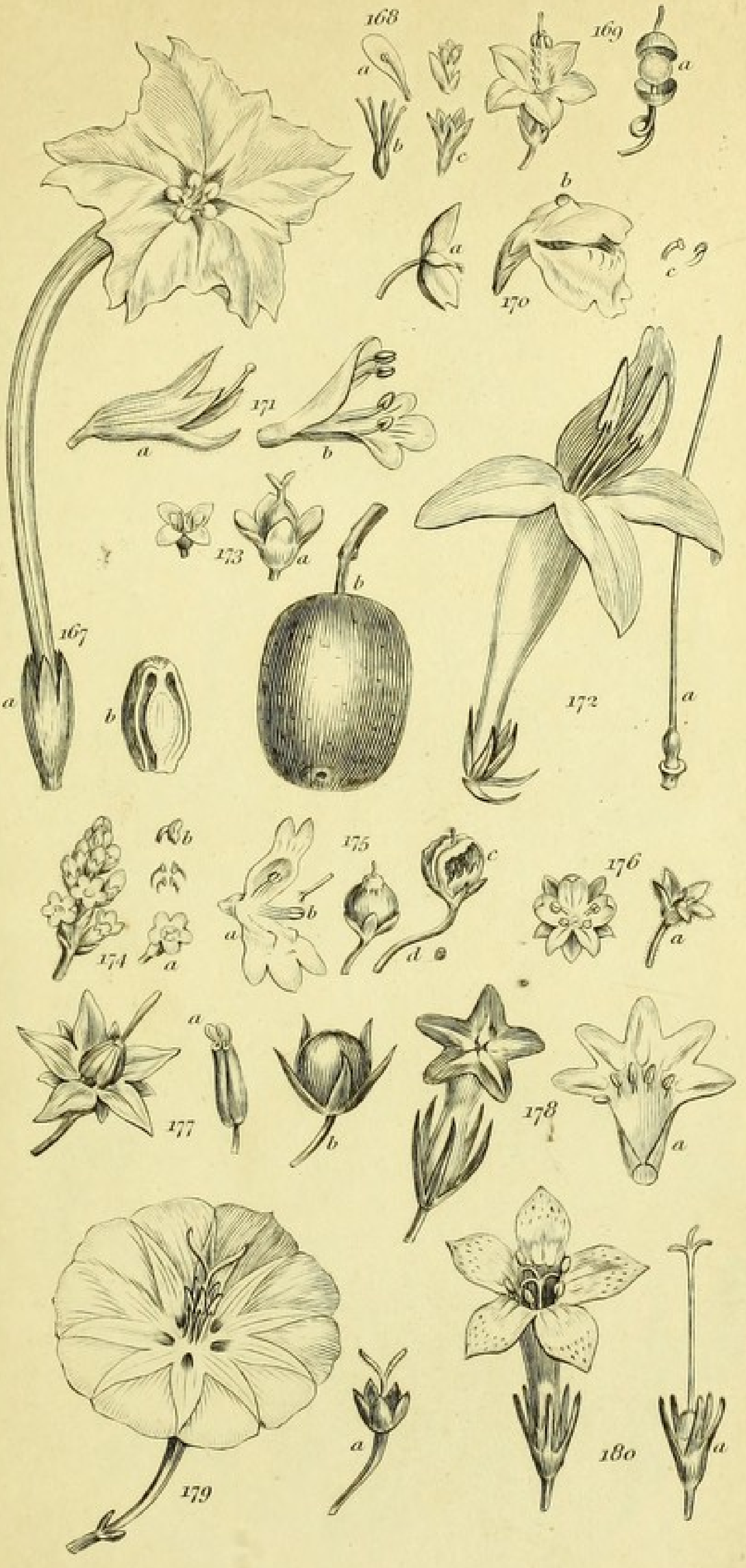
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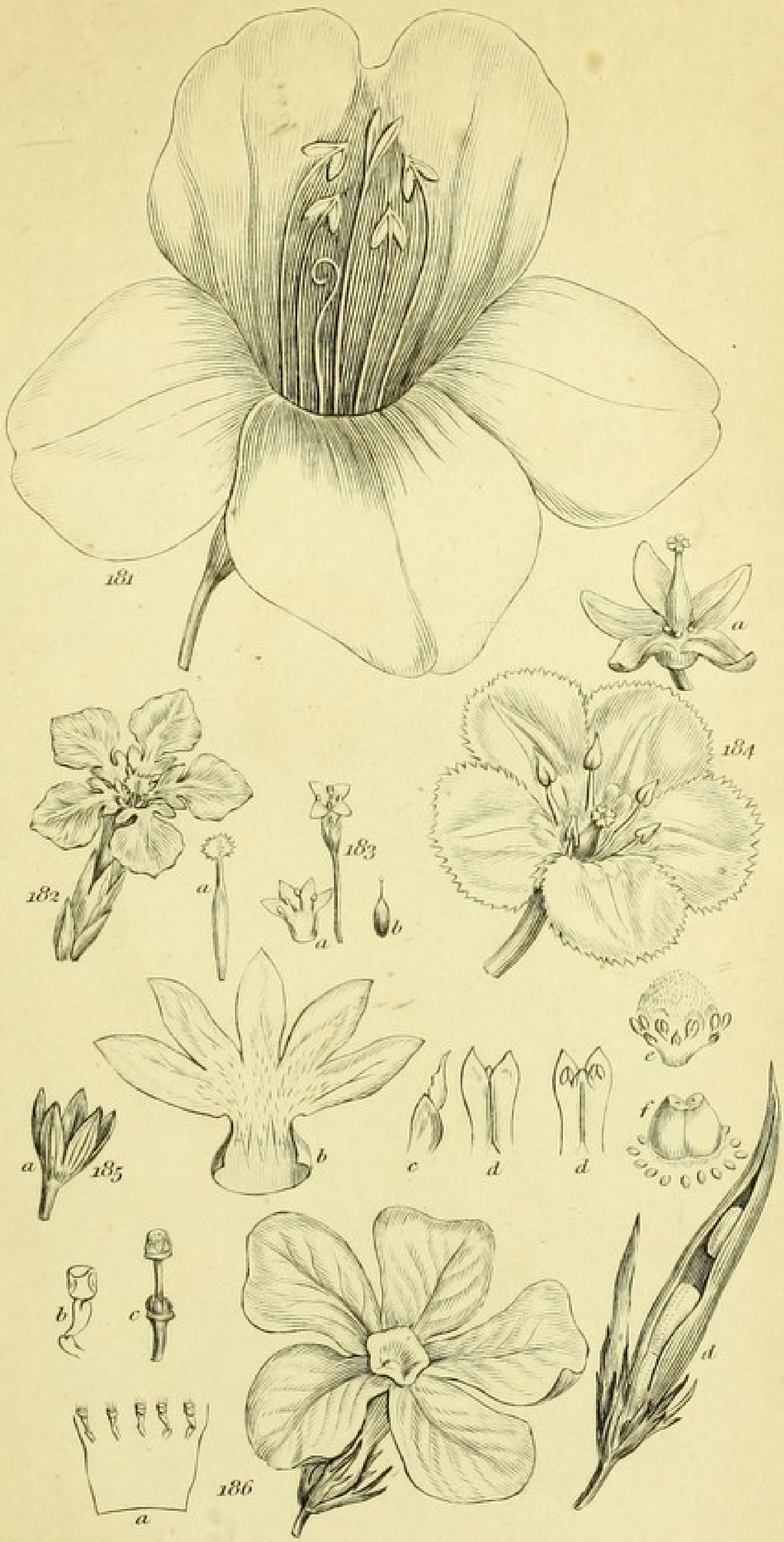
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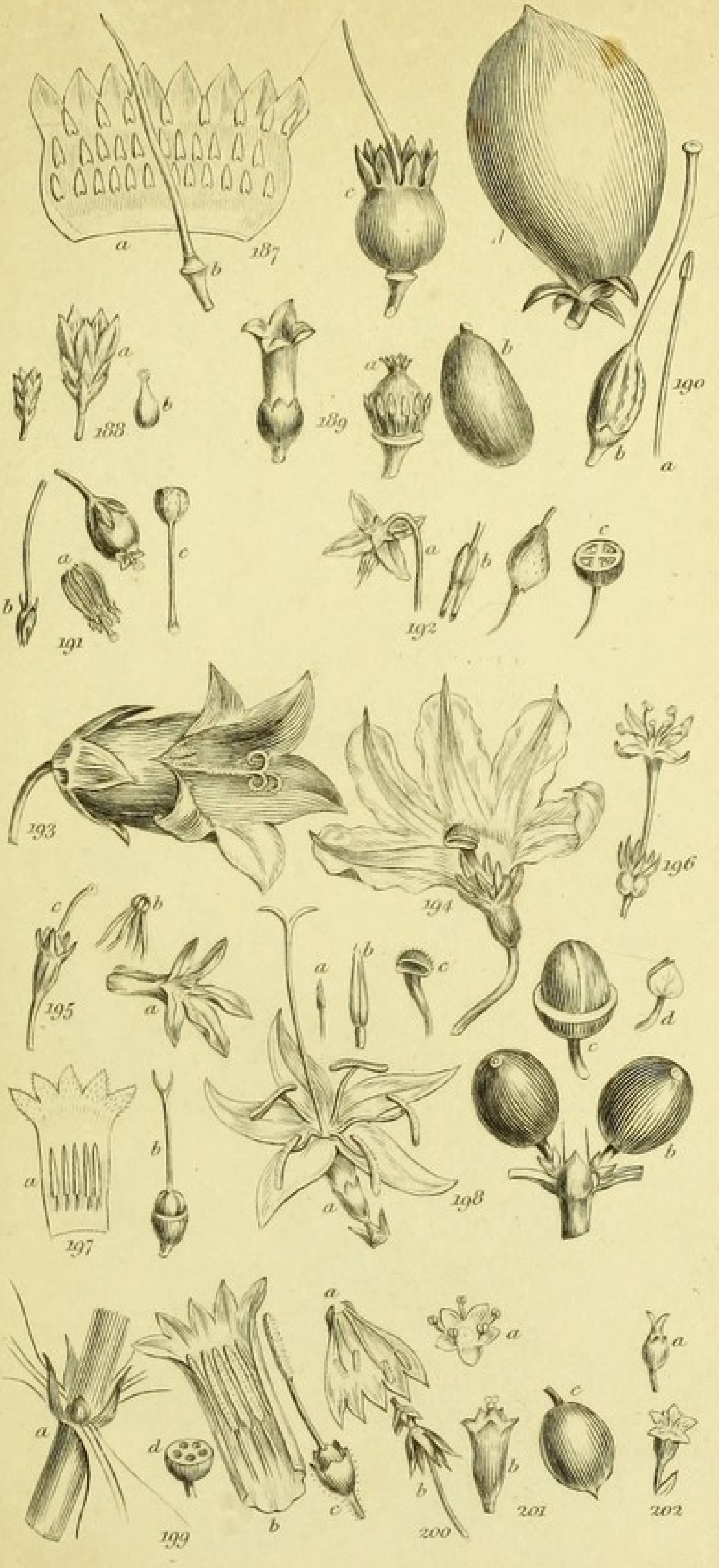
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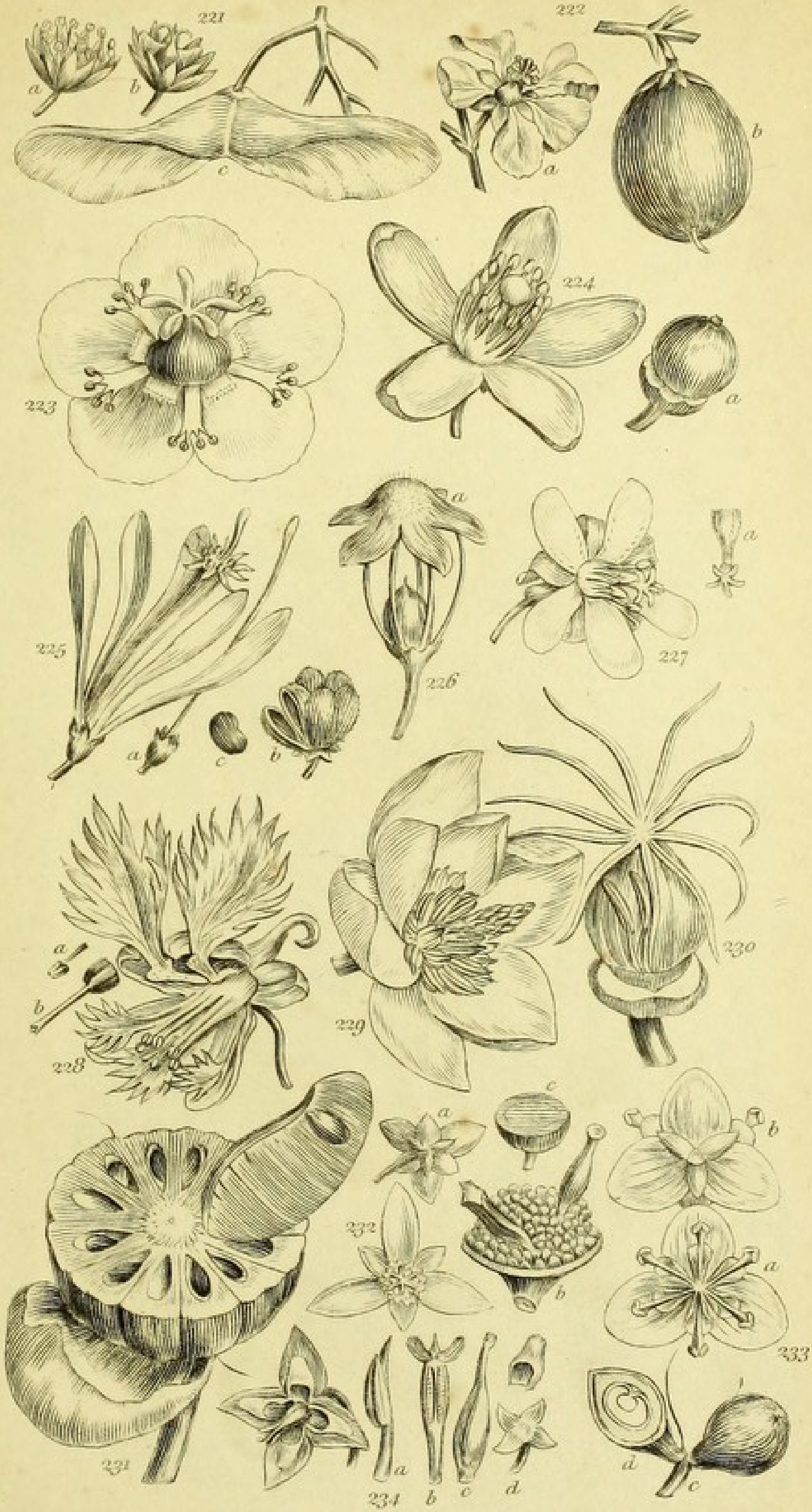
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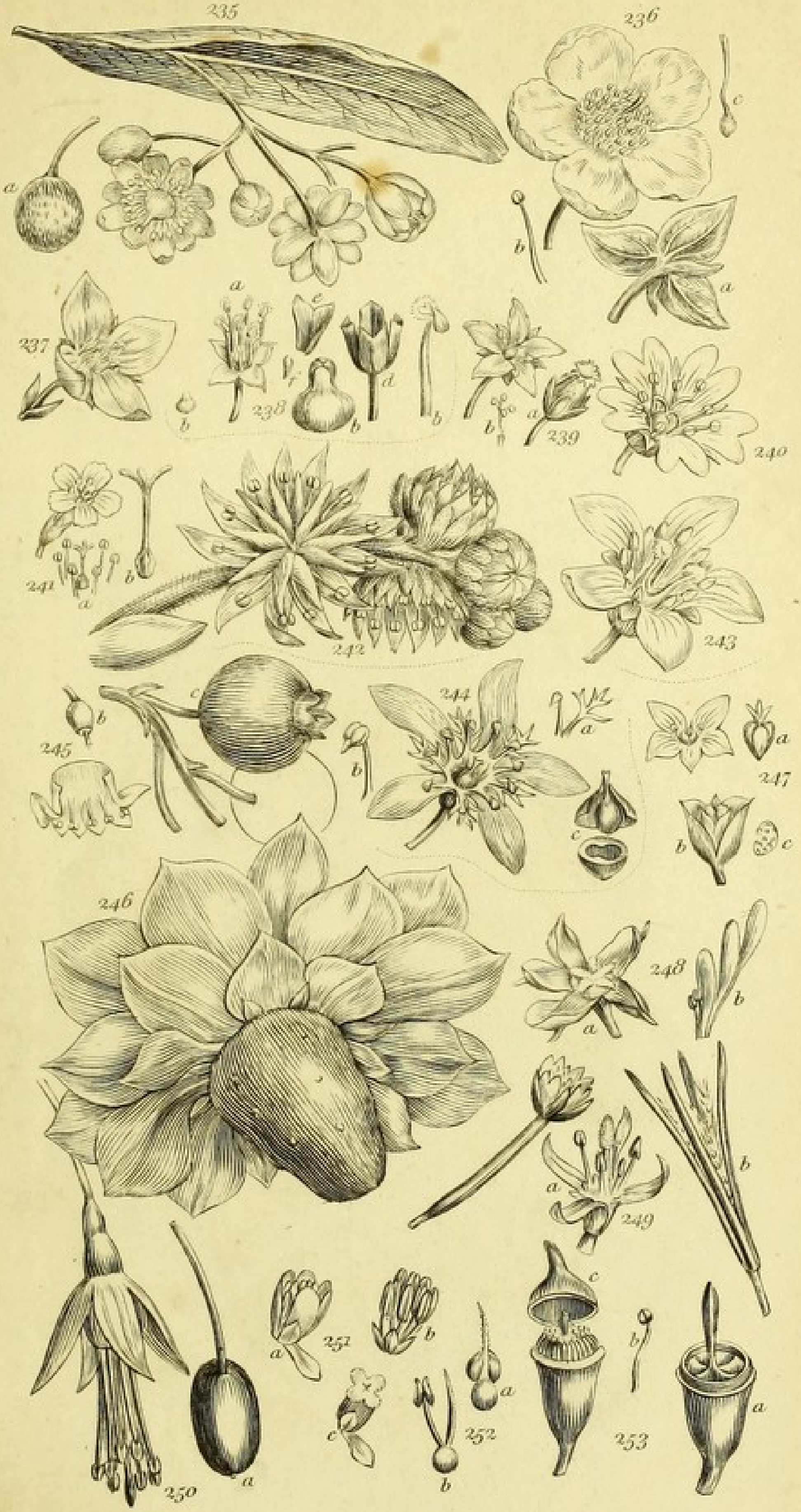
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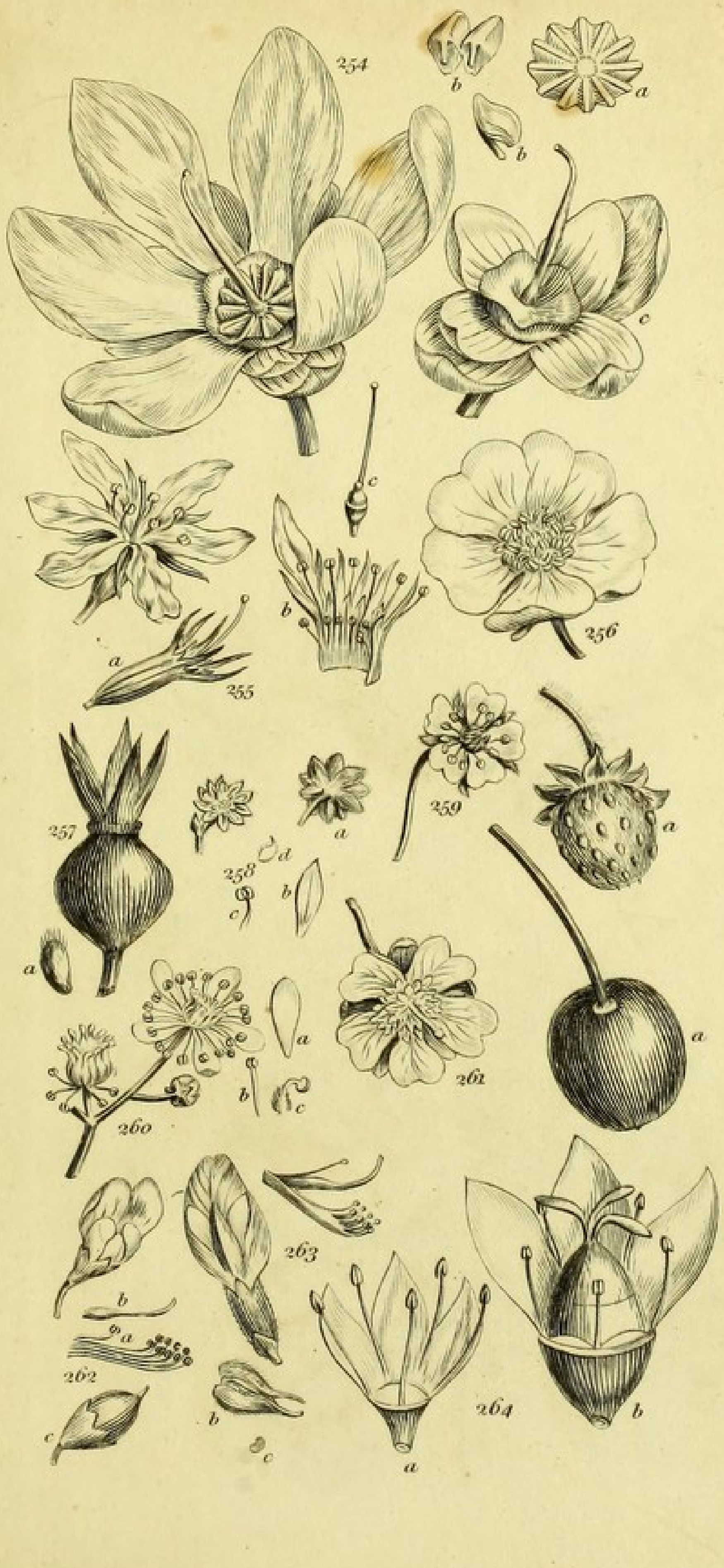
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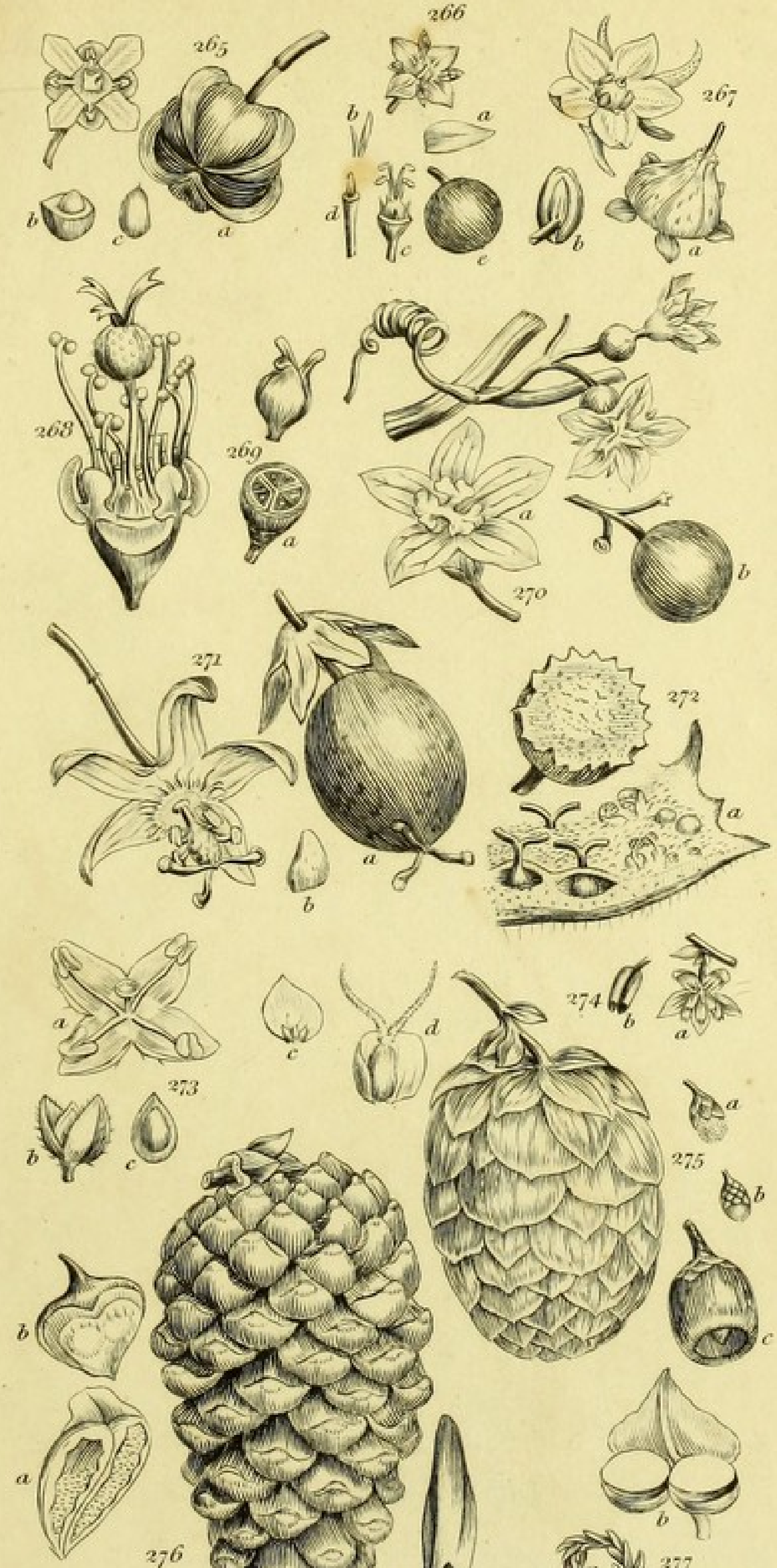
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