Caprifolium Periclymenum.

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THE

ILLUSTRATED BOTANY.

COMPRISING AN

INTRODUCTION TO THE NATURAL SYSTEM, A TREATISE ON VEGETABLE PHYSIOLOGY, AND ON THE BOTANY OF FOSSILS, TOGETHER WITH DESCRIPTIONS OF NUMEROUS SPECIES OF PLANTS.

EDITED BY

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PUBLISHER'S PREFACE.

The publisher is happy to announce to the patrons of this work that its prospects for the coming year are now very flattering. It will be perceived from the title page that he has been so fortunate as to secure the editorial services of a gentleman than whom no American author in several departments of science is better known, both at home and abroad. He considers this fact alone to be a sufficient guaranty for the improvement and usefulness of the work.

In addition to this, the publisher would also state that, even with facilities by no means great, and under many unfavorable circumstances, the subscription list has already, during the past year, attained the number of four thousand and more, and has thus placed the continuance and stability of the work beyond ordinary contingencies. It is believed that there are few instances where a periodical, commenced under like circumstances, has in so short a time established itself so firmly in public estimation, and the publisher cannot but feel an honest pride in the success which has crowned his exertions, as well as sincere gratitude to those whose patronage has so materially contributed to that success. The original idea of the work, it is but justice to himself to say, was entirely his own, and though he felt great confidence in its ultimate popularity, yet it was with some misgivings that he expended his time, labor and money, in the important and difficult undertaking of its commencement. With no aid except what his own resources furnished, with no name of weight and influence to recommend it, the nature of the subjects to which its pages are devoted has been sufficient to give it a strong hold upon public favor. Its future course will be unimpeded by these or similar embarrassments, and there can be no doubt that it will reach such an eminence in the estimation of a discerning community as it shall be justly entitled to by the ability with which it will be conducted, the great and increasing interest felt in the science of Botany, and the unwearied efforts, both of editors and publisher, to render it, in every respect, worthy of the first rank among similar publications. The explanation of the plans formed for the future course of the work, belongs more particularly to the editor, but the publisher may say that it will embrace every thing necessary to make it a standard treatise on Botany, together with such accessories as shall be suggested by taste and experience, and shall be calculated to gratify the natural desire for what is at once elegant, entertaining and instructive. For this purpose the publisher is confident that he could possibly make no more favorable arrangements than he has done for the year to come; and that the expectations of his patrons will not be in the least degree disappointed. The matter which is furnished by the editors will be of the most substantial character, and in point of beauty and correctness of delineation and of coloring the plates will be equal at least to any thing of the kind executed.

J. K. WELLMAN.

INTRODUCTION.

At the commencement of the second year's existence of this work, under auspices somewhat different from those by which it has hitherto been governed, there is perhaps some propriety in saying a few words to those who may read it, respecting its conduct in future. As is announced by the publisher, a change in the editorial arrangement has been effected, in regard to the judiciousness of which it does not become the present writer to speak. He indulges the hope, however, that the interest of the work will be at least fully sustained, and that whatever reputation it may now possess, will not be diminished in his hands. It is also hoped, that in consideration of the assistance which has been promised from abler pens than his own, of certain new features which he proposes to introduce, and of the firm foundation on which, in other respects, the work has now been placed, that it may increase in popularity as well as in literary and scientific value. Upon a sufficiently careful inspection of the foregoing numbers, the Editor is convinced that a method, considerably different from that already pursued, may be adopted with enlarged benefit both to its usefulness and interest; and that some branches of the science, not hitherto entered upon, may be discussed with advantage. An unconnected collection of isolated facts, theories, descriptions and explanations, however entertaining for the moment, is of little permanent use to any one who wishes to become a botanist, or indeed to attain even a tolerable degree of excellence in any scientific pursuit whatever. The nature of all sciences is progressive. It is necessary for the student of Botany to proceed by deliberate advances. *Festina lente* is his safest maxim. He must begin by learning the elements of the science as a child learns letters. He must first acquire a thorough familiarity with the simplest and broadest distinctions between the great divisions of the Vegetable Kingdom, the reasons upon which those distinctions rest, the names of the parts on which they depend, the differences of organization, the modifications of structure or of appearance, which are the foundation of the modern science of Botany. In short, Botany cannot be understood in its most interesting and most important view, without a very considerable degree of patience and toil; especially in taking the primary steps. It is like a noble fortification, of which the outposts are the most difficult to be captured, but which, when once in the hands of the invader, offer a comparatively easy access to the more important, but less strongly guarded interior. Such, indeed, is the condition on which all valuable knowledge must be obtained; and the assertion is a safe one, that whatever learning can be easily and superficially acquired, is in itself superficial. An eminent author has maintained that the popular notion that Botany is a science of easy acquirement, is a popular error, and to this position we entirely assent. To the study of Botany, one who wishes to master it *as a science*, must bring no ordinary combination of faculties. To patience he must add quickness of perception; to methodical habits of thought, a certain kind and degree of imagination; to comprehensive views of nature, the power to enter into the most minute details. On the one hand, he must be calm and considerate; on the other, energetic, enthusiastic and inquiring; capable as well of long continued and laborious effort as of dexterous and versatile exertion. And yet, to assert that Botany is not calculated for a popular object of study, would be as absurd as the same assertion in regard to the science of music: and an argument against the general pursuit of the former, based upon the fact that every student cannot become a Linnæus or a Lindley, would be as fallacious as to contend that no one should study music because he could not reach the fame of a Mozart or a Haydn. Indeed, a contrary argument, without a paradox either, might be drawn from these very circumstances.

But we take it for granted that our readers need no such reasoning to induce them to follow us when, in ensuing parts of this work, we attempt to lead them, by a somewhat more thorough and regular course than has been before pursued, to some acquaintance with the great modern system of Botany, as improved and extended by Lindley and others, and which seems to have given to the science a stability and precision which it has been comparatively late in acquiring. It will, of course, be quite impossible, in such a periodical, to enter minutely or largely into the details of this subject. All we shall aim at will be, to give the reader as competent a knowledge of first principles, as will render him capable of studying with pleasure and profit the learned and systematic works of more able and distinguished authors. It will be our purpose to devote a portion of each number, during the ensuing year, to a series of articles of this nature; in which we shall, so far as possible, avoid technical difficulties, and which, taken collectively, at the end of the year, we hope to render a nearly complete introduction to the Natural System of Botany, as expounded by its great advocate and teacher, Professor Lindley. For this object we shall make a free, but we hope a judicious use of the works of the celebrated Professor, as well as those of other standard writers. We also expect the occasional aid of one of the most accomplished and distinguished of American botanists, whose labors in the fields of our native Flora deserve the gratitude of every lover of science.

Another portion of the work will be occupied exclusively by the senior editor, with a series of notices on the subject of Fossil Botany: a branch of the science hitherto but little appreciated or understood in this country; but which, being the connecting link between Botany and Geology, we hope to make interesting to the inquirer in both these sciences.

As to the engravings which each number will contain, we intend a somewhat different course from that pursued during the past year. Instead of an indiscriminate selection, determined only by taste or fancy, we expect to make the engravings serve the cause of the science and facilitate the progress of the reader, by giving the figures of such plants as shall answer the purpose of illustrating the order which forms the subject of each successive article. For instance, whenever the Natural Order *Ranunculaceæ*, shall be the theme of our remarks, we shall illustrate its general features by figures of some species of the genera comprised in that order, and shall add representations of the peculiarities of structure which are the marks of distinction between it and others. It may, in doing this, be necessary to offer a second time figures of plants which have been already described; but as far as possible this will be avoided, and whenever it does occur, the description will be new and different in its arrangement.

The highly interesting subject of Vegetable Physiology, inseparable as it is from a competent knowledge of the Natural System, will form an important part of our consideration, and we believe that by proper illustrations and explanations, we shall be able to render it both instructive and entertaining.

Into the subordinate details of our proposed plans we do not consider it necessary to enter. So far as the minor matters of taste or elegance of embellishment are concerned, we may promise, that while they do not interfere with the general scope of our graver and more important labors, they shall yet receive a degree of attention sufficient to render them entirely satisfactory.

In conclusion, we venture to hope that none of our readers, especially those of the gentle sex, if any such we are so fortunate as to possess, will be led to imagine, from any thing we have here written, that our purpose is to make this work too dry and scientific for general perusal. Such is by no means our intention. We believe that such a work can be rendered sufficiently scientific at once and popular: that without sacrificing science to popularity, the two can be so combined as to instruct at the same time and to please. We are well aware that too many consider the difficulties which must be overcome before any considerable knowledge of Botany can be obtained, to be more than a sufficient bar to their efforts. Difficulties, it is true, exist, and are of the essence of the subject; but none which, for all the purposes at least of this work, a diligent student cannot master; though, as we have before intimated, no royal road through them exists.

Many are also deterred from seeking a knowledge of Botany, by a misapprehension of the true character of the science. They believe the end proposed by its pursuit to be only the filling of their minds with a mass of unmeaning technicalities, and hard and unintelligible names. A greater mistake cannot possibly be made. Nomenclature is indeed of only secondary importance, and without going so far as to assert with Rousseau that "one may become a first rate botanist, without knowing a single plant by its name," we may safely say that he will never become a botanist who learns nothing of plants except their names. Such knowledge would truly be useless, meagre and insipid enough. But the peculiarities of structure and of vital action, the remarkable operations of nature in adapting the physiological arrangements of plants to the functions which they are destined to perform, the singularities of their internal and external developement, the combination of vessels, of nerves and of tissues of which they are formed, so miraculously and beautifully fitted for the offices of sustentation and increase, form matters of inquiry and of reflection which cannot fail, in a well regulated mind, to instil ideas of the most elevated and inspiring character, and to lead the heart of the thoughtful student from an observation of the wonders of these creations up to the great Being whose hand in them all is so evident.

Inferior to no study in interest of this kind, that of Botany is peculiarly favorable to the pursuit of the inquirer, from the readiness and ease with which the objects of its investigation may be procured. Every flower and every leaf, the tiniest grass, the most neglected lichen, may form a theme for lofty contemplation. The eye of the botanist may become endued with a sort of second sight. It may discern in the commonest things of the earth wonders which are not found in the most gorgeous palaces. It may perceive in the most ordinary works of Nature an exquisiteness of design, an elaborateness of execution, an adaptedness of means to the end proposed, which are looked for in vain in the most exalted plans of human genius. And more, the true student of nature, too often care-worn and oppressed by the toil and disappointments of his harsher human existence, may forget all in the separate life, in which, among all these wonders, he may become soothed and consoled. There is to him *more* than "a pleasure in the pathless woods," *more* than "a rapture on the lonely shore," and he needs the impulse of neither misanthropy nor satiety, to become in such scenes a wiser, a happier, and a better man.

It is in the spirit of these reflections that we approach the task before us, confident of our success in inspiring our readers as we proceed, with something like a similar feeling.

J. C. C.

THE ILLUSTRATED BOTANY.

THE NATURAL SYSTEM OF BOTANY.

NUMBER ONE.

In attempting, through the pages of a periodical work, to convey proper ideas of the Natural System, to afford such aid to the learner as will enable him to understand its importance, and for that purpose to overcome the difficulties by which it is surrounded, the writer is conscious that he is engaging in a task of considerable magnitude. He is not aware that a similar undertaking has yet been accomplished in this country. In fact, except among botanists of high attainments, the Linnæan System has here been the common, if not almost the exclusive object of study. Little more has been published for the benefit of the beginner in Systematic Botany, than the merest outline of the Natural System, while many of those who pursue the study as a recreation, or as a popular branch of knowledge, seem to be nearly ignorant of the existence of a system different from the Linnæan. Works there are, it is true, whose object is expressly to afford elementary instruction on this subject, but they are, so far as our observation has extended, mostly foreign publications, and from their scarcity or expense, are out of the reach of ordinary students. It has been considered, therefore, (without offering further reasons,) that a monthly series of articles, in a popular magazine, each of which may easily be read and understood before the appearance of the next, might be made serviceable to the learner, and might be so arranged as, in a collected form, to supply the place of an American Introduction to the Natural System, until such an Introduction shall be produced, (a consummation devoutly to be wished), by some one of our eminent botanists.

It is supposed that the student who intends to follow us in these articles, has already an acquaintance with the Linnæan System, and a knowledge of the parts of plants, sufficient for the purpose of understanding at least some of the terms used. For instance, when we come to speak of stamens and pistils, of carpels and dissepiments, of bracts and ovaries, we shall take it for granted that our reader knows the part or organ indicated by these names. Should he be deficient in such knowledge, he will find in the articles on Vegetable Physiology, which will be the monthly companions of these, much important information, and for whatever more may be necessary, he can consult almost any elementary treatise. Considering, then, that he is properly prepared to follow us, we begin by some general remarks on Classification.

The science of Botany may be correctly divided into two distinct departments. One of these may be termed Physiological Botany, and has for its object the investigation of the internal structure and method of the growth and reproduction of plants. The other, which is closely connected with, and in a great measure depends upon the first, concerns the arrangement of plants into groups or divisions, and is termed Classification. The utility of such an arrangement must be obvious, when we think of the utter impossibility of studying and remembering by themselves the peculiarities of every one of the one hundred thousand species which the globe is estimated to contain. For instance, suppose the grain which we call *Wheat* was lately discovered, and generally unknown; by what method could one, who knew nothing of Classification, designate it so that it might be distinguished from all others? Without some systematic arrangement, and some definite terms to denote its distinctive characters, this would be manifestly difficult and uncertain. It is on these distinctive marks, or invariable peculiarities, that, in all branches of natural science, systematic arrangements are founded, and accordingly we find, that in the earliest periods of botanical research, some kind or degree of classification was adopted. This was no less natural than necessary, and was founded on the same great principles of general resemblance and similarity of properties which form the basis of the most complete modern system. The most superficial observer, says Dr. Smith, must perceive something like the classification of nature. The Grasses, Umbelliferous Plants, Mosses, Sea Weeds, Ferns, Liliaceous Plants, each constitute a family strikingly similar in form and qualities among themselves, and no less evidently distinct from all others. It is singular, that in all other departments of natural science, such a method of classification is strictly adhered to, while in Botany, principles have been introduced, which in Zoology would lead to the greatest absurdities. The earliest attempts at the classification of plants only extended to a few simple divisions, formed from the widest distinctions. One ancient writer, for instance, divides vegetables into water plants, parasites, pot herbs, forest trees, and corn plants; another into aromatics, gum bearing plants, eatable vegetables, and corn herbs. Many centuries elapsed before any thing further was effected towards a more correct and precise arrangement, and it was not till the year 1570 that Lobel, a Flemish botanist, made important improvements in the former methods of distinction, and by the use of more definite characters than had before been employed, laid the grounwork of the present system. Several authors of eminence followed, whose principles of classification were the same. At length, near the end of the seventeeth century, the necessity began to be felt, of greater precision, and this led to the invention of a system, which, partly from the renown of its author, and partly from its simplicity and the readiness with which it may be understood and applied, has obtained the greatest celebrity. The first attempt at what is now called the Artificial System, was made by Rivinus, who, in 1690, invented a system depending on the formation of the corolla. He was followed by Kamel and by Magnol, whose methods depended, the first on the formation of the calyx, and the second on that of the calyx and corolla together. It was reserved for Linnæus, in 1731, to complete the ideas of his predecessors by the invention of the system since so universally adopted, and named after its inventor. This, no doubt, contributed largely to the dissemination of botanical knowledge, and was of much benefit to the state of the science as it then existed; but the researches of modern botanists, aided by the great improvements in optics which have so facilitated their observations on life and structure, have shown that it is by no means suited to or sufficient for the advancement of later times. Indeed, its chief merit consists in the convenient clue which it offers to the *name* alone of an unknown plant, while as to structure or properties it affords no indication. It has been compared to the alphabetical index of a book, which directs the reader to the point which he wishes to ascertain, without giving him any information as to the general nature of the book, or of the method in which its subjects are arranged. Indeed, Linnæus himself was fully sensible of its defects, and by no one more than by him have the superior advantages of a Natural System been appreciated. When he framed his Artificial System, he probably intended it only for temporary employment, and to facilitate that acquaintance with the vegetable kingdom which must precede the formation of a perfect Natural System, and he anticipated the time when greater progress should cause it to be abandoned, and botanists to revert to the system of nature. Though not then fully developed, he said that the elucidation of the principles of the latter should be the first and ultimate aim of botanists, to this end should their labors be directed, and the merest fragments of such a system should be carefully studied; and he adds, "For a long time I have labored to establish it, I have many discoveries, but have not been able to perfect it; yet while I live, I shall continue to labor for its completion. Those are the greatest botanists who shall be able to correct, augment, and perfect this method." From this it is evident, that those who, out of veneration for the name of the great Naturalist, adhere to his system to the exclusion of one formed on natural principles, and imagine they have his authority for so doing, mistake his views and misrepresent his declarations. The Linnæan, or Artificial System, as we shall hereafter call it, in contradistinction to the Natural System, is not, however, even at present, without its advantages. To one who is not ambitious of extending his studies into the higher regions of the science, but is only desirous of becoming acquainted with the names and characters of such plants as he may meet with in his rambles, this System offers facilities which are well calculated to encourage. To determine the class and order by counting the stamens and pistils, is generally a very simple matter, and when this is done, the discovery of the genus and species can be readily effected, with the aid of a Manual and a little practice in examination. It is not too much to say, however, that this System is, after all, of no further use, taken by itself, than merely to assist in finding out the name of an unknown plant, and even in its application to this purpose it possesses many imperfections. The number of pistils or of stamens is often inconstant in any species, and varies even among individuals of the same species, or even in the different flowers of the same individual. This must of course lead to great confusion, and every one who has experienced the frequent difficulty of determining the name only of a plant by the artificial method, must have become aware of the necessity in such cases of applying to other principles for assistance. Then it is that the necessity of means of discrimination not afforded by the mere number or positions of stamens or pistils, becomes apparent. For instance, the genus *Polygonum*, some members of which are commonly known by the names of Bind-weed or Knot-grass, is placed in the class Octandria and order Trigynia. Now out of sixteen species of this genus, which are found in the northern and middle states, nine only are Octandrous, and some of these vary, while of the remaining seven species two are Pentandrous, three Hexandrous, and two Heptandrous, and out of the whole sixteen at least ten are not properly Trigynous. Now, if without any previous knowledge of these facts, the student should find a Polygonum which has five, six, or seven stamens, he would at once look for it in the class Pentandria or Hexandria or Heptandria. He finds nothing like it, and must endure his perplexity and disappointment until some one who has perhaps passed through the same difficulties shall tell him that his plant is a Polygonum. Should he inquire how this happens, when it evidently belongs to a different class, the only answer can be that it is so much like the Polygonums that it cannot be separated from them, and they in most cases belong to Octandria. Thus it appears that it is not by means of the Artificial System that the plant is to be discovered, but through its resemblance to other Polygonums, thus applying the very principles of the Natural System. Again, the genus *Rhamnus*, or Buckthorn, is placed in the class Pentandria, while the most common species, (R. alnifolius,) is Diœcious; so that if, on observing that one individual bears female and another male flowers, it should be sought for in the class Diœcia, the result would be the same as before. These instances are not exaggerated, and similar ones are by no means uncommon. It has been proved that in fourteen divisions of the Linnæan System, including one hundred and seventy-three British genera, the number of such exceptions amounts to forty-three, or nearly one quarter; and that out of two hundred and seventy-four North American genera, belonging to eighteen Linnæan sections, there are no less than seventy-eight exceptions, or more than a quarter of the whole. This comprehends, too, only those variations which are constant and uniform, and not merely accidental deviations. It is true, that the labors of botanists have in a degree lessened the difficulty by pointing out the most perplexing of these variations, in such a manner as to prevent the loss of time and patience in futile endeavors at finding genera in wrong classes, or species in wrong genera; but this does not lessen the imperfections of the system.

VEGETABLE PHYSIOLOGY.

NUMBER ONE.

In order to obtain a correct knowledge of either animals or vegetables, it is not enough simply to observe their outward appearance, to examine their different parts superficially, to mark the changes which they undergo, or to watch their habits and motions. These are but the results of their internal structure, and before we can arrive at a right understanding of them, we must become acquainted with that structure. Two branches of science have for their objects the mechanism and functions of the organs of animals and plants. Anatomy explains the form, structure, and disposition of those organs, and Physiology their uses and functions. In Zoology, the distinction between these branches is more strictly adhered to than in Botany, though in the latter science Vegetable Anatomy or Phytotomy is properly a separate department from Vegetable Physiology. We do not consider, however, that it is necessary here to specify the subordinate sections into which botanists have divided these sciences, since the beginner is liable to be embarrassed and discouraged by a multiplicity of terms, which he will better understand in the course of his onward progress. We shall prefer, therefore, for the present, to define Vegetable Physiology as that science which explains the nature, appearances, and uses of the internal organs of plants. It will be necessary, of course, to examine the form and structure of these organs, before their functions can be discovered. Let us take, then, almost any common plant, and see the parts of which it is composed. The most obvious of these are the stem, roots, leaves, and flowers. It will be seen, when we have advanced a little further, that they are subdivided into many other parts—but for our present purpose it is enough to mention these. The root, then, whose office it is to fix the plant in its place, and to draw nutriment from the soil, the stem which carries this to the leaves, and raises them to receive light and warmth, the leaves which elaborate this nutriment and make it fit for the sustenance of the whole plant, the flowers which produce seed necessary for its reproduction, are termed *organs*, while the effects produced by these parts are called their *functions*. All bodies which possess these or analogous parts, are called *organic*, while those which do not, are *inorganic*. Some of the functions of organic bodies are subject to the same laws which operate on inorganic matter. For instance, the principle on which the blood is propelled by the heart through the arteries is the same on which water may be driven through a series of pipes by a pump. But the nature of the force is entirely different. In the latter case, it is merely mechanical. In the former, it is produced by a property peculiar to organized structure, and especially belonging to *muscle*—that of contracting when it receives a certain stimulus or irritation. This property, and many others which are never displayed by inorganic bodies, are called *vital*, and it is by means of these that those changes are effected which constitute the life of an animal or plant. These properties of organized bodies operate only under certain conditions. A seed may remain for centuries in a dormant state, and may never become any thing but a seed. As soon, however, as it is laid where it can receive moisture, warmth, and air, it will begin to germinate. These, then, are the conditions required to produce in it vital action, or those changes which are termed Life. In case the plant, after it has begun to grow, under these influences, be placed entirely out of their reach, it either dies, or remains inactive for a time, until returned to its former position. Light, warmth, and moisture, for these reasons, are called the *stimuli* to vital action. In our considerations, therefore, are naturally comprised that of the *structure* of plants, of the *properties* which belong to that structure, and of the operation of *external stimuli* upon those properties.

It will be perceived here, that the distinctions so far explained, between organic and inorganic bodies, apply as well to animals as to plants. Before proceeding to our main subject, then, it will be proper as well as interesting to trace some of the less general distinctions by which is produced the difference between these two grand divisions of organized matter. It is sometimes by no means easy to point out such a difference, since some animals so nearly resemble plants as to make it almost impossible to detect the line of demarcation. But in general, and among the higher orders of animals, the distinction is so clear as to require no demonstration. An animal may be defined as a living body possessed of sensibility and voluntary motion. Locomotion, or the power of changing from place to place, is not, however, essential, since animals exist which are fixed to one spot. But all animals have a stomach, or internal cavity, into which is received matter from without, to be elaborated into a nutritive substance. This stomach does not occur in plants. Animals are also possessed of a nervous system and muscular fibres capable of contraction, together with the power of selecting the matter which is to afford them nutriment. Thus their food is composed of many kinds of animal and vegetable substances, for the digestion of which the organs which perform that office are variously modified and arranged. But plants, being unable to move from a particular spot, and to search for their food, are nourished by the substances which surround them, and absorb, by their surfaces, air, water, and many matters which these contain in solution. Thus, from the little diversity of their food, results the great uniformity in structure and purpose of their organs. The parts of the animal body are also possessed of mobility, and do not preserve a fixed position, while those of the vegetable are nearly stationary, so that the impulse which causes the distribution and motion of the nutritious fluids in the former, is internal, while in the latter it acts from without, and is not connected with the organization. Thus the operation of the digestive organs, which in man forms chyle, is independent of the conditions which are essential to the analogous operation in plants, such as heat, moisture, and evaporation. The chemical composition of both is the same, but the elements are differently combined. The organs of sensation and of motion, nerves properly so called, and muscles, are entirely wanting in vegetables. They possess no heart or other great organ of circulation, and have no vessels resembling arteries or veins. There are some plants, notwithstanding, which would seem to form exceptions to the general principle that they lack sensibility and voluntary motion. The phenomena which some of these exhibit, such as the closing of the leaves of the Sensitive Plant on being touched, must be familiar to every one. The little *Dionæa Muscipula*, or as it is commonly called, Venus' Fly-trap, which inhabits the swamps of many parts of this country, is another singular instance. The leaf is formed, or rather has an appendage, of two lobes, on the edges of which are long, slender and sharp spines, and in the centre a viscous fluid, which is attractive to insects. Whenever one of these alights on the leaf, for the purpose of tasting this fluid, the two lobes suddenly contract, close themselves together, and with their spines pierce through and confine the unfortunate victim. The Sun-dew, (*Drosera rotundifolia*,) also a common inhabitant of the northern states, has its leaves covered with brown upright filaments, on the top of which is a globule of clear fluid, and which on being touched, instantly fall down. The common Barberry, (*Berberis Canadensis*,) presents another instance, which may readily be observed. On touching with a pin the lower part of the stamens, they instantly throw themselves forward against the pistil. These and other similar phenomena are caused, however, by no voluntary power like that exerted in the movement of animal muscles, but are explained on entirely mechanical principles. But there are many respects in which animals and plants agree. They are both produced from a germ or egg, they increase by the assimilation of foreign matter, they gradually reach their full developement, propagate their species, decay, and at last lose their vitality, become subject to the decomposing influence of the atmosphere, are dispersed, and their elements enter into new combinations. Plants respire air, and have a continual motion of their fluids, which, like those of animals, are partly converted into the solid matter which enters into their composition, and partly escape through the pores of their outward surfaces. Yet these analogies are far from being perfect, and the organs of plants can bear but a limited comparison with those of animals. Of these affinities we shall take more particular notice when we enter upon the explanation of the structure and functions of the different parts of vegetables, as a preliminary to which these concise remarks are offered.

FOSSIL BOTANY

The progress of Geology has developed the elements of what may be considered a new science—that of Fossil Botany. The splendid work of Count Sternberg, on the continent of Europe, and those of Hutton and Lindley in England, together with several others of less note, have created, not only among the learned, but also among all classes of the educated, an interest in the Flora of the ancient world. Nor can any recent book on Geology, now a common study in this country, be understood and appreciated without a knowledge of the elements of this science.

The subject is indeed highly curious and interesting to any inquiring mind. Who can read accounts, or examine the remains, of vegetables, sometimes of colossal proportions, differing entirely in appearance, and, in some respects, in structure, from any now growing on the earth, without a desire to learn more concerning them? For the acquirement of such knowledge, the Botanist will be conscious that the Sexual System, or Linnæan method of classification, must be insufficient—since the flowers and other parts on which the Artificial classes are founded, are, in most cases, entirely wanting, only the trunks, limbs and leaves being preserved. The Natural System therefore can only be employed, and this to but a limited extent, since trunks only, without the vestige of leaf, flower or fruit, have occurred in great abundance. In such instances the structure of the interior, the external appearance of the bark, the marks left by the falling off of the leaves, the branching of the top, when this can be found, are all that serve as data on which to base an opinion as to the class or family to which the tree belonged. In this country, if little interest is felt on this subject, it is only because there has yet been published no popular exposition of the objects of Fossil Botany, or the methods by which it is investigated. We therefore propose to dedicate a few pages of this periodical to a series of articles on this science, for which we have not a doubt of ultimately receiving the thanks of our readers.

To those who are ignorant of Botany, and only wish to acquire a knowledge of the elements of the fossil arrangement, the trouble of learning the twenty-four classes and numerous orders of the Linnæan System will be spared. Indeed, we shall at present hardly venture on any strict arrangement or classification, but only offer such information on the structure of fossil wood and leaves, as will enable the reader to understand what will follow.

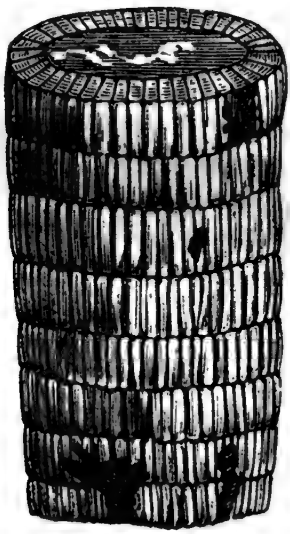
The structure of vegetables, compared with that of animals, presents a remarkable simplicity. While in animals every separate operation of life is carried on by a set of separate organs, of peculiar construction, a few tissues, variously modified, constitute the whole mechanism by which all vegetable functions are performed. Hence, for the purpose of distinguishing one of the grand classes of plants from another, only a transverse section of the stem or trunk, or a leaf, is required. The method of arriving at such a result in the case of fossil plants, especially when the trunk or wood is the only part preserved, requires some instruction and a few illustrations, which we propose to insert in our next number.

For the present, we must content ourselves with giving an engraving or two representing fossil remains of vegetables, and a few general observations and descriptions which may serve as an introduction to the subject.

Some of the antediluvian plants were highly curious in their form and structure, and must have been remarkably beautiful in their appearance. Others were similar to species now growing, or *recent* species—so called by the botanist, to distinguish them from those which no longer grow, termed *extinct* species. The *ferns* compose the most numerous family of vegetables found as organic remains, some of which closely resemble recent species, though none have been found which can be considered as more than types of those now existing. The argillaceous nodules, or balls of clay, found in some of the English coal mines, the great depositories of fossil plants, often exhibit very perfect impressions or casts of these ferns. In most instances they appear to have been produced in tropical climates. This is inferred from the fact, that in hot countries their nearest living analogies are to be found—though, as we have before stated, identical recent species have not been discovered. When these nodules are carefully broken, the impressions are seen preserved on both faces of the clay,—but contrary to expectation, not displaying each side of the leaf or stem, but the same side on each broken surface; on the one in *alto*, and on the other in *basso relievo*, or slightly depressed on one side and slightly raised on the other. The best explanation of this curious circumstance, which long puzzled observers, appears to be the following.—The vegetable matter, in passing through its bituminous change, first became softened, and filled its own mould between the walls of clay with the liquid or deliquescent substance thus produced; this subsequently became hardened, and adhered to one side of the clay, which on being broken shows the surface of the adherent bituminous cast, while the other side displays the corresponding mould. The adjoining cut will give an idea of such appearances. It represents a species of fern or Polypodium, in clay slate, from an English coal mine. Sir James E. Smith considers it the product of a tropical climate, but not referable to any recent species.

It is well known to geologists that nearly all the plants, particularly those of the cryptogamous tribes, as the Ferns, and Algæ, or sea weeds, now found in geological formations in all parts of the earth, indicate by their increased proportions, the influence of tropical regions. Moisture and heat appear to be the conditions of the largest developement of these plants. Thus, the Ferns, as the brake, *Pteris*, or polypody, *Polypodium*, grow in our climate only from two to four feet in height, nor have we any individual of this tribe in this country which attains more than twice that stature. But in hot countries, as in Tropical America and in the East Indies, the Arborescent or Tree Ferns, though belonging to the same family as our own, attain the altitude of forest trees, with stems of eight or ten inches in diameter. On the stairs of the British Museum at London, there is an Arborescent Fern which recently came from Bengal, measuring forty-five feet in height. In the ardent climate of South America, Baron Humboldt, to his astonishment, saw immense groves of a similar colossal growth, and it may well be supposed that nothing in the vegetable world can present to the eye of the traveller a more beautiful, interesting and imposing scene.

In the fossil state, in cold climates, similar ferns, as has been mentioned, are found at the present day. They are abundant in the coal mines of England, France, and Germany; and in this country near the Canada line, as well as in Siberia, similar phenomena occur. Now it might be supposed, referring to the general deluge for an explanation, that transportation of these plants by water, from their native country to the place where they are found, would readily account for these facts; but the plausibility of this theory is at once swept away by another fact, which is this. These ferns are sometimes found standing in the identical spots where they grew, their roots still inserted into the earth, as in their life-time, but equally with their stems and leaves, petrified into stone. The cnly consistent solution of the difficulty, appears to be in the theory, that the temperature of the earth was once much higher than it now is, and that the climate of the regions in which these fossil remains are now discovered, was of the same nature with that in which their analogical recent brethren are now produced,—a theory, the truth of which, at present we shall neither affirm nor deny, and for a discussion of which this is not the place. Although allusion has been made in the foregoing remarks to the Ferns only, yet there are several other families of plants to which the same circumstances are equally applicable. Among these are the *Equisetums*, a tribe well known as recent plants, one of which, a little straight species of the size of a pipe-stem, is known by the name of *Scouring Rush*, and from the quantity of silicious matter in its outer covering, is sometimes made serviceable in polishing metal. To this family belongs the *Calamites*, which is now only found in a fossil state, and which attained the magnitude of a forest tree. Specimens of the same species occur in the coal formations at Newcastle in England, at Lubec near Canada, in France, and in Siberia, showing the wide extent to which this plant was spread, at a time when heat and moisture seem to have pervaded the whole earth, and to have given to this family, like the Ferns, a gigantic size, while in this climate no recent species become more than three or four feet high, with diameters seldom attaining an inch. The following figure represents a part of the stem of a fossil species, called *Calamites approximatus*, on account of the proximity of the joints.



In the next number, we propose to continue the subject of Fossil Botany, and to explain the means of distinguishing and classifying the different species of plants found in the strata of the earth, illustrating our descriptions with cuts, and attempting to render the subject both useful and entertaining, to all readers of sufficient capacity to understand explanations which we intend to make at once clear and precise.

CYPERUS PAPYRUS—PAPER REED.

Natural Class, Monocotyledones; Order, Cyperaceæ. Linnæan Class, Triandria; Order, Monogynia. Generic Distinctions:—spikelets, compressed, distinct; glumes, one valved, numerous, imbricated; corolla, none; style, deciduous; seed, naked.

This genus, and others belonging to the same natural order, are very widely distributed over the globe. Says Lindley, "They are found in marshes, ditches, and running streams, in meadows and on heaths, in groves and forests, on the blowing sands of the sea shore, on the tops of mountains, from the arctic to the antarctic circle, wherever Phænogamous vegetation can exist." These plants also compose the Sedge tribe, which, though so strongly resembling the grasses in general appearance and habit, differs from them in this remarkable particular. Many of the grasses possess nutritive qualities, and furnish materials for the manufacture of flour and sugar, while the sedges are mostly destitute of the necessary nutriment even for the food of cattle. The roots of some of the Cyperuses, however, possess medicinal properties. Those of *C. longus*, are succulent, and contain a mucilage, together with a bitter principle which gives them a tonic effect. Those of another species are employed in India by the native physicians in cases of cholera, and the Hindoo ladies use those of *C. perennis* in perfuming their hair. In this country, these and similar plants are principally used in making the bottoms of chairs, in stuffing cushions, and for similar purposes.

The most useful and celebrated of the genus Cyperus, is undoubtedly the one represented in our engraving. It is an inhabitant of the southern regions of Europe, Italy and Sicily, (where it has probably been introduced in comparatively modern times,) of Palestine, and of Arabia. But the Papyrus is best known for its connexion with the history of the Egyptians. Its native country, it is presumed, was Ethiopia, whence it spread along the Nile into Egypt. The Egyptians, from the earliest times, made ropes, as well as boats, of the Paper Reed, and it is supposed by commentators, that the Hebrew word which the translators of the Bible have rendered *bulrush*, really signifies the same plant; as in Exodus ii. 3; Job viii. 11; and in other parts of the Old Testament. If this be the case, the ark in which Moses was laid must have been made of the Papyrus. "The waving, feather-like tops of the full-grown Papyrus were used to crown the statues of the goddesses in many temples; the upright stem was used in the construction of light vessels. When macerated in water or wet sand, the fibres served for cordage, and sail cloth was occasionally woven of it. The solid part near the root was converted into soles for the sandals of the priests, cups and various toys, the more valuable on account of the scarcity of wood in Egypt; but the chief and most important use of the Papyrus was as a material for writing on."* The ancient Egyptian name of this plant was *biblos*, which, for an obvious reason, was adopted by the Greeks to signify book, and is retained by christians in the name of the bible. From the common name Papyrus is derived our word paper, the ancient method of manufacturing which from this plant, as described by Pliny, appears to have been as follows:—The stem of the reed was divided into lengths, each sufficient for a page, and then carefully peeled in a transverse direction, as far inward towards the core as possible, so as to make the width of the page the greater. Several of these strips were laid together, and then covered with some glutinous material, such as gum, glue, or flour paste. Some authors say that the slimy water of the Nile is sufficient for this purpose, but experiments have shown that it would not answer. The first layer being dry, a second was placed transversely upon it, that the fibres might cross each other, like the threads of cloth. The whole was then beaten, and a strong pressure applied to make it smooth and level. It is probable that Pliny was ignorant of some part of the process, since this method has been attempted without success by Bruce, the traveller, who, however, by a different process, succeeded in making a tolerable sheet of reed paper. It is said that the invention of parchment, which for many centuries was the

* For these and other facts imbodied in this account, see "A Scripture Herbal," by Maria Callcott. London, 1842. Art. Paper Reed.

Cyperus Papyrus.

The Papyrus.

common material for writing upon, and the use of which quite superseded that of Papyrus, was owing to the fact that an Egyptian sovereign prohibited the exportation of reed paper from his kingdom. As frequently happens in such cases, a substance was soon discovered to take its place, and to Attalus, king of Pergamus, is ascribed the credit of having first prepared the skins of animals for this purpose. In this connexion, it may be remarked that a curious treatise might be written on the various ancient substitutes for paper, and the methods of writing on them. Books are yet in existence written on palm leaves, and the most ancient inhabitants of Italy, as well as some of the East Indian nations, used a kind of linen cloth, so prepared as to retain the marks of the pen. Tablets of various kinds of wood, and the bark of trees, have also been employed. The latter substance, called by the Latins *liber*, has given the name for book to the languages of Southern Europe. Our word *book* is itself derived from the Gothic, signifying *beech-tree*, since the bark of that tree was used for writing upon, as also the wood, which for that purpose was cut into thin plates or staves; whence verses in poetry are often called staves, each being separately written on one of these tablets.

The Papyrus also supplied the Egyptians with a fibre which they twisted into a fine cord, and used in the lacing of their mummy cases. It appears that, in those cases, which were ornamented and prepared before the corpse was placed in them, an aperture was left open in the back for its introduction, which was afterwards drawn together with these cords in a very ingenious manner, and the seam then covered with a piece of cloth glued or cemented, so as to make it perfectly secure.

The Papyrus, when growing together in groups, as represented in the engraving, is an extremely elegant plant, the upper part resembling a graceful plume of green feathers. In favorable situations, it sometimes attains the height of fourteen feet, but its ordinary height is less. The tender shoots and roots were sometimes used as food.

Epilobium Angustifolium.

EPILOBIUM—WILLOW HERB.

Natural Class, Dicotyledones; Order, Onagraceæ. Linnæan Class, Octandria; Order, Monogynia. Generic Distinctions:—calyx, four cleft; petals, four; stamens, eight; style, filiform, with a clavate or cruciform stigma; capsule, linear, of four cells, with four valves; seeds, numerous, bearded.

E. Angustifolium. (L.) Leaves, lanceolate, denticulate, veined; peduncles, shorter than the germen; flower buds, obovate, narrowed at the base, and suddenly contracted into a point at the apex. Sepals, linear, lanceolate, acute, equalling or slightly longer than the petals; capsule, linear, straight, erect, three to four feet high; grows in damp, shady places.

Of this genus there are a large number of species, both in this country and in Europe. There is so strong a family likeness between them, as to leave little room for mistaking one after having seen another. The natural order in which they are comprised, has for its type the Evening Primrose, (Oenothera,) and is very well defined by the great similarity of its members to each other, in several curious particulars. Plants belonging to this order, are scattered in various countries of the world, from South America to Siberia, and they all agree in this respect, that every one of the parts of the flower consists of four pieces, or of some number that may be divided by four. The calyx is composed of *four* sepals, the petals are *four*, the stamens are *eight*, the ovary contains *four* cavities, the style separates into *four* stigmas, the fruit is a dry oval case with *four* angles, opening into *four* valves. There are many plants of different orders, which have *some* of their parts of the number of four, but it is only in this tribe that all the parts are in fours at the same time.

Some of the species of Epilobium are very handsome, showy plants, particularly E. spicatum, which is a native of New York, and of the Northern and Eastern States. It flowers in August, and when a large cluster is seen together, as is often the case, the tall, leafy stems, and long spike of purple blossoms, produce a very brilliant effect. We have cultivated this species with very good success in pots, by giving it a portion of the earth in which it originally grew, and keeping it well watered, in which case it will frequently attain an extra ordinary size, and produce a close spike of flowers, sometimes two feet in length. This, we believe, is the only species indigenous to the northern part of the United States, which is worth the trouble of reclaiming, the others being comparatively mean looking plants. The Epilobiums, as well as most, if not all the Evening Primrose tribe, have few good qualities besides their appearance, possessing no useful properties of any consequence.

BORAGO OFFICINALIS—BORAGE.

Natural Class, Dicotyledones; Order, Boragineæ. Linnæan Class, Pentandria; Order, Monogynia. Generic Distinctions:—calyx, in five deep segments; corolla, rotate; tube, very short; throat, with short, erect, emarginate scales; stamens, exserted; filaments, bifid, the inner fork bearing the anther.

B. Officinalis. **(L.) Lower leaves, obovate, obtuse, attenuated below; segments of the corolla, ovate, acute, flat, spreading; grows in waste places and rubbish; flowers, blue.**

This genus forms the type of the natural order Boragineæ. The species represented in the engraving is the only one much known in this part of this country, though nearly all are inhabitants of temperate climates. Their number appears to be much smaller in America than in Europe. Borage is possessed of some useful qualities. It abounds in mucilage, and is sometimes cultivated for the sake of the leaves and young shoots, which are boiled as 'greens' in the spring, but are far inferior for that purpose either to those of the Dandelion, or the Asclepias. It also gives a coolness to liquids in which it is steeped, and for that reason as Main says in his "Hortus Dietetica," an odd book, with an odd title, "the flowers are required in the composition of *cool-tankard*, a favorite beverage amongst *aldermen in warm weather*." The flowers undergo a remarkable change of color. At their first appearance, the petals are of a bright red color, which becomes a brilliant blue when they are fully expanded. This phenomenon is probably caused by the loss of some acid principle. To those who are fond of tracing analogies between the higher and

Borago Officinalis.

lower orders of creation, we might suggest a similarity between this operation of nature, and that which sometimes takes place in certain of the delicate sex—"Dians of the times,"—who blush enchanting red on their first "coming out," but in the course of *seasons* become *blues* of the most intense and immeasurable tint. Female chemistry, however, seems to offer a reason for this change, the reverse of that supposed in the case of the flower, and makes it attributable, not to the loss, but to the gain, of some '*acid* principle.' In consideration that the Borage is emblematic of BLUNTNESS, we hope to be pardoned for so wicked a parallel, and will not risk a second offence, by intruding our opinion as to the propriety of giving it another signification, which we therefore leave our fair readers to discover for themselves.

BIGNONIA RADICANS—TRUMPET FLOWER.

Natural Class, Dicotyledones; Order, Bignoniaceæ. Linnæan Class, Didynamia; Order, Angiosperma. Generic Distinctions:—calyx, divided or entire; corolla, monopetalous, usually irregular, four and five lobed; stamens, five, unequal, always one, sometimes three, sterile; ovarium, seated in a disk, two celled, many seeded; style, one; seeds, transverse, compressed, often winged.

***B. Radicans.*—Leaves, pinnate; leaflets, opposite, ovate, acuminate, toothed; panicles, terminal; flowers, scarlet; stem, climbing.**

THE genus Bignonia forms the type of the natural order Bignoniaceæ, the essential characters of which will be fully explained when it is noticed in its proper place. The genus derives its name from the Abbe Bignon, librarian to Louis XIV., and is composed of beautiful plants, some of which are trees or shrubs, and others are climbers. They are mostly inhabitants of hot climates, from which, on the American continent, they extend northward to the Middle United States, and southward to Chili. There is a strong family likeness between them, though the petals of the different species are of various colors. The knowledge yet obtained of their medicinal or other properties, is very imperfect. The natives of some parts of South America use for painting their faces and bodies, a red substance which they denominate *chica*, produced by boiling the leaves of one species, called from this circumstance, Bignonia Chica. This article was, some years ago, introduced into England, and recommended to the attention of dyers; but we believe that it did not prove of sufficient value to lead to any important result. The shoots of another species are employed by the Brazilians in the making of baskets, and others form large trees, which afford material for timber and for the manufacture of bows. The species B. radicans, which the engraving represents, must be familiar to many of our readers, under the name of "Trumpet Flower," or "Trumpet Creeper." It is a native of the Southern and Middle States, and is cultivated in New York and New England. It frequently climbs to the height of forty or fifty feet, and when covering, as it sometimes will, nearly the whole side of a house, with its deep green foliage and its large, trumpet-shaped scarlet flowers, it presents a very splendid appearance. The tendrils by which this plant supports itself in such a position, are extremely strong and tenacious, and often adhere to the wood, and penetrate between the clapboards with so firm a hold that it is almost impossible to tear them away. The seeds are winged with a beautifully reticulated transparent membrane, resembling the wing of the large *Libellula*, or Dragon Fly.

Wherever the Trumpet Flower grows, there come the humming-birds, with whom it is a great favorite, and the delicate little creatures sometimes bury themselves so deeply in the large corolla, as to make it a trap for their capture. Indeed, we will warrant any person of ordinary dexterity the possession of one of these "flying gems," if he will watch for a few hours on some clear August day near a Trumpet Creeper in the country.

This plant is known and cultivated in England under the misnomer of "American Jasmine," and in France, as "Jasmine de Virginie." It is in England made the emblem of SEPARATION, from the fanciful notion that it does not thrive well without its guardian spirit, the humming-bird, which in that "cold and cloudy clime," does not exist. We should prefer it to signify here an entirely opposite sentiment.

1. *Browallia grandiflora.* — (Large flowered Browallia.)
2. *Castilleja coccinea.* — (Painted Cup.)

Tradescantia Virginica.

CASTILLEJA—PAINTED CUP.

Natural Order, Rhinanthaceæ. Linnæan Class, Didynamia; Order, Angiospermia. Generic Distinctions:—calyx ventricose, two or four cleft; corolla, two lipped, upper lip long and linear, embracing the style and stamens; anthers, linear, with unequal lobes; capsule, ovate, compressed; two celled; seeds, numerous, surrounded with a membranaceous vesicle.

C. coccinea. **Leaves and colored bracts, pinnatifidly three cleft; segments, divaricate; calyx, bifid, nearly equal with the corolla; segments, retuse, and emarginate. (*Pl.* 11. *Fig.* 1.)**

This is a handsome and singular plant. It is a native of most of the United States, and must be familiar, under its common and appropriate name of Painted Cup, to many of our readers. Indeed, this seems to be the only certain and lasting appellation which this poor plant is destined to retain, since, within our own recollection, it has been christened twice anew by botanists. It was first placed by Linnæus in the genus Bartsia, named in honor of his friend, Dr. Batsch; it was then separated, and the new genus Euchroma, (signifying *well painted*,) was created expressly for it, by Nuttall, and it is finally settled in its present genus, by Sprengel, a German botanist, where *requiescat in pace.* The genus Castilleja is derived from the name of a botanist of Cadiz, D. Castillejo. This species owes its brilliant appearance not, as is generally the case, to its corolla, but to the colored bracts, which are of a vivid scarlet, passing into orange. The corolla itself, which is often nearly concealed by these, is yellow. It is said by the British botanists to be very impatient of cultivation in England, since it there ripens but very few seeds, so that it is easily lost. In fact, although it was introduced into that country in 1787, it soon ran out, and was not restored until 1826. It may be easily cultivated in this country, by sowing the seeds in loose, gravelly soil, early in the spring, and after the plants come up they require very little attention.

NOLANA—THE NOLANA.

Natural Order, Nolanaceæ. Linnæan Class, Pentandria. Order, Monogynia. Generic Distinctions:—calyx, five cleft; corolla, campanulate, regular, plaited. Drupes usually five, containing each a three or four celled nut.

N. atriplicifolia. **Stems procumbent, rather hairy; calyx, campanulate, with ovate lanceolate, acute, connivent segments; leaves, spatulate, radical ones large.** (*Pl.* 12.)

The name of this genus is derived from the Latin word *nola*, a little bell, and was given by Linnæus to the first of the species discovered, on account of the bell-shaped form of its corolla. The proper position of Nolana in the natural system has been a matter of considerable doubt among botanists. It was placed by Jussieu in the same order with the Borage and the Echium, but its distinction from the plants of that order is so plain, particularly in its plaited flower bud, that its right there was soon doubted. It has a strong resemblance to some species of Convolvulus, but differs from that genus entirely in its fruit, which is a fleshy drupe, containing a hard stone, somewhat like a cherry. De Candolle included it in the order *Solanaceæ*, from which again its fruit distinguishes it, all plants of that order bearing a fleshy berry, as that of the Tomato or Egg-plant. Professor Lindley, for the purpose of giving it its proper place, formed the order *Nolanaceæ*, which comprises also two other genera nearly allied to the Convolvulus.

The species came from South America, and are now commonly cultivated in England. The one in our engraving is the most beautiful. The flower is very large, and the distinct combination of the three colors, bright blue, yellow, and clear white, gives it an extremely fine effect. This is heightened by the contrast of the broad, fleshy, deep green leaves, which, on the bending stems, soon become so abundant as to completely cover the ground. This species is an annual plant, and its cultivation is said to be quite easy. The seeds are to be sown early in the season, in a rich soil.

Nolana atriplicifolia (The Nolana)

Petunia nyctaginiflora. — (White Petunia.)
Petunia phenicea. — (Purple Petunia.)
Thunbergia alata. — (Winged Thunbergia.)

PETUNIA—THE PETUNIA.

Natural Order, Solanaceæ. Linnæan Class, Pentandria. Order, Monogynia. Generic Distinctions :—segments of the calyx, foliaceous, spatulate; corolla, with a short tube, and a dilated, rather unequal limb. Stamens, unequal, enclosed.

P. nyctaginiflora. Diffuse, clothed with clammy hairs; lower leaves alternate, ovate, obtuse, hairy; Floral leaves, sessile, cordate-ovate, opposite. Flowers on peduncles, axillary. Tube of the corolla, three or four times longer than the calyx. (*Pl.* 13. *Fig.* 1.)

P. phœnicea. Prostrate, clothed with hairs. Leaves, ovate, on short petioles, acute. Corolla, ventricose, with ovate, acute segments. Flowers, solitary, axillary, pedunculate. (*Pl.* 13. *Fig.* 2.)

The plants of this genus are ornamental annuals, and are great favorites wherever they are cultivated. The generic name is from Petun, the Brazilian word for Tobacco. There are several species, which are very generally esteemed in the flower garden. The two in our engraving are, perhaps, the most beautiful and the most commonly cultivated. The white Petunia was discovered near the mouth of the Rio de la Plata, and seeds of it were first sent to Europe in 1823. It was found to be quite hardy, and to grow well as a border flower, in the open air, and from its beauty and the little trouble required in its management, became at once an object of favor among florists. The soil which it requires is a peat or sandy loam, and it must be watered frequently, as the roots are apt to wither if allowed to become dry.

The Purple Petunia is a more showy and highly colored species, and although it was unknown in England until 1830, and flowered there for the first time in 1831, it has already a place in every garden there. It was discovered on the banks of the river Uruguay in Buenos Ayres. It grows equally well in the open air and in a green house, and as long as its fine vein-like roots are kept moist and allowed to grow in light fine soil, without too much wet, it may be trained in almost any form, and is sure to reward its possessor with a profusion of its large dark purple blossoms. It is generally trained against a wire frame, or over an open bed; or the seeds may be sown in the autumn or winter, and the young plants kept in pots and set out in May. As fast as the old flowers drop off, new ones will expand, and the bed continue to present a mass of splendid purple until the coming of frost. This species is found to hybridize freely with the other, and the union of the two produces a great number of beautiful varieties, some of which are very large and fragrant, and of a lilac color, and others of a fine rich crimson shade of purple. Their culture is very easy; they will grow and bloom freely, if the seeds are merely scattered on any common soil, and by no flower is the care of the cultivator better repaid.

THUNBERGIA—THE THUNBERGIA.

Natural Order, Acanthaceæ. Linnæan Class, Didynamia. Order, Angiospermia. Generic Distinctions:—calyx, double; exterior in two leaves, interior shorter, with awl-shaped teeth; corolla, campanulate, tube inflated, limb five lobed, equal; stigma, two lobed; capsule, globose, beaked, two celled.

T. alata. **Stem twining; leaves triangularly cordate, sinuately toothed, five nerved; petioles winged. (*Pl.* 13. *Fig.* 3.)**

This genus was named by Linnæus in honor of Charles Peter Thunberg, an eminent naturalist, professor of botany at the University of Upsal, and author of several scientific works. The species are mostly climbing plants, and some of them are very beautiful. Their colors are singularly opposite and different; the flowers of one species being blue; those of another scarlet; those of others white, bright orange, and, as the one in the plate, a pale buff. *T. alata* is a native of the East Indies, and its beauty has made it very popular among gardeners, who frequently give it the pet name of Black-eyed Susan. Its seeds are of a curious shape, and have the appearance of being covered with a delicate net work, and the capsule which contains them is hard and horned. The proper method of cultivation seems to be, to sow the seeds in a soil composed of nearly equal parts of peat earth, or vegetable mould, and sand,

Mathiola annua.—(Ten Week Stock.)

which should be kept constantly moist, but well drained, as they are not fond of stagnant water. When growing, they may either have the tops of their shoots cut off frequently, so as to render the plant bushy, or the long slender stems, instead of being allowed to twine, may be laid over the bed and fastened down at the joints.

MATHIOLA—THE STOCK.

Natural Order, Cruciferæ. Linnæan Class, Tetradynamia. Order, Siliquosa. Generic Distinctions :—silique, roundish; stigmas connivent, thickened or cornute at the back; calyx, bisaccate at the base.

M. annua. **Stem erect, branched; leaves lanceolate, blunt, hoary. Pods somewhat cylindrical, without glands. (*Pl.* 14.)**

Few plants are better known than the species and varieties included under the general name of Stocks and Stock-gilliflowers. The genus is named from Peter Andrew Mathioli, an Italian botanist, first physician to Ferdinand of Austria, and author of a commentary upon Dioscorides. The plants belonging to it are generally covered with a white, soft down, and are among the most popular of garden flowers, particularly the species represented in the engraving. Of this there are an immense number of varieties, both single and double. Some of the single ones are white, some purple, some crimson, some spotted, and some striped. Our figure represents one of the most curious and beautiful of the double varieties, of the kind called the German Stock. The following description of this plant, and directions for its culture, are given by Mrs. Loudon, to whom florists are greatly indebted for her series of fine and correct works, some of which are of great value, not only to the practical gardener, but to the student of botany.

" This is a plant growing from one to two feet high, with an erect branching stem, hoary leaves, and long spikes of flowers, the size and richness of color of which differ greatly in the several varieties, some of them being very splendid. The species is a native of the south of Europe, by the sea shore, whence it was introduced in 1731; but the principal varieties have been originated in England and Germany. The German varieties are particularly beautiful, and the seed saved in that country, from the greater heat of the summers, and the great care bestowed by the weavers of Saxony, who are the principal growers of it, is very superior to seed saved in England. What are called the Russian and Prussian varieties, are, generally speaking, all grown in Upper Saxony by the weavers, who take as much pleasure in raising and saving the seed of their Stocks, as the Lancashire weavers do in England in growing their pinks and carnations. Home-saved seed can rarely be depended upon, as where several varieties are cultivated together, spurious ones are made by the wind carrying the pollen from one plant to another, and the seed can never be kept true. Regular seed growers preserve only the plants with the best flowers, and throw the others away. To produce the finest flowers, the seed should be sown in August, in a bed of rather light soil, which should be covered with a frame; or the seed may be sown in pots, four or five in a pot, and placed in a cold frame. (A cold frame is a pit or frame covered with glass, but not heated by manure, or in any other manner.) The plants, when they come up, should be kept dry during the winter, to strengthen them, and in April they should be taken out of their beds, with a ball of earth round their roots, or if in a pot, turned out with the earth entire, and planted in a warm border, in very rich soil. The poor soil in which they were raised will have previously checked their growth; but planting them in the rich soil after this previous check, will make them grow luxuriantly, and produce rich spikes of flowers in June.

"Those persons who wish to have fine Stocks to flower early in the summer, but who have no frame to raise them in, or indeed do not like the trouble of keeping plants during the winter, will find it their best plan to purchase young plants in April or May, and to plant them in rich soil. These autumn-sown plants have, however, the disadvantage of fading very soon, when exposed to the heat of summer. Their fibrous roots wither, and their dark colors become blotched, or blanched by the sun. From this disadvantage spring-sown plants are free. If sown in February, March, or April, in a dry poor soil, they may be transplanted into a rich soil in April or May, taking care to preserve the earth about the roots, and not to injure the fibres, though in some cases the extreme point of the tap-root may be taken off, to induce it to throw out more fibres. Other seeds may be sown in May, which will not need transplanting, and which, if preserved from the frost, will continue flowering till Christmas. Some persons, to produce larger flowers, take off the side shoots as they appear, and thin the blossom buds on the flower spike, by taking off every alternate bud; and others water with liquid manure, and use other means, to produce fine plants. In whatever manner they are treated, it must always be remembered that they require great care in transplanting, and that this should be done when they are quite young. The general rule is, that they are fit for transplanting when they have opened their second pair of leaves, and that it should not be delayed longer than a little after the third pair is produced. When large plants are removed, it should always be with such a ball of earth attached that the roots may experience no check from the removal. When the Stocks are planted out in the borders for flowering, they are generally placed three together in an angular form, so as to allow room for a stake to be placed in the centre to tie them to, if necessary."

Like all other plants belonging to the same natural order, the Stock possesses anti-scorbutic and stimulant qualities. The leaves of all the species are sometimes used as pot herbs. The name Ten-week Stock is applied to this species, from the circumstance that about that period elapses from the time when the seeds are sown to the period of the full growth and flowering of the plant. On the method of producing double flowers from single ones in this and other garden plants, we shall shortly give some instructions.

THE NATURAL SYSTEM OF BOTANY.

NUMBER THREE.

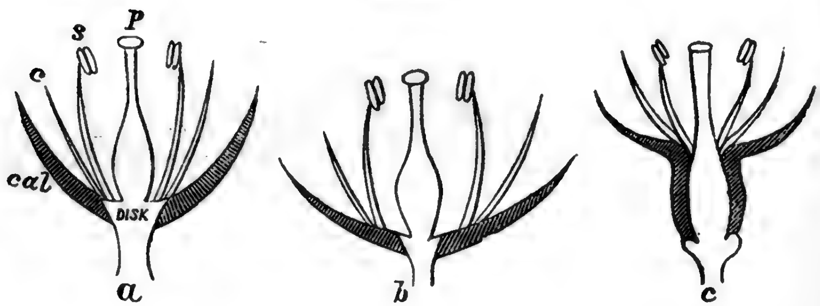
Exogenæ or Dicotyledonous plants are next subdivided into two very natural and easily ascertained families. All those whose seed is enclosed in a *pericarp*, or seed vessel, are included in the division ANGIOSPERMÆ, signifying *covered seeds*, and all whose seed is destitute of an outer covering, belong to the division GYMNOSPERMÆ, *naked seeds*. The first division of Endogenæ, or Monocotyledonous plants, consists of those which have a true calyx and corolla in three or six parts, or if these are absent, stamens and pistils without any envelope. This division is named PETALOIDEÆ. The second division contains those plants which have no true calyx or corolla, but whose parts of fructification are enclosed in imbricated scales or bracts. These are the GLUMACEÆ. All these classes, subclasses and divisions, together with the minor divisions which are not so strictly natural, will be presented to the reader in a tabular form, their points of distinction briefly recapitulated, and examples of plants belonging to each of them mentioned, so as to give at a single glance a clear idea of the whole.

Before offering this, however, and before proceeding with descriptions of the orders of the system, it is necessary that the student should become somewhat acquainted with the marks or characters used by botanists in determining these orders, and should be able to estimate with some degree of precision the value of these characters for that purpose. The great advantage of some previous explanation of these will be felt by the student when he comes to the perusal of succeeding articles, and he must have the greater patience with what may now seem to him dry and tedious, upon the assurance that his future difficulties will be thereby materially diminished. He will commence the study of the natural orders with an interest and a pleasure heightened by the sense of having overcome some of the chief obstacles to an acquaintance with them, and his progress will be the more rapid in consequence of his present delay. The following remarks are incidentally proper also, for the purpose of explaining many of the terms used in defining the natural orders, without some knowledge of which on the part of the student, we should be frequently obliged to interrupt his after progress. Our plan is, as has already been seen, not to pause longer than is unavoidable on the meaning and application of technical words, but rather to trust the observation and memory of the reader to gather the necessary information on such points, as he proceeds. This, so far as our own experience extends, is much better than to continually intrude upon the senses a collection of compound words, with lengthy explanations, which are almost certain to confound and disgust the mind, and to lead it away from the main subject. We hope in these observations, as well as in the articles on Vegetable Physiology, so to accustom the eye of the student to most of the words which botanists make use of, that when he sees those words collected together, in the form of a diagnosis, or in the essential characters of a natural order, he will understand them at once, without the trouble of repeated references to a glossary. This object, to its fullest extent, we cannot pretend to effect, but only so far as concerns the scope of this work.

Before estimating the degree or the manner in which the external organs, such as the leaf, or the flower, are used to determine natural affinities, it may be remarked as a first principle, that for this purpose the value of these organs is proportionate to the certainty with which they severally afford indications of important similarities or differences of *general* conformation. A single character of an organ may be sometimes a key to all those of the plant or class of plants to which it belongs; as for instance, a reticulated leaf at once shows that the plant from which it is taken, increases from the outside, has a vascular structure, and a seed composed of more than one cotyledon, because these peculiarities invariably accompany such a leaf. This principle may be made more plain by a reference to the animal kingdom. If a living being is found covered with feathers, we know at once that it has a complete bony skeleton, that its blood is red, it breathes air, its young are produced from eggs, in short, that it possesses all those distinguishing qualities which constitute a bird. Again, the form and arrangement of the teeth of a quadruped afford almost unfailing indications of the form of its digestive apparatus, of the nature of its food, and of its general structure. In a similar manner the botanist selects from the whole set of characters on which his classification depends, those which afford the most apparent marks, to distinguish one division from another. The most natural character, then, as the distribution of the veins of a leaf, is that which affords the most plain and extensive information as to *all* the other characters of the plants to which it is peculiar. The number of the stamens or styles indicates comparatively nothing in this respect, and is therefore only an artificial character.

A second important principle of natural classification is found in the fact that when a number of plants or animals are collected according to their general resemblances, some individuals of the group will possess in a much higher degree than the rest, the characters which are common to all, while others will be so deficient in these characters as to seem hardly related to the same assemblage. Those members of a natural group which most strikingly present an union of all the characters by which it is distinguished, are called its *types*, and those in which such characters are less obvious are termed *aberrant*. By these latter is formed the connexion between the different natural orders, since it is often the case that in the aberrant members of an order, its characters become gradually shaded off, until they almost blend with those of the next. To refer to animals again, for an illustration, the family of Lizards is intermediate between the Serpents and the Tortoises. The body of some lizards is so elongated, and their legs so small, as to render them nearly similar in appearance to snakes ; and in one species the outer form is exactly that of a serpent, while under the skin are found two pairs of very minute legs. This, then, is an aberrant form, which it is scarcely possible to refer with certainty to either family. On the side of the tortoises, again, the lizards are connected by a species with the head, neck, legs and tail of a lizard, but with a shell on its back. In the vegetable kingdom instances of this kind will be frequently met with, and therefore it by no means follows, when a plant is included in a certain order, that it must necessarily possess *all* the characteristics of all plants of that order. Again, in the case of birds, the structure and appearance of the feathers, their general mark of distinction, are much varied in those which approach nearest to other animals. The Cassowary, for instance, which belongs to the Ostrich tribe, has feathers which differ little from coarse hair, and those of the fin-like wings of the Penguin are much like the scales of fish. In like manner, some of the plants belonging to the Ranunculus tribe, have the parts of their flowers arranged in threes, like Endogenæ; yet their stems are exogenous, their leaves reticulated, and they have two cotyledons. On the other hand, the Arum, or Indian Turnip, has partially reticulated leaves, but an endogenous stem and a single cotyledon. It has been already mentioned that the structure and mode of increase of the stem are the characters by which flowering plants are divided into Exogenæ and Endogenæ, and these divisions are entirely natural. There are, however, some Exogenæ whose stem is not marked by annual layers, and in some the predominance of cellular tissue is such that they are soft and succulent, and nearly resemble Cellulares. The structure of the stem, then, does not offer a certain foundation for any division of the primary classes into sub-classes or orders. No characters uniform in particular families are afforded by the Roots, since the modifications of their form are few, and cannot be applied with certainty. One general rule is, however, that no Exogenous plant has that form of root-like stem called a *bulb*, nor the prostrate stem which sends down roots from its lower surface, called a *rhizoma*. The external figure of the stem is sometimes one of the distinctions of an order. In Menispermeæ, the Cocculus tribe, the stem is always twining; in Labiatæ, the Mint or Catnip tribe, the stem is always square, and in one or two other orders its angular or cylindrical figure is a mark of difference. The leaves are of the greatest use in affording characters for determining the relations of plants. One of the most important of these characters is the relative position of the leaves, though this may be of much greater value in some orders than in others. In Gentianeæ, the Gentian tribe, and in Labiatæ, they are uniformly opposite, so that no plant can belong to either of these orders, which has alternate or verticillate leaves. In Urticaceæ, the Nettle tribe, in Umbelliferæ, to which belong such plants as the Parsnip and Carrot, and in some others, they are as uniformly alternate. In many other orders, however, both these arrangements may be found; as in Compositæ, which includes the Aster and the Daisy, and which generally has opposite leaves, are some plants whose leaves are alternate; and in Leguminosæ, the Pea tribe, which commonly has alternate leaves, they are sometimes opposite. Some orders have only compound leaves, some only simple leaves, and some both simple and compound. The degree in which the leaf is divided, is not a certain character, since in many orders the leaves are both divided and entire; but in others, this is a sure mark of distinction. Leaves with a toothed or serrated margin are never found in Cinchonaceæ, the Coffee tribe, and are very rare among endogenous plants. The characters afforded by the veining of leaves are of great value, and will probably be of more assistance in determining orders, when more knowledge of them is obtained. All plants of the order Melastomaceæ, have about four strong ribs extending from the base to the apex of the leaf, and connected by transverse bars, very like some Endogenæ. Myrtaceæ, the Myrtle tribe, all have a delicate vein running all around the leaf, just inside the margin; and in Cupuliferæ, the Oak tribe, veins extend directly outwards from the midrib to the margin. Another curious character is afforded by the presence or absence of those little dots, which are so apparent in the leaves of some species of Mint, and which secrete a peculiar oil. All Aurantiaceæ, the Orange tribe, possess these, and are thereby distinguished from allied orders. The nature of the juice of the leaves or stem is of great use in distinguishing particular orders. In all the Asclepias tribe the juice is white, thick, and milky; and in all the Ranunculus tribe it is thin, clear, and acrid. The little imperfect leaves, called stipules, often found at the base of the true leaves, sometimes are a remarkable indication of affinity, and their presence or absence is frequently sufficient to distinguish the order to which a plant belongs. They are always present in Salicineæ, the Willow tribe, and always absent in Guttiferæ. The small bracts at the base of some flowers sometimes indicate genera, but are not used to distinguish orders. The mode in which the flowers are arranged often characterizes an order. Some have their flowers in heads, some in umbels, some in spikes, some in *amenta*, or catkins. The calyx is used in several ways to distinguish orders. By its absence, as we shall see, all *Achlamydeous* orders are known. The number of its sepals is often constant in a particular order; as in Cruciferæ, the Cabbage and Turnip tribe, they are always four, and in Papaveraceæ, the Poppy tribe, always two. Their equal or unequal size is also sometimes an important character, and their union by the adhesion of their edges is a circumstance of great value. When this adhesion unites all the sepals, the calyx is said to be *monosepalous*. A character of still more importance, is the degree of adhesion of the calyx to the organs on its inside. When it grows immediately out of the disk, or top of the flower stalk, and when the corolla, stamens, and pistil, are quite distinct from it, having a separate point of growth, the calyx is said to be *inferior*, that is, below the pistil. But when it adheres to the outside of the ovary, and encloses it, so that the sepals appear to arise out of its upper part, the calyx is called *superior*. As to the value of the corolla in indicating affinities, it may be said that its most important characters are those of the adhesion or separation of the petals. When these are all united into one, the corolla is *monopetalous*, and when they are all separate, it is *polypetalous*. This is a distinction of great value. All the Rose tribe, and all the Poppy tribe, for instance, are polypetalous, and the Borage tribe, and many others, are monopetalous. When no corolla exists, the calyx alone being present, the plant is said to be *apetalous*, or *monochlamydeous*, without petals, or having a single envelope. These two characters are not, however, invariable, since plants without petals are sometimes found in orders which generally have complete flowers. When we come to the stamens and styles, we find that the number of the stamens is of little importance, since this, as has been before mentioned, is liable to great variation among plants of the same genus, or even individuals of the same species. In some orders, however, the number is always invariable; but the principal characters derived from the stamens depend upon the manner of their insertion into the lower part of the flower. In some cases they spring from beneath the ovary, in which case they are said to be *hypogynous*, and are separately inserted, with the petals and sepals, on the disk. Sometimes they adhere for a part of their length to the calyx, their points of insertion being the same with the sepals, which, when they are detached, carry away the stamens with them; or they adhere in a similar manner to the petals. In these cases the stamens are *perigynous*. In other instances the stamens are closely enveloped by the calyx, which also embraces the ovary, so that they appear to arise from its upper part. In this case they are *epigynous*. Figure 1. represents sections of flowers showing these modifications. In *a* the stamens are hypogynous, in *b*, perigynous, and in *c*, epigynous.

Figure 1.



The manner in which the anthers open to disperse the pollen, is sometimes characteristic of an order. In the Barberry tribe, for instance, they open into valves, like the pod of a pea, or a little box, and in the Heath tribe they have pores through which the pollen is projected. These peculiarities are not to be implicitly relied on. Of all natural characters, those afforded by the central parts of the flower are probably the most invariable. The number of styles, like that of the stamens, is subject to variation, though not in so great a degree, and in some genera it is quite constant; but the *carpels*, or separate parts of the pistil, each of which contains a seed, afford a very decisive character. When these are distinct from each other, the ovary is *apocarpous*, and when they are united into one, it is *syncarpous*. There are few natural orders in which one of these conditions is not invariable, to the exclusion of the other; so that plants bearing a general resemblance, but differing in this respect, may be at once referred to their proper place. The position of the ovary in respect to the calyx is also to be considered. When the ovary is inferior, the calyx is superior, and vice versa. Some ovaries are divided by partitions, and some have but a single cavity. When an ovary consists of but one carpel, it of course can be only one-celled; but there are *syncarpous* ovaries which are also one-celled. This is owing to the obliteration of the partitions, or dissepiments, originally formed by the adhering carpels. When this occurs, the ovules are attached to a central column, leaving an empty space between themselves and the wall of the ovary; or they are attached to the wall itself, leaving a cavity in the centre. The point of attachment of the ovules is called the *placenta*, and this in the first case is *central*, and in the second, *parietal*. These are distinguishing characters of several orders. Other marks of distinction are found in the enlargement of the receptacle on which the carpels are situated, and in the varieties of form, substance, and manner of opening of the ovary when ripe, but these are not of the highest importance. The definite or indefinite number of the ovules is often regarded, but their *position* in the ovary is much more essential, and is one of the most valuable forms of structure to be taken into account. Those which stand upright in the ovary are termed *erect*, those which hang from the upper wall are *pendulous*, and some other intermediate positions occur. The substance in the seed, which surrounds the *embryo*, or rudiment of the future plant, is called *albumen*. The presence or absence of this is a character of importance, particularly when it constitutes nearly the whole bulk of the seed. In orders whose seed consists almost entirely of albumen, it is very uncommon to find plants whose seed is destitute of it; but when its quantity is less, and the embryo nearly or quite equals it in size, the character is of minor importance, and an order may contain some genera whose seed is quite filled with the embryo, and others which have a portion of albumen. There are some other characters used by botanists for distinguishing natural orders, but it is hardly necessary to mention them here, as they will be incidentally used as we proceed, and as those already enumerated are of the greatest importance. We have also anticipated in some measure, as was unavoidable in pointing out characters dependent on the structure of the ovary and seed, a future article on Physiology, in which this structure will be fully explained, with the aid of proper engravings, and which can be consulted for any thing which is not already understood.

We apprehend that the student who has read the foregoing remarks, is not a little perplexed on account of the constant uncertainty which has been asserted to attend the value of the characters. He will find, however, that this uncertainty is greater in appearance than in reality, and experience will show him nearly the precise estimate which he can place upon each mark of distinction. He will learn that though a *single* character is seldom to be relied on, yet that a *combination* of characters, peculiar to an order, may be ascertained with less difficulty than he may perhaps now imagine. The power of judging of these more or less intricate combinations, to use the words of Professor Lindley, "is the same test of a skilful botanist, as an appreciation of symptoms is that of a physician."

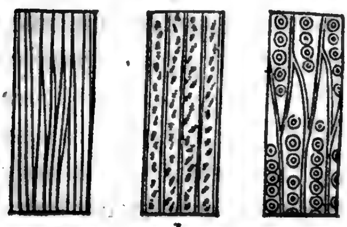
In our next article we shall be prepared to present the tabular view of the natural divisions, and to describe one of the orders.

VEGETABLE PHYSIOLOGY.

NUMBER THREE.

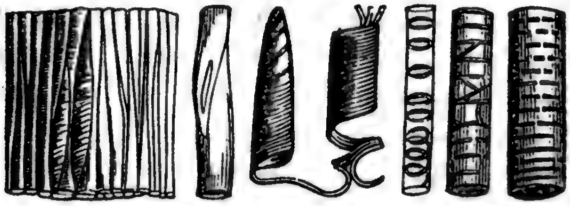
The form of elementary tissue called Woody Fibre is so named because it has been supposed to consist of fibres infinitely divisible. It is now considered to be only a variety of cellular tissue, in which the cells are much elongated, and lie close to each other in bundles. It is possessed of great tenacity, and those plants in which it exists in the greatest perfection, such as flax and hemp, are used in the manufacture of cordage. If a fibre of hemp be examined by the microscope, it is found to consist of a great number of smaller fibres adhering together, and each of these is discovered to be a slender, transparent tube, pointed at each end. Figure 5, *a*, represents a bundle of this tissue, as it commonly exists. Its use in vegetable economy appears to be, to convey fluids in the direction of its length, and some observers have thought that each tube has a pore at the end so as to afford a communication with the rest. The especial office of this tissue in its adult state, is evidently, to give strength and elasticity to those parts of the structure which require support, and accordingly in all plants whose stem is permanently elevated, as trees and shrubs, it is very abundant. In these it receives additional consistence and firmness from the deposition of various secretions within its tubes, and a difference in the quantity or character of these secretions produces the distinction between the inner portion, or heart, of a tree, and the surrounding wood. In its hardest state the tubes are entirely filled up, so that no sap can pass through them. Figure 5, *b*, shows the appearance of woody fibre, when the walls of its tubes are straight and parallel, and the granules deposited by the permeating fluids begin to adhere to them. Another variety of woody fibre is represented in Figure 5, *c*, and is called *glandular* woody fibre. This is peculiar to the natural order *Coniferæ*, or cone bearing trees, such as the Pine, Fir, and Juniper. It may be readily known by the regular series of circular glandules, with an opaque centre, which are found on the tubes of which it consists. They appear like little dots, and are supposed to be formed by the growth of matter in the inside of the tubes. Their form and arrangement can readily be observed by placing a thin pine shaving under a magnifier, and even with the naked eye they can be distinguished. Their nature and use do not seem as yet to be clearly understood, but they are of considerable interest as having assisted in establishing the true nature of coal. The formation of this substance, after it was acknowledged to be of vegetable origin, was at first supposed to have been produced by the decay of plants of the Fern tribe; but the question then was, how to account for the bituminous matter so often combined with it. Nothing of this kind is contained in any of the Ferns, and therefore it was evident that some resinous wood must have afforded it. On examining those portions of coal which present the strongest traces of woody structure, they are found to display the dots and all the other peculiarities of the glandular form of woody fibre, and hence it may be considered as satisfactorily ascertained that coal is only the remains of immense forests of those trees in which alone this species of tissue is found. The arrangement of the dots being different in different divisions of that tribe of trees, it may even be possible to say to which of these their coal producing ancestors belonged.

Fig. 5.



Another variety of elementary tissue is that called the Spiral Vessel. This is a membranous tube, tapering to a point at each end, and having within it a cylindrical fibre, spirally rolled, and capable of being untwisted. This fibre has been already described on page 43. To this vessel has also been given the name of *Trachea*, or windpipe, from a fancied resemblance in its structure and function to that organ. It is considered by some to be formed only of fibre spirally twisted, without any membrane, but the better opinion seems to be that which we have followed in the above definition. The fibre itself has been also variously represented as cylindrical, flat, or tubular. It is generally formed of a single thread, as in Figure 6, *c*, but sometimes it is double, or triple, as in *d*, and in some plants it is quadruple. These vessels are extremely delicate, their diameter averaging the 1000th of an inch. The bark, wood or root seldom contains them, but in the stem and leaf stalk they are often found, and they form almost the whole of a peculiar part which surrounds the pith of some plants, called the *medullary sheath.* They may be detected in the *stringy* parts of the stem of the Asparagus, more readily than perhaps in any other situation, by separating the strings by boiling, and placing one of them upon a piece of glass under the microscope, and then further dividing it lengthwise with the point of a needle. These vessels are very similar in their construction to the air-tubes of insects. The principal difference between the two is, that those of the insect branch off into a set of continuous tubes, all having a direct communication with each other, while those of the plant are parallel, and their ends are closed. All the varieties of vessels not furnished with an elastic spiral filament, are named *Ducts.* These are considered as only elongated cellules, and seem to be formed by the breaking down of the partition between the cells, which as we have seen compose cellular tissue, so that a continuous tube is produced. Sometimes the remains of these partitions are discovered in them. The variety of duct which approaches most nearly to simple cellular tissue is the *dotted duct,* Figure 6, *g.* This is formed by a membranous tube in which appear to be the remains of a spiral fibre broken into small fragments. Some observers, however, consider that this duct is membranous only, and that what appear to be portions of fibre, are only an interior deposite. The dotted duct is the largest vessel discovered in the vegetable fabric, many of them being visible to the naked eye, and of sufficient diameter to admit a hair. If the stem of a grape-vine be cut across, their mouths can be distinctly seen, and the sap will flow from them freely. Their office is the important one of conducting the sap through the stem and branches to the leaves. Another kind of duct, which more nearly resembles the spiral vessel, is the *annular duct,* Figure 6, *e.* This shows clear traces of a spiral fibre running within its membrane, sometimes broken so as to form a complete ring, so that it would seem as if the membrane had grown faster than the fibre, which, losing its elasticity, had been thus separated into pieces. A third variety displays the spiral fibre continuous in some parts, in others branched, and sometimes has a netted or barred appearance, as in Figure 6, *f*. This is named a *reticulated duct*. The structure of the annular duct much resembles that of the windpipe of most animals, which like it, is composed of membranous walls, preserved in their cylindrical form by regular rings of cartilage; and the half spiral, half annular duct is constructed precisely like the windpipe of an animal of the whale tribe, in which is a spiral cartilage terminating at intervals in rings. There are several other varieties of the duct, presenting various proportions of membrane and fibre, combined in numerous different forms. The office of all these is the same,—that of conveying fluid, while the true spiral vessel only contains air. The combination of woody fibre, spiral vessels and ducts which constitutes vascular tissue is shown in Figure 6, *a;* and *b* represents the joining together of two ducts.

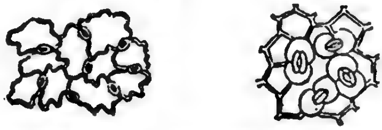
Fig. 6.



Besides these elementary organs, properly so called, there are various cavities resulting from their connexion or separation, which require some notice. It has been already stated that the cellules often leave between themselves vacant spaces, to which the name of intercellular passages is given. These vary in size, being largest in the most succulent plants, and always contain a fluid. Besides these, there are cavities in the tissue, bounded by its cellules, which have no lining membrane, do not communicate with the intercellular passages, and contain air, for which reason they are called *air-cells.* Sometimes the intercellular passages are unusually dilated by the fluids which they contain; or by the pressure of the fluid, cavities are formed in the cellular tissue. Such cavities, filled with the peculiar juices of the plant, are by some named *proper* *vessels,* receptacles of the juice, reservoirs of the proper or peculiar fluids, or accidental reservoirs. Although destitute of lining membrane, their walls are generally compact, being formed of condensed cellules. They vary in size and form, and though often quite regular, sometimes have no definite figure or arrangement. This is the view taken of these proper vessels by some botanists, while others consider them to be not simply cavities between adjacent cells, but a separate form of tissue, to which they give the name of *branching vessels.* They are found on the lower sides of leaves, and in the bark, and the sap or proper juice is carried by them from the leaves, where it is produced, down the bark, and thence to other parts of the structure.

Of these modifications of membrane and fibre, are formed all the parts of plants. The varied combinations of the vascular and cellular tissues give rise to an endless variety of structure and external form, and produce an equal diversity in the properties of the juices and secretions. Many plants, as we have seen, are entirely composed of cellules, but the greater number, of both cellules and vessels. The compound organs of plants, as the leaves and flowers, which are formed of combinations of these, will be described hereafter. There are, however, parts more or less complex which may also be considered as elementary. These are the *cuticle, epidermis,* or general envelope of plants, and the organs immediately connected with it. This is a modification of cellular tissue in the form of a delicate membrane. In young plants it extends over the whole external surface, from the fibrils of the roots to the leaves, the petals of the flower, and the fruit. From the leaves of some plants, as the Iris, it may be easily stripped, without any preparation, and from others, after being soaked in water. It is usually transparent and colorless, and is found to consist of flattened cells containing air. The form of these is various in different plants, some being regularly oblong, and some, as it were, dove-tailed into each other. Sometimes these layers of cells are single, sometimes arranged in two or three series. Over all these is an extremely delicate film, perforated by minute oblong pores. The use of the cuticle appears to be to prevent the moisture of the soft tissues beneath it from evaporating. Accordingly, it is absent in all plants which live beneath the surface of the water, and those which grow partly in the water possess it only on those parts which are not submerged. When it is destroyed on the succulent twigs of perennial plants it is soon renewed, but on the leaf and flower, and on annual plants, it is not reproduced, and the part from which it is removed soon withers. The cuticle possesses certain peculiar apertures, called *stomata*, from the Greek, signifying *mouths.* They are usually of an oval form, but sometimes square, or circular, and are bounded by two curved or kidney-shaped vesicles, by the contraction or expansion of which the orifice is diminished or increased. The appearance and structure of some of these is shown in Figure 7, *a* and *b*.

Fig. 7.



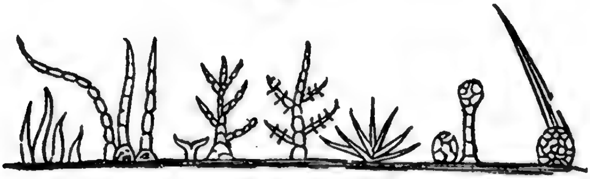
Stomata are chiefly found on the soft green tissue of young shoots and leaves, and on such succulent stems as those of the Cactus or Prickly Pear, and they always open into intercellular passages. On the upper surfaces of many leaves whose tissue has become hardened, they seldom occur: but in other leaves, particularly those which grow upright, as those of the Iris and Flag, they are common to both sides. No traces of them are seen in the sea weeds, and few in the mushrooms or lichens; but in the Liverwort tribe they occur in a remarkably complex form, and in all flowering plants they abound. Their size is very minute, being only from the 3000th to the 1500th of an inch in length. Their office seems to be connected with the evaporation of water from the inner tissue, which is one of the processes by which the fluid absorbed by the roots is converted into the nutritious sap, or proper juice. Some curious experiments have been made to show the effect of light in the production of stomata. There is a common kind of Liverwort, called *Marchantia polymorpha*, which grows in moist situations, and has a very peculiar system of fructification. It produces small leafy buds, which spontaneously separate themselves from the parent structure, and become new plants. In these buds no stomata or roots exist when first separated, but as soon as they begin to grow, stomata are found on the upper side, and roots on the lower. If the plant be then turned over, so as to bring the stomata on the under surface, and the roots in the air, it will twist itself completely back again, so as to bring the surfaces into their former position.

Some observers have had the curiosity and the patience to count the number of stomata contained within an inch square of the surface of the leaves of various plants. The following tabular statement has been collected from such observations. The letters U. S. indicate the upper, and L. S. the lower side of the leaf.

NAMES OF PLANTS WHOSE PORES HAVE BEEN COUNTED.	U. S.	L. S.
Andromeda speciosa, - - - - -	None.	32.000
Arum draconitum, - - - - -	8.000	
Alisma plantago, - - - - - -	12.000	16.320
Amaryllis Josephiana, - - - -	31.500	31.500
Cobaea scandens, - - - - - -	None.	20.000
Dianthus caryophyllus, - - - -	38.500	38.500
Hydrangea quercifolia, - - - -	None.	160.000
Ilex, the Holly, - - - - -	None.	63.600
Peonia, the Peony, - - - - -	None.	13.600
Pyrus, the Pear, - - - - -	None.	24.000
Syringa, the Lilac, - - - - -	None.	160.000
Rheum, Rhubarb, - - - - -	1.000	40.000
Rumex, the Dock, - - - - -	11.088	20.000

The cuticle possesses several different kinds of appendages, which this is the proper place to mention. These are *hairs*, *bristles*, *stings*, *prickles*, *scales*, *glands*, &c. Hairs are constructed in various ways. Sometimes they are composed of a single cell, as in Fig. 8, *a*; often of a row of cells, *b*, in which case they appear like a tube divided by transverse partitions. They may be branched, as *c*, or covered with small processes, which are themselves branched, *d*, or they may be divided, as in *e*. Hairs are generally acute, but often their point is blunt or enlarged at the extremity, as *f*, secreting a viscid fluid, when they are called *glandular* hairs. Sometimes they are tubular and pointed, and fixed upon a gland containing an acrid fluid, which, when the hair is touched, rises up, by the compression of the gland, into the wound made by the point. In this case it is called a *sting*, *g*, and must be familiar to every one who has had the misfortune to handle a nettle. This kind of hair is analagous to the poison fang of a serpent. The prickles of

Fig. 8.



the Rose, Raspberry, and other shrubs, are also appendages of the cuticle, which, when stripped off, carries them with it. They are thus easily distinguished from spines, which are prolongations of the woody tissue, and do not come off with the bark. They occur on many parts of plants, but are rarely found except on the stems. Scales are thin, flat, scurf-like processes, composed of cellular tissue, and one form of them is found in great abundance on the stalks and leaves of ferns. A gland is a small prominence in the tissue just beneath the cuticle, which it causes to project. Sometimes it is furnished with a little pedicel, by which it is elevated somewhat above the surface of the cuticle. Glands frequently secrete a peculiar fluid. Those which are so abundant in the rind of the Orange and Lemon contain the volatile oil which gives it its odor and flavor. The turpentine of resinous woods is collected in similar glands.

We have been compelled to leave unnoticed many of the different forms which result from the combination of membrane and fibre, and the foregoing remarks afford but a bare sketch of what might be very widely extended. We hope, nevertheless, that the reader has not failed to observe the simplicity of the plan by which so many different results are effected, so many functions necessary to vegetable economy performed. Nature is a better artificer than man. While the most elaborate works of the latter are found, the more closely they are scrutinized, the more full of defects, those of the former display new beauties at every examination, and the more thoroughly their intricacies are penetrated, the more perfect do they appear.

PROLONGED VITALITY OF SEEDS.

The article on Fossil Botany for the present month is unavoidably omitted, and in its place we present the reader with the following interesting anecdotes, illustrating the great length of time during which the vitality of seeds is sometimes retained.

The seeds of most plants are endowed with a remarkable power of preserving their vitality for an almost unlimited time, when they are placed in circumstances which neither call their properties into active exercise, nor occasion the decay of their structure. The conditions most favorable for this preservation are a low or moderate temperature, dryness of the surrounding medium, and the absence of oxygen. If all these be arranged in the most favorable manner, there seems no limit to the period for which seeds will retain the power of performing their vital operations. Even if moisture or oxygen be not entirely excluded, the same result may take place, provided the temperature be low and uniform. Thus many seeds may be kept for several years, freely exposed to the air, if they are not permitted to become damp, in which case they will either germinate or decay. Some of those which had been kept in the seed-vessels of plants belonging to the herbarium of Tounefort, a French botanist, were found to retain their fertility after the lapse of nearly a century. Frequent instances have happened, in which ground, recently turned up, has spontaneously produced plants different from any in their neighborhood. Undoubtedly this is owing, in some cases, to the seeds having been deposited there by the wind, or by other means, and growing because they have found a congenial soil; but there are authentic facts which can only be explained on the principle that the seeds of the newly appearing plants have lain for a long period imbedded in the earth, at such a distance from the surface as to prevent the access of air and moisture, and that they have been excited to germination by exposure to the atmosphere. To the westward of Stirling in Scotland, there is a large peat-bog, a great part of which has been flooded away, by raising water from the river Teith and discharging it into the Forth, for the purpose of laying bare the undersoil of clay for cultivation. The clergyman of the parish was on one occasion standing by, while the workmen were forming a ditch in this clay, in a part which had been covered with *fourteen feet* of peat earth; observing some seeds in the clay thrown out of this ditch, he took them up and sowed them. They germinated, and produced a species of Chrysanthemum. A very long period must have elapsed whilst the first covering of clay was formed over the seeds, and of the time necessary to produce fourteen feet of peat earth above this, it is scarcely possible to form an idea.

The following circumstance, which occurred in Maine about thirty years ago, is still more remarkable. Some well-diggers, while sinking a well, at the distance of about forty miles from the sea, when they arrived at the depth of about twenty feet, struck a layer of sand. This excited their curiosity and interest, from the circumstance that no similar sand was to be found anywhere in the neighborhood, nor in any other place except on the sea-beach. As it was drawn up from the well, they placed it in a pile by itself, and did not mix with it the stones and gravel which were also drawn up. But when the work was finished, and the pile of stones and gravel removed, the sand was scattered about on the spot where it had been at first placed, and was for some time scarcely remembered. In a year or two, however, it was perceived that a number of small trees had sprung from the ground where the sand had been strewn. These trees became in their turn, objects of strong interest, and care was taken to preserve them from injury. At length they were ascertained to be Beach Plum trees, a species of *Prunus*, which had never before been seen, except immediately upon the sea-shore, and they actually bore the beach plum. These trees must therefore have grown from seeds which had existed in the stratum of sea-sand pierced by the well-diggers, and had remained inactive until this was dispersed in such a manner as to expose them to the air. "By what convulsion of the elements," adds the narrator, "they had been thrown there, or how long they had quietly slept beneath the surface of the earth, must be determined by those who know very much more than I do."

Another example of the same general fact, is interesting from its connexion with historical events. During the rebellion in Scotland in the year 1715, a camp was formed in the King's Park at Stirling. Wherever the ground was broken, broom sprang up, although none had ever been known to grow there. The plant was subsequently destroyed; but in 1745, after the ground had been broken up for a like purpose, a similar growth appeared. Sometime afterwards the Park was ploughed up, and the broom spread all over it. The same thing happened in a field in the neighborhood, from the whole surface of which about nine inches of soil had been removed. The broom seeds could not have been conveyed by the wind, since they are heavy, and without wings; and the form of the ground is such that no stream of water could have transported them, or covered them afterwards with soil. The effect must have been produced by the operationof causes continued through a long period of time.

The most remarkable instance on record, as presenting satisfactory proof of the lapse of at least 1600 or 1700 years, during which the seed was dormant, is perhaps one related by Professor Lindley. "I have now before me," he says, "three plants of Raspberries, which have been raised in the gardens of the Horticultural Society, from seeds taken from the stomach of a man whose skeleton was found 30 feet below the surface of the earth, at the bottom of a barrow,* which was opened at Dorchester. He had been buried with some coins of the Emperor Hadrian." Grains of wheat enclosed in the bandages of mummies are said to have sometimes germinated, and though there is no improbability in the

* These barrows are large mounds of earth, common on the downs along the south coast of England. They are evidently artificial, and when dug into, are usually found to contain human remains, with pottery, weapons, coins, and other articles. They are evidently burial places, and as a number of them are generally found together, they seem to have been erected on fields of battle, to contain the bodies of the slain.

fact, yet as the Arabs from whom the mummies are usually obtained, are in the habit of previously unrolling them in search of coins, it is not *always* certain that the seeds which have sprouted were really at first enclosed with the body.

CONDITIONS OF THE GROWTH OF PLANTS.

Every distinct tribe of plants flourishes naturally under peculiar conditions. Some prefer a warm atmosphere, some a cool one; some luxuriate only in moisture, and others in dry situations alone; some require the brightest light, and some only grow in darkness. There are some plants which are very deficient in the power of adapting themselves to slight changes in these conditions, and are accordingly restricted to certain localities, which are favorable to their growth, and are hence considered *rare* plants. For example, there are certain species which require in the moisture of the air which surrounds them, a portion of salt, and these abound only near the sea-shore. But if works for the manufacture of salt are established, even more than one hundred miles inland, in the neighborhood of these they will spring up, their seeds having been conveyed by the wind or by birds, which have spread them over the whole surface of the ground, but finding only in *that spot* the conditions required for their development. On the other hand, many plants can grow in almost any situation, and can adapt themselves to a great variety of circumstances, often exhibiting under the influence of these, evident changes of form and quality. For example, the Potato, growing in its native tropical climate, does not require for its young shoots that store of nourishment which, in temperate regions, is provided in its fleshy tubers, and thus its edible portion is there extremely small, since the warmth and moisture constantly supplied to it, develope the growing parts without such assistance. But when transplanted to a colder clime, and to a richer soil, that nourishing matter is greatly increased, and becomes one of the most important articles of food to man. If it were not for this capability of adapting itself to new circumstances, it could not thrive in Northern America; since its own powers of growth would be insufficient, when its external conditions are so much changed. It is this capability which renders it so useful. If large potatoes raised in northern countries be planted again in tropical climates, they at once dwindle, and their produce becomes little superior to that of the original stock; since when circumstances no longer demand it, the acquired habit ceases. The Cabbage, Broccoli, and Cauliflower are, in like manner, only varieties of a single species, greatly altered by cultivation and change of circumstances; the plant which was the original stock of all having been found susceptible of enduring such changes, and thus rendered at the same time useful and easy of production. The celery which is in such common use on our tables, in its original state is a small, rank, coarse plant, wholly unfit for eating. By causing it to grow in a peculiar manner, it becomes sweet, crisp, juicy and agreeable.

These instances, to which many others might be added, will suffice to show that not only in their original state is exhibited the adaptation of each tribe of plants to particular circumstances, but that there are many which can thus spread themselves, or be spread by man, over a large portion of the globe. In this capability, no less than in their native aspect, do we recognise the wisdom and power of the Almighty, who willed that no portion of the globe should be unclothed by vegetation, and that from every place should spring forth herbage for the animal creation, which is entirely dependent on it, either directly or indirectly, for its sustenance. Such, then, being the universal diffusion of plants, it is obvious that in no spot can he who seeks to make himself acquainted with their structure and habits, be without some subjects for examination; and since the humblest and simplest of these beings are found to display an organization as remarkably and beautifully adapted to the functions they are to perform, and to the conditions in which they are to exist, as is that of the highest and most complicated, there is no reason why any, however insignificant they appear, should be neglected.

LICHENS.

Every one is familiar with that tribe of flowerless plants, called Lichens, which spread like dry, hard, scaly crusts, over walls, old trees, and rocks, but perhaps few think of the important part which they perform in the vegetable world. To them may be well applied the title of *Vernaculi*, or bond-slaves, which Linnæus fancifully gave to the sea-weeds; for they seem as it were chained to the spot which they labor to improve for the benefit of others. The way in which they prepare the sterile rock on which they grow, for the reception of plants of higher rank than themselves, is most remarkable. They may be said to dig their own graves. While alive, they form a considerable quantity of oxalic acid, which by its chemical action, eats a small hollow in the rock, in which the particles of the lichen remain after its death. The moisture which is caught in these cavities, finds its way into the cracks and crevices of the rock, and when frozen, rends off minute fragments by its expansion, and thus adds more and more to the forming soil. Slowly and unwearily do successive generations of these bond-slaves perform their duties, until at length there is soil enough made for the growth of mosses, ferns, and other cryptogamia, and at length, the barren and insulated rock, or the pumice and lava of the volcano, are covered with sufficient depth of mould for the nourishment of the luxuriant grass and the lofty forest tree. Thus by the labors of these poor and insignificant plants, are men enabled to reap their harvest, to feed their cattle, to supply themselves with timber, on what was once but a naked and desolate rock. One of the sternest and most faithful delineators of Nature, Crabbe, has described such a process, as it occurs on ruined buildings. We may be allowed the hypercritical remark, however, that the terms *seed*, *foliage*, and *flower*, are not strictly applicable to the Lichens, which possess none of these.

Gentiana saponaria (Soapwort Gentian.)

Ackermann's Lith. XX

"Seeds, to our eyes invisible, will find
On the rude rock the bed which fits their kind;
There in the rugged soil they safely dwell,
Till showers and snows the subtle atoms swell,
And spread the enduring foliage; then we trace
The freckled flower upon the flinty base;
These all increase, till in unnoted years
The stony tower as gray with age appears,
With coats of vegetation thinly spread,
Coat above coat, the living on the dead.
These then dissolve to dust, and make a way
For bolder foliage, nursed by their decay.
The long enduring ferns in time will all
Die and depose their dust upon the wall;
Where the winged seed may rest, till many a flower
Shows Flora's triumph o'er the ruined tower."

LONGEVITY OF TREES.

At Ellerslie, in Scotland, the birthplace of William Wallace, exists an oak which is celebrated as having been a remarkable object in his time, and which can therefore be scarcely less than 700 years old. Near Staines, in England, there is a yew tree known to be older than Magna Charta, which was granted by King John in 1215; and the Yews at Fountain's Abbey, in Yorkshire, are probably more than 1200 years old. In the Garden of Olives at Jerusalem are eight Olive trees, known to have existed at least 800 years. Every American has heard of the celebrated Charter Oak, at Hartford, in Connecticut, and knows the story which gave it its name. This tree must have been of considerable age in 1687, the year when the charter was hidden in it; for the case, containing the parchment on which the charter is written, is at least three feet in length by six inches in diameter, and the hollow part of the oak must have been of still larger dimensions. This remarkable oak is still flourishing, a hale old tree.

Incidents in the Life of Thomas Paine.

THE PAINTED CUP.

Bryant has written some fanciful lines to the Castilleja, which might form a proper pendant to the description of that plant, and its representation in Plate 11.

Scarlet tufts
Are glowing in the green, like flakes of fire;
The wanderers of the prairie know them well,
And call that brilliant flower the Painted Cup.
Now if thou art a poet, tell me not
That these bright chalices were tinted thus
To hold the dew for fairies, when they meet
On moonlight evenings in the hazel bowers,
And dance till they are thirsty. Call not up
Amid that fresh and virgin solitude,
The faded fancies of an elder world,
But leave these scarlet cups to spotted moths
Of June, and glistening flies and humming birds,
To drink from, when on all these boundless lawns
The morning sun looks hot. Or let the wind
O'erturn in sport their ruddy brims, and pour
A sudden shower upon the strawberry plant,
To swell the reddening fruit that even now
Breathes a slight fragrance from the sunny slope
But art thou of a gayer fancy? Well—
Let then the gentle Manitou of flowers,
Lingering amid the bloomy waste he loves,
Though all his swarthy worshippers are gone—
Slender and small, his rounded cheek all brown
And ruddy with the sunshine; let him come
On summer mornings when the blossoms wake,
And part with little hands the spiky grass;
And, touching with his cherry lips, the edge
Of these bright beakers, drain the gathered dew.

MARTYNIA—THE MARTYNIA.

Natural Order, Pedalineæ. Linnæan Class, Didynamia; Order, Angiospermia. Generic Distinctions:—calyx, five parted; corolla, ringent; capsule, woody, dry, with a hooked beak, containing a four-celled nut.

M. proboscidea.—Stem, branched; leaves, alternate, lobed, cordate at the base; stamens, four, all fertile.—*Plate* 15.

This genus was named in honor of John Martyn, who was professor of botany at the University of Cambridge, and author of several botanical works. He died in 1768. Martynia is nearly allied to *Bignonia*, the Trumpet-flower genus, in the formation of its corolla, the number and position of its stamens, and in other respects; but is readily distinguished by the absence of wings from its seeds, and by the oil which they contain.

The species in our plate, takes its name, *proboscidea*, (proboscis-like,) from the singularity of its capsules or seed vessels, which are hard and dry like a nut, and terminate in two beaks or horns. It is a native of Louisiana, and probably of some of the other southern states, having been discovered on the banks of the Mississippi, and introduced into England in 1759. Its cultivation is said to be easy; the seeds are to be sown in April or May, in a light, rich soil, and warm situation. The seeds, like all others which are oily, are apt to become spoiled, and often only a few of those which are sown, will germinate. It is a showy and curious plant. The stem and leaves are covered with glutinous hairs, the flowers are somewhat bell-shaped, dotted, and variegated with several shades of purple, on a white ground; the throat of the corolla is edged with yellow, and the stigma is divided into two lobes, which are irritable, and when touched, close together.

There are three or four other species, all but one of which are natives of Mexico and Brazil. Of these, *M. lutea* much resembles the one already described, but its flowers are a bright orange color, and its leaves have toothed edges. *M. diandra*, which comes from Vera Cruz, has very peculiar flowers, the limb of the corolla being a delicate pink, variegated with deep scarlet,

Martynia proboscidea.

(Horny Martynia.)

and the throat having a yellow stripe on its inside. The calyx has a kind of involucre formed of two large membranous bracts, of a pale pink color. *M. longiflora* is a native of the Cape of Good Hope, and its flowers are very long and purple.

The Order *Pedalineæ*, or the Oil-seed Tribe, to which this genus belongs, takes its name from the genus *Pedalium*. All the plants of this Order agree in possessing seeds which contain an abundance of oil. The genus *Sesamum* produces a seed which is much used in the Levant, and also in Africa, as an article of food, and an oil is pressed from it which is used on salads, and for all the purposes of sweet oil. A species of this is the "Open Sesame," which every reader of the story of the Forty Thieves in the Arabian Nights, will remember.

GLAUCIUM—HORNED POPPY.

Natural Order, Papaveraceæ. Linnæan Class, Polyandria; Order, Monogynia. Generic Distinctions:—calyx, two-leaved; petals, four; pod, linear, two-celled; stamens, indefinite; stigma, bilamellate.

G. luteum.—Stem, smooth; cauline leaves, repand; pods, rough, warty.—*Plate* 16. *Fig.* 1.

The genus *Glaucium* takes its name from the glaucous, or bluish bloom which covers all the herbaceous parts of its species. They closely resemble the true poppies in many points, but may always be distinguished by their long, horn-like pods, and their stigma, which, instead of radiating into numerous divisions over the top of the ovary, forming so elegant a feature in the fructification of the common Poppy, is simply divided into two plates or lamellæ. We shall see how these pods, as well as the capsules of the Poppy, are formed, when we describe the Order *Papaveraceæ*.

The species in our plate is the one common on the sea side in England, and from the blue tint of its stem and leaves, "looks," says Dr. Lindley, "as if the salt of the sea spray had incrusted itself upon its skin." It becomes, in favorable situations, two or three feet in height, and the large, brilliant yellow

rgemone Mexicana, Mexican Prickly Poppy.

laucium Luteum, Yellow Horned Poppy. 1

flowers make it very showy and conspicuous. When the petals fall off, the pods grow out like horns, and sometimes become more than a foot in length, being composed of two valves, and having the seeds arranged along the inside, like peas in their shells. The leaves are rough and prickly, and the whole plant abounds in a yellow juice, which is fetid, poisonous, and said to produce madness.

This plant is often cultivated as a garden flower, and will grow in almost any soil, though it prefers sand, on account of the great length of its roots, which penetrate this more easily than any tougher soil. It will not bear transplanting, and therefore the seeds must be sown where the plants are intended to remain, and sparingly, since they should be at a considerable distance from each other to look well when in flower.

Another species, *G. phœniceum*, comes from the south of Europe. Its petals are bright scarlet, with a black spot at the base, and varieties with yellow flowers sometimes occur. There is also a North American species.

ARGEMONE—PRICKLY POPPY.

Natural Order, Papaveraceæ. Linnæan Class, Polyandria; Order, Monogynia. Generic Distinctions:—petals, four to six; style, almost wanting; stigmas, four or five, radiating, concave; capsule, obovate, prickly.

A. Mexicana.—Leaves, repand, sinuated, spiny, blotched with white; flowers, solitary; calyx, smooth; capsules, prickly, three or four valved.—*Plate* 16. *Fig.* 2.

The name *Argemone* is derived from *argema*, a cataract of the eye, which was once thought to be curable by the juice of this plant. Like *Glaucium*, this genus is readily recognised as a near relation of the opium-bearing poppies. The species differ from both those of *Glaucium* and *Papaver* (to which latter belong all the true poppies) in the disposition of their stigmas, which form a kind of cross at the top of the ovary, by which they may be at once ascertained. There are several species, all natives of Mexico, of which the one represented in the plate, is the most common. It is about two feet in height; the leaves are very deeply cut, covered with prickles, and of a bluish-green color, which is varied with white blotches along the principal veins. The capsule is oblong, and also studded with prickles. From this circumstance, and from the shape of the capsule, it was called by the Spaniards, at their invasion of Mexico, *Figo del inferno*, or Devil's fig. The whole plant abounds in a yellow juice, glutinous and milky, which when hardened in the air, is not distinguishable from gamboge, is used for the same purposes,—and is probably of equal efficacy, in cases of dropsy, jaundice, and cutaneous diseases. (The true gamboge probably comes from a species of *Garcinia*, which belongs to the order Guttiferæ.) It is also used in maladies of the eye, and is said to form a principal ingredient in certain eye ointments. The narcotic quality of the seeds is said to be much stronger than that of Opium, and an oil is pressed from them, which is used in Mexico by painters, and for polishing wood. When cultivated, the seeds are to be sown early in the spring, and the plants require little attention. They flower from August to October.

Another species of *Argemone*, is named *ochroleuca*. It is a large plant, and the flowers are cream colored. The handsomest species is *A. grandiflora*, whose flowers are a pure white, and frequently four inches in diameter.

COLLINSIA—THE COLLINSIA.

Natural Order, Scrophularineæ. Linnæan Class, Didynamia; Order, Angiospermia. Generic Distinctions:—corolla, gibbous above the base; limb, very irregular; capsule, two-valved; valves, two-parted.

***C. heterophilla.*—Lower leaves, trilobate; upper ones, ovate, acuminate; peduncle, shorter than the flower; calyx, covered with a glandular pubescence; segments of the corolla, rounded at the apex, crenate; middle tube of the lower lip, acute; border of the upper lip, nearly entire.—*Plate* 17.**

This is a genus of very beautiful plants, and was named by Nuttall in nonor of Mr. Collins, formerly of the Philadelphia Academy of Natural Sciences. The species are all North American plants, and the first discovered was *C. verna*, which Nuttall

Collinsia heterophylla.

(Variable-leaved Collinsia.)

found on the borders of Lake Erie, in Ohio, in 1810. He lost the specimens then gathered, and in the spring of 1816, he made a long journey in search of it at the place where he had first observed it. Not being able to find it here, and after looking for it in vain for a distance of a hundred miles, he at length found a withered specimen on the banks of the Ohio river, from which he saved the seed. Another *Collinsia*, at first supposed to be a different species, but now considered the same, was discovered, in 1826, near the Columbia river, and since that year, three others, which are well defined species, have been sent from California, and introduced into England, where they are much cultivated and highly valued. They are very hardy plants, can endure a low temperature much better than heat, and will live in almost any soil or situation, though from differences in these, some of the species will become so variable in appearance, as to be hardly recognisable. The seeds, to grow in perfection, should be sown in the autumn, and the plants removed in the spring to a bed of rich and strong soil, where the roots can be shaded and kept moist, when they will grow two feet high, with an erect stem, and produce a profusion of splendid, large, clear, and brilliant flowers. If the seeds are sown, as is generally the case, in the spring, the flowers will be small, and the stems weak. Care must also be taken not to expose the roots to the sun, since if this takes place, the plants will wither and die. The species here engraved is perhaps the most showy and elegant. Its leaves, of which the lower ones are divided into three lobes, are of a fine dark green, and the flowers are large, and beautifully colored with deep violet, shaded into light purple, and the veins of the petals are a delicate red.

IBERIS—CANDY TUFT.

Natural Order, Cruciferæ. Linnæan Class, Tetradynamia; Order, Siliculosa. Generic Distinctions:—two outer petals, largest; silicle, compressed, truncate, emarginate.

***I. umbellata.*—Herbaceous, smooth; leaves, lanceolate, acuminate; lower ones serrate, upper entire; pods, umbellate, acutely three-lobed.—*Plate* 18. *Fig.* 1.**

***I. coronaria.*—Pubescent; leaves, wedge-shaped, obtusely toothed; pods, corymbose, acutely two-lobed, margins crenated; seeds, winged; stem, branched.—*Plate* 18. *Fig.* 2.**

The ancient name of Spain was *Iberia*, from which is derived the name of this genus, some of the first known species of which, came from that country, and were called Spanish Tufts. Another species was brought from Candia, which gave the common name of Candy Tufts to the whole genus. They all possess the peculiar properties of the Cruciferæ, which we shall notice at length when that order is described in its proper place. The seeds of all the Candy Tufts are pungent, and have been used as mustard, and their leaves and young shoots may be eaten as pot herbs. *I. umbellata* is best known as a garden plant. It is about a foot in height, with spreading branches and large heads of purple flowers. It has long been a favorite in the gardens of Great Britain, as well as of this country—and is well known to every cultivator. Mrs. Loudon gives th following directions for its culture, which are probably as well suited to the meridian of New York as to that of London.

"It does best on a rich soil, if not too moist; and as it will not bear transplanting without serious injury, it should be sown where it is to remain. As it looks well in masses, it may be sown in square beds, mixed with mignonette, or a row may be sown at the back of a border, and smaller flowers planted or sown in front of it. It may be sown in autumn, or in March, April, or May. When it is wished to have the flowers very fine, the seed should be sown rather thinly in August or September; and when the plants produce their second pair of leaves, they should be thinned out. They should be kept rather dry during the winter, and protected from frost. In the spring, as soon as the plants begin to grow, they should be thinned again, and a third time when they begin to branch. After this, they should be watered with liquid manure, taking care not to let the liquid touch the plants, but to let it sink in the ground, so as to afford nourishment to the roots. When they are going into flower, the heads should be examined, and if they appear too numerous, the weakest should be removed. By this treatment, and keeping the ground free from weeds, and occasionally loosening it around the plants, flowers of the common Purple Candy Tuft have been grown three inches across, most beautifully colored, being of a very dark purple on the outside, softening to white in the centre. The great points are, thinning the plants gradually as they increase in size, and supplying their roots with abundance of rich food when they are going into flower." The seeds may also be sown in the spring, but the flowers of such never attain the same size as those sown in autumn. There are several varieties of this species, some having crimson, and others white flowers.

I. coronaria is the most splendid of the genus. It will grow, if properly treated, to a height of more than two feet, branching widely, and producing racemes of flowers from eight inches to a foot in length. The mode of cultivation is the same as that recommended for the other species. It would seem that little is known of the history of this plant. No work which has mentioned it, so far as we know, has given any information as to its native country, though it appears to have been cultivated for a considerable length of time in France. There are several other species, as the sweet scented, the pinnate, and the bitter Iberis, which are often raised by florists.

ANNUAL FLOWERS.

After the foregoing descriptions of several commonly cultivated annual plants, it may not be improper to introduce some remarks respecting the culture of such plants as an appro-

1. Iberis umbellata. Purple Candy
2. Iberis coronaria. Rocket Candy

priate and agreeable occupation for ladies. We quote from a work of great authority.

Of all kinds of flowers, the ornamental garden annuals are perhaps the most generally interesting; and the easiness of their culture renders it peculiarly suitable for a feminine pursuit. The pruning and training of trees, and the culture of culinary vegetables, require too much strength and manual labor; but a lady, with the assistance of a laborer to level and prepare the ground, may turn a barren waste into a flower garden with her own hands. Sowing the seeds of annuals, watering them, transplanting them when necessary, training the plants by tying them to little sticks as props, or by leading them over trellis-work, and cutting off the dead flowers, or gathering the seeds for the next year's crop, are all suitable for feminine occupations, and they have the additional advantage of inducing gentle exercise in the open air.

It is astonishing how much beauty may be displayed in a little garden only a few yards in extent, by a tasteful arrangement of annual flowers. All that is required is a knowledge of the colors, forms and habits of growth of the different kinds. Many of the flowers now grown in our gardens are not worth culture; but they are grown year after year, because their cultivators know them, and do not know anything better. Many beautiful flowers have been introduced, grown for a season or two, and then thrown out of cultivation from the want of a demand for them; and this want has arisen from very few flower-growers being aware of their existence.

The culture of annuals has two great advantages over the culture of all other flowers whatever. In the first place it is attended with less expense than any other description of flower culture; and in the second, all the enjoyment it is capable of affording is obtained within the compass of six or eight months. Bulbous or tuberous-rooted plants, like annuals, produce their blossoms in the first year; but they are attended with a greatly increased expense. Perennial herbaceous flowers never come to perfection until the second year, and, like bulbs, can be beneficially purchased only by those who expect to retain the occupation of their garden for several successive years. To a resident of New York, who generally 'moves' every May day, this latter circumstance is a stronger argument than to any one else, in favor of annual flowers. On the other hand, the seeds of annual flowers cost a mere trifle; the expense of stirring the soil, sowing them, and thinning them when they come up, is also very little; while the effect produced is as great, or greater, than that of most bulbs, and most perennials. The flower of a choice hyacinth, the bulb of which will cost a dollar or two before planting, is not much more beautiful than that of a double larkspur, which may be reared to perfection in three months, from a seed, a hundred or two of which may be had for sixpence. Annual flowers are therefore, above all others, suitable for the gardens of residences which are hired for not more than a year; while they are equally fit for decorating all other gardens whatever, and peculiarly so for those which are defective in soil, situation, or exposure to the sun. In one of the numbers of "*Paxton's Magazine of Botany*," the leading botanical periodical of England, the editor, who is the chief manager of the gardens of the Duke of Devonshire, observes, "Considered as the principal ornaments of the flower garden throughout the most delightful period of the year, and during a considerable portion of it as the most interesting features in the green house, annual plants have great claims to our attention, and should be very extensively cultivated in every pleasure-garden. But the vast number and variety of sorts that are now known in our collections, the whole of which it is impossible to introduce into even the most extensive gardens, renders necessary a judicious selection of the best kinds, in order to compensate for any deficiency in number or variety by the superior beauty of those which are admitted." It is a common error, then, to suppose that all that is necessary to make a showy flower garden is to sow the ground with a great many kinds of flower seeds. A few of the most brilliant and ornamental kinds, so arranged as to harmonize in their colors and habits of growth, cultivated with care, and trained and pruned into regular and compact shapes, will produce more effect than three or four times the number sown injudiciously, and afterwards neglected. On looking into most flower gardens, it will be found that the annuals are crowded together, each tuft having been left unthinned; and that the plants having neither been trained nor pruned, present, as they grow up, the most tawdry appearance, without either the grace and elegance of wild nature, or the trimness and neatness of art. A flower garden is essentially artificial; not only from the avowed art displayed in its general shape, and in the artistical forms of its beds, but from the collocation of the flowers of so many different countries and climates. Everything in the flower garden, in short, shows that it was planted by the hand of man, and the flowers themselves, to be in keeping with the garden, should also show the effects of human care in their training.

THE NATURAL SYSTEM OF BOTANY.

NUMBER FOUR.

RECAPITULATION.

First Class, or Grand Division.—VASCULARES, OR FLOWERING PLANTS.

Plants having distinct flowers furnished with stamens and pistils.

This division includes all plants of the Linnæan System, except the class Cryptogamia; and is therefore by far the most important part of the vegetable kingdom.

They are called *Phænogamous* plants, because they bear visible stamens and pistils; and *Cotyledonous* plants, because their seeds consist of cotyledons. Both these terms distinguish them from the cryptogamia, in which no such parts exist.

The plants of this division are characterized by internal spiral vessels, and woody fibre; but more obviously, by their flowers containing stamens and pistils, and the veiny appearance of their leaves.

Sub-Class I.—Exogenæ, or Dicotyledonous Plants.

Leaves reticulated; stem with wood, pith, bark, and medullary rays; cotyledons, two or more, placed opposite to each other.

This sub-class contains all such plants as have seeds composed of two or more cotyledons. The species of this latter kind are, however, very few in number, nearly all Exogenæ, having seeds with only two cotyledons.

Tribe I.—Angiospermæ.—Seeds enclosed in a pericarp.

This tribe includes all such plants as have two cotyledons, and seeds enclosed in a pod or shell, or in a coat which proceeds from the germen. Examples: Pea, Chestnut, Larkspur.

This tribe is divided into *Polypetalous, Apetalous, Achlamydeous,* and *Monopetalous* plants.

A. Polypetalæ.—(*Many-petaled.*)—These have a calyx and corolla composed of more than one petal. Ex.: Rose, Buttercup.

B. Apetalæ.—(*Without petals.*)—These have a calyx, but no corolla. Ex.: Mignonette, Spurge.

C. Achlamydeæ.—These have neither calyx nor corolla. Ex.: Birch, Willow.

D. Monopetalæ.—The corolla of these consists of a single petal. Ex.: Trumpet Flower, Morning Glory.

The three last of these divisions are sub-divided no farther, but the first is separated into Thalamifloræ, in which the stamens are hypogynous, or adhere to the sides of the ovarium; and Calycifloræ, in which the stamens are perigynous. Each of these latter is again divided into *Apocarpæ,* in which the carpels are distinct, and *Syncarpæ,* in which they cohere in a solid pericarp.

Tribe II.—Gymnospermæ.—Seeds destitute of a pericarp.

The plants of this tribe have neither stigma nor style, the influence of the pollen being communicated directly to the seed through a foramen or orifice. They must not be confounded with the Gymnospermæ of Linnæus, which all belong to the natural tribe Angiospermæ. The only two divisions of Gymnospermæ are *Coniferæ* and *Cycadeæ.*

CONIFERÆ.—The Fir Tribe. Ex.: Pine, Juniper.

CYCADEÆ.—Ex.: Cycas, the Sago-plant.

Sub-Class II.—ENDOGENÆ, OR MONOCOTYLEDONOUS PLANTS

Leaves, with parallel veins; stem, with no distinction of wood, bark, and pith; flowers, chiefly with a ternary division; cotyledon, one, and if two, placed alternate.

The plants of this sub-class hold an intermediate rank between the Exogenæ, or Dicotyledonous plants, in which vegetation acquires its highest degree of developement, and Cellulares, or Cryptogamia, whose vegetation is of the lowest degree. In Exogenæ there are two cotyledons, in Endogenæ there is one cotyledon, and in Cellulares none. The scale of vegetable developement appears to be graduated in exact conformity to these circumstances, exhibiting a striking proof of the harmony that exists between the great features of vegetation and the seed from which they originate. The fact, already mentioned, that the kind of seed is indicated by the appearance of the leaf, is a still more obvious and forcible illustration of the same harmony. It may be remarked as another distinctive character of the Endogenæ, that their leaves generally have no articulation with the stems.

Endogenæ are divided into two tribes.

Tribe I.—PETALOIDEÆ.

The plants of this tribe are characterized by having a calyx or corolla, and sometimes both, in three, or six divisions, or if these parts are wanting, then the stamens and pistils are naked. This tribe comprehends all Endogenæ except the Grasses and Sedges, and is further divided into three sections.

1. TRIPETALOIDEÆ.—The calyx of these is herbaceous—that is, of a different structure, and usually of a different color, from the corolla, and the latter is petaloid. Ex.: Spiderwort, Water-plantain.

2. HEXAPETALOIDEÆ.—In these, the calyx and corolla are the same in color, and nearly equal in size, both being fully

developed and petaloid, or petal-like. Ex.: Amaryllis, Hyacinth, Lily, Orchis.

3. Spadiceæ.—These possess no calyx or corolla, but in their place herbaceous scales, equal in size and uniform in color. Ex.: Arum, or Indian Turnip, Ictodes, or Skunk's Cabbage.

Tribe II.—Glumaceæ.

Flowers destitute of a true calyx or corolla, but enveloped in scales or chaffy bracts. This tribe comprehends the Grasses, properly so called, and the Sedges, with which in many respects they are nearly allied. Ex.: Wheat, Oats.

Class II.—Cellulares, or Flowerless Plants.

Plants having neither stamens, pistils, flowers, nor spiral vessels.

This, the second of the grand divisions, as has been before mentioned, includes all those plants which are destitute of any perceptible organs of fructification, and is separated into the three following sections :—

1. Filicoideæ.—These have a distinct stem or axis, and a vascular system. Ex: Ferns, Club-moss, Equisetum, or Horse-tail.

2. Muscoideæ.—These have a distinct axis, but not a vascular system. Ex.: Moss, Liverwort.

3. Aphyllæ.—These have neither a distinct axis, nor a vascular system. Ex.: Mushroom, Sea-weed.

The above comprise all the primary divisions of plants, according to the system of Lindley, a general view of which is given on the following page. Of these, the sections into which Angiospermæ, and Petaloideæ are divided, are called Artificial Divisions.

NATURAL DIVISIONS. ARTIFICIAL DIVISIONS.

- *CLASS I.* — VASCULARES, OR *Flowering Plants.*
  - *Sub-Class I.*—EXOGENÆ, or *Dicotyledonous Plants.*
    - 1. Angiospermæ.
      - POLYPETALÆ.
        - *Thalamifloræ.*
          - Apocarpæ.
          - Syncarpæ.
        - *Calycifloræ.*
          - Apocarpæ.
          - Syncarpæ.
      - APETALÆ.
      - ACHLAMYDEÆ.
      - MONOPETALÆ.
    - 2. Gymnospermæ.
  - *Sub-Class II.*—ENDOGENÆ, or *Monocotyledonous Plants.*
    - 1. Petaloideæ.
      - TRIPETALOIDEÆ.
      - HEXAPETALOIDEÆ.
      - SPADICEÆ.
    - 2. Glumaceæ.
- *CLASS II.* — CELLULARES, OR *Flowerless Plants.*
  - 1. Filicoideæ.
  - 2. Muscoideæ.
  - 3. Aphyllæ.

Sub-Class I.—Exogenæ.—*Tribe I.*—Angiospermæ.

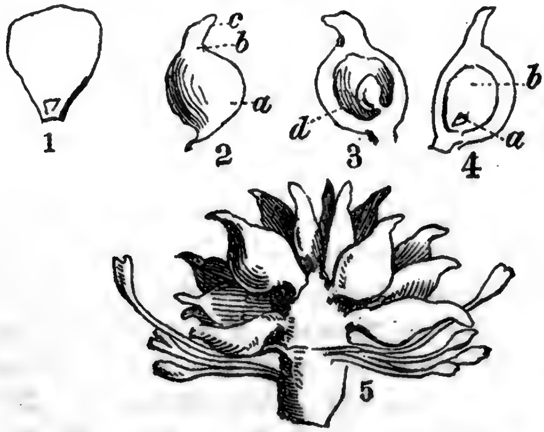
Order, Ranunculaceæ. The Crowfoot Tribe.

In our descriptions of those of the natural orders which we intend to mention, we shall follow the method and arrangement usually pursued in the best works on the subject, and shall particularly refer to that admirable book, "The Ladies' Botany," of Professor Lindley. In the selection of plants to illustrate the essential characters of each order, we intend, however, to be governed by the principle that those are to be preferred which are most familiar to the American reader, and accordingly, when practicable, such will be chosen.

The species belonging to the Crowfoot tribe, and especially to the genus Ranunculus, are so abundant in the United States, that the one used as the illustration of the order at present to be considered, can be readily obtained by every one. The most common species is perhaps *Ranunculus acris*, known by the familiar name of Butter-cup. Let the reader take an individual of this species, while in blossom, and examine with us the parts of the flower. The petals are five, of a brilliant yellow, and underneath them are the sepals of the calyx, also five in number, like small, hairy leaves. Upon separating one of the petals, near its base, on the inside, will be seen a little scale from which exudes honey. Within the corolla are the stamens, which are, with the sepals and petals, separately inserted into the receptacle. In the centre of the flower, are a number of little green grains, collected together, and seated on an elevation of the receptacle. When examined by a magnifying glass, they are found to be rounded at the bottom, and contracted into a short, curved horn at the top. Each of these grains is a single *carpel*, the horn-like top is the style, and the tip of this, which is somewhat broader, and more shining, is the stigma. Each carpel contains a single ovule, or young seed. When young, the ovule occupies but a small part of the cavity of the carpel, but afterwards fills it entirely. After the calyx, corolla, and stamens have fallen off, the cluster of carpels remains, and ripens into the fruit. Their form is not changed, but they increase in size, and become dry, hard, and brown. In this state they are ordinarily called seeds, but in reality, as we have seen, they are only the seed vessels, each containing a single seed. If one of these be cut through with a sharp knife, the inside will present only a mass of white flesh, which is the *albumen;* unless the division has been made exactly through the centre, from top to bottom, when a very minute oval body will be seen near the base. This can be taken out by the point of a needle, and when submitted to the microscope, proves to be the *embryo*, or the part which grows when the seed germinates, and is composed of the *plumule*, or rudiment of the stem, the *radicle*, or part which forms a root, and the *cotyledons*, which are the beginnings of leaves.

Some of these parts are represented in Fig. 2; 1, a petal, with the scale on the inside; 2, a carpel, its ovary being marked *a;* style, *b;* and stigma, *c;* 3, section of a carpel; *d*, the ovule within it; 4, section of the ripe carpel filled with the seed; *a*, the embryo, *b*, the albumen; 5, the carpels and some of the stamens adhering to the receptacle.

Fig. 2.



On turning attention to the other parts of the plant, the leaves are found to be dark green, and very much divided into lobes. It will also be observed that their form is more simple at the upper part of the stem, than near the root, the lobes in the former being more narrow, and not themselves divided—while in the latter they are more expanded, and their edges more deeply cleft. Beneath the flower, near the bottom of its stalk, are two small leafy bodies, called *bracts*. These are intermediate between the true leaves and the leafy parts of the flower, being sometimes lobed like the leaves, and sometimes simple, like the sepals. The netted, branching arrangement of the veins of the leaves, at once indicates that the Ranunculus is an Exogen, and that its embryo, as we have already discovered, has two cotyledons.

The characters thus indicated, are those by which the Order Ranunculaceæ is distinguished from all others. The greater part of these characters are, to be sure, presented by many different plants, and on the other hand are not *all* presented by every member of this order. Some Ranunculaceæ have three or six sepals in their calyx, instead of five, and the petals of others are sometimes more than five, and sometimes wanting altogether. The number of stamens is indefinite; that of the styles is also variable, since the styles of all the carpels may unite into a single one, or may remain, as in the Ranunculus, entirely distinct. What then are the *essential* characters which distinguish *all* the plants of this order from all others? These essential characters are simply, 1st, a great many stamens which arise from *beneath* the carpels, such stamens being *hypogynous*, as in Fig. 1. *a*; and 2d, several carpels which are not joined together, but are separate and distinct. It is thus obvious, that in order to ascertain whether a plant belongs to the Crowfoot tribe, it is not necessary to pay attention to all its different parts, but a decision is at once made by ascertaining the presence or absence of these two very easily determined characters. The structure of the other parts of the flower may not be conformable to that of the Ranunculus; and it is by minor variations that the genera of the order are limited. A mistake may sometimes be made, on account of the general resemblance of some of the flowers of this order, to those of Rosaceæ, the Rose Tribe. It will be readily observed, however, that the stamens of the latter do not arise at once from the receptacle, but adhere to the calyx, or are *perigynous*.

All the plants which agree in the characters essential to Ranunculaceæ, also agree in their properties; their juice being watery, acrid, and nauseous; that of several species raising a blister on the skin, and being poisonous if taken into the stomach. Some of them have a narcotic principle, on account of which they are occasionally used as medicine. They further agree in being either herbaceous, or shrubby plants—never becoming trees.

Of this order there are about twenty genera, and one hundred and seven species, belonging to North America. Of the genus Ranunculus alone there are reckoned thirty-eight species. Several of these are well known, and are common in every meadow and by the side of every brook. *R. multifidus*, a floating species, is curious from the delicate capillary form in which its leaves are divided. Several foreign species are much cultivated in gardens, on account of their tendency to become double. Among these, the varieties of *R. asiaticus*, are endless. A single cultivator in England, once exhibited eight hundred different ones.

To this order belong the *Anemonies*, some species of which are among the earliest spring flowers of this country. Other species are well known florist's flowers, and are cultivated everywhere. In these the petals and sepals are colored alike, so that the corolla cannot be distinguished from the calyx. When the flower has dropped off, there are seen in its place little tufts of feathery tails, or oval woolly heads, instead of the clusters of grains found in the Ranunculus. These tails are the styles, which, having grown large and hairy, serve the purpose of wings, by which the seeds are disseminated. Here also belong the *Hepaticas;* one of which, the only native species, *H. triloba*, is known to the youngest student of botany, when he sees its delicate blue corolla peeping up from its woolly leaves, on the side of a sunny bank, almost before the snow is melted away. They differ from the Anemonies by having either six or nine sepals and petals.

Clematis, a genus of climbing plants, is found here, one of which, *C. Virginica*, is familiar to country people under the name of Virgin's Bower, and in July fills every thicket with the fragrance of its white blossoms. These are almost the only plants of the order which have woody stems.

A subdivision of this order contains the *Aconitum*, or Hellebore, the *Trollius* or Globe Flower, the *Coptis*, or Goldenthread, and also the Larkspur and Columbine. It would seem as if the flowers of these two latter, bore little resemblance to that of the Ranunculus; but by examining the stamens and the carpels, they will present the same essential characters.

The *Pæonies*, so generally cultivated in gardens for their showy flowers, also belong to this Order. They differ from the Ranunculus in having a persistent calyx, and a smaller number of carpels, but the essential characters are the same. Nearly all the Ranunculaceæ belong to the Linnæan Class Polyandria.

It would far exceed our limits to give anything like a complete description of the plants of this order, but for the convenience of the student, we add here a list of the North American genera, with the number of their species. This list may be considered as nearly accurate, having been prepared by Dr. Torrey.

RANUNCULACEÆ.

Clematis - -	14	Enemion - - -	1
Thalictrum -	5	Aquilegia - -	3
Anemone - -	14	Delphinium	7
Hepatica - - -	1	Aconitum - -	3
Hydrastis - -	1	Actæa - - -	1
Adonis - - -	1	Cimicifuga -	4
Myosurus - -	1	Macrotys - - -	1
Ranunculus - -	38	Xanthorhiza - -	1
Caltha - - -	8	Pæonia - - -	1
Trollius - - -	1		
Coptis - - -	2	is	107

VEGETABLE PHYSIOLOGY.

NUMBER FOUR.

In the preceding articles we have described what are called the Elementary Organs of plants, or those whose nature is disclosed by the aid of the microscope, and we now come to those various combinations of these, which are called Compound Organs, or simply, Organs, and which have been already mentioned as being divisible into Organs of Nutrition, and Organs of Reproduction. These do not all exist in every plant, nor do they in any case show themselves all at once, but are developed successively, and sometimes are transformed into each other. To obtain a general idea of them, it will be proper to follow the progress of growth in some common plant, from the period when the seed begins to germinate, to that at which it produces its own seed.

In every seed is contained within the envelopes, a small organized body, called the *Embryo*. When germination has commenced, this body swells, bursts its covering, and shoots out into two parts, one of which penetrates into the ground, and the other rises into the air. The descending part is called the *radicle*, and ultimately becomes the root. The ascending part is the *plumule*, or *caulicle*, and is the rudiment of the stem, leaves and flowers. From the point of junction of the plumule and radicle, proceed laterally one or more appendages, which are the *cotyledons*, and are the first leaves of the plant.

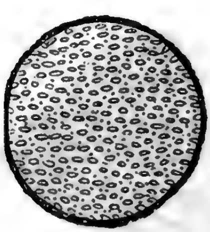
When the root has attained its full growth, it usually becomes a fleshy body, variously branched, and furnished with *fibrils*, or *rootlets*, having *spongioles* at their extremities, by which nourishment is drawn from the soil. The plumule shoots up into a stem, which subdivides into branches and twigs. The *Leaves* are flattened, expanded organs, generally of a green color, which absorb nutritious fluids from the atmosphere, and exhale others.

After them appear the *Flowers*, which decay and fall off, except the part containing the seeds, which continues to grow, and forms the *Fruit*. Thus the essential organs of plants may be reduced to five, of which the Root, the Stem, and the Leaves, being subservient to the growth and preservation of the plant, are named Organs of Nutrition; while the Flowers and Fruit, whose office it is to continue the species, are the Organs of Reproduction.

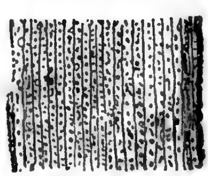
Before examining these in succession, it is necessary to enter into a short explanation of some circumstances, to which allusion has already been made, both in our articles on the present subject, and in those on Natural Botany. We have seen that all vegetables are first divided into Flowering plants, or Vasculares, and Flowerless plants, or Cellulares, and that Vasculares are further divided into the great classes, Exogenæ and Endogenæ. We propose, before going farther, to give such explanations, and such engravings in illustration of the differences of structure on which these divisions are founded, as to fix them more firmly in the mind of the student.

The cellular structure is the most obvious physiological character of the Acotyledonous, or flowerless plants, of which it forms the entire substance. By this they are distinguished from the Cotyledonous, or Vascular plants, which possess not only cellular tissue, but spiral vessels and woody fibre. This distinction may pass without farther remark at present. Exogenæ and Endogenæ, or Dicotyledons and Monocotyledons, are distinguished from each other by obvious physical properties, both in the structure of their internal organs, and of their leaves and seed. The peculiar characters of Endogenæ are shown in

Figure 9.



a



b

a represents the transverse section of a stem of sugar cane, showing no medullary rays, nor concentric layers, but appearing to be composed of little else except cells and membranes in a confused mass, with strings or fibres interspersed. A longitudinal section of the same stem is represented in *b*, in which the membranes between the cells are more distinctly shown. In fig. 10, *a*, is represented the germination of a monocotyledonous seed, and *b* shows the leaf of a plant of this class, with its characteristic parallel veins.

Figure 10.

a *b*

Fig. 11.

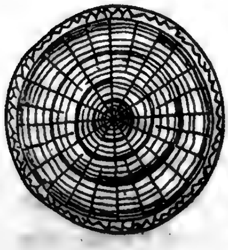


Figure 11, represents a transverse section of the stem of an Exogen or Dicotyledonous plant. In this, the distinctions of wood, pith and bark, the concentric rings, and the medullary rays are apparent. The seed of an Exogen is represented in a state of germination, in fig. 12, *a*, and an exogenous leaf, with its reticulated structure, in *b*.

Figure 12.

a *b*

Such are the very plain distinctions between the two great classes of Flowering plants, and it will at once be evident that a leaf, or even a fragment of a leaf, or a piece of a stem, is sufficient to indicate with certainty whether the plant to which it belonged had one cotyledon or two, whether it had pith, wood and bark, or none of these, and whether it increased by internal or external additions.

We are now ready to proceed to the examination of the five essential organs of plants, the parts of which they are composed, and their uses in vegetable economy. The structure and functions of the Root are of primary importance. The Root may be defined as that part which terminates the plant below, and penetrates into the soil. It generally consists of two parts, the *caudex*, or body, and the *radicles*, or fibres. These latter are terminated by soft, succulent extremities, called *spongioles*, which, as we shall see, perform an important office. Upon the roots the plant is dependant for the supply of moisture required for its growth. That they actually absorb a great amount of fluid matter, may readily be proved by placing those of almost any plant in a tumbler of water. It has been found that four plants of spearmint, weighing altogether four hundred and three grains, have taken up in fifty-six days fifty-four thousand grains, or almost seven pints, of water. The greater part of this is exhaled from the leaves, by a process hereafter to be mentioned, and only a small proportion is retained as food for the plant. This great supply of fluid appears to be necessary in order to afford the plant a sufficiency of the solid matter which it also requires, and which is contained in the liquid in very minute proportions. In some plants, as the sea-weeds, this power of absorption is not confined to the root, but belongs to the whole surface. Upon examining the root of a Rose, it will be found to branch and spread beneath the ground, in much the same way as the branches above. From the sides and extremities of the principal divisions proceed delicate fibres, each terminated with its spongiole. That the fibres are the parts by which alone absorption takes place, can be readily proved. If a radish be taken from the ground, while growing, and the root be so bent that it can be covered with water, and the leaves, and the fibres at the point of the root, be kept dry, the plant will soon wither. But if only the points of the fibres be allowed to touch the water, they will absorb moisture sufficient to make the plant flourish. The knowledge that the fibres are the true and only organs of absorption, has a very important practical application. It often happens in transplanting trees, or other plants whose roots are much branched and extend deeply into the ground, that sufficient care is not taken to preserve the delicate fibres and spongioles uninjured, and the consequence is that the plant languishes or dies. This may be obviated by carefully digging around the roots so as to include the whole, and then removing the earth from among them in so gentle a manner as not to break off or bruise their fibres. The growth of roots always takes place in that direction where they can find moisture, and on this account, some writers have attributed to them a species of instinct. The fact can, however, be explained on the principle that the soft points of the fibres will naturally extend themselves most where there is least resistance; and moist earth is always softer than dry. The same principle will account for the occurrence, which sometimes takes place, when the roots of a tree insinuate themselves between the stones of a wall, or ruined building. In this case, meeting with an obstacle to their growth, in the stones, they turn into the crevices, and the fibrils grow by their own absorption and the nourishment sent to them, until they become so distended as to force the stones apart, and even throw down the wall. Roots are ordinarily distinguished from stems, not only by their direction, and by the presence of the absorbing fibres, but also by the absence of buds. This last circumstance is more characteristic of the root than any other, since the part of the axis above ground is not always a stem, nor that under the ground always a root. The two parts may sometimes indeed be transformed into each other. The branch of almost any tree, upon being stuck into the ground, will produce root-fibres, and form a new plant, while there are some instances in which a tree or shrub may be inverted, and made to grow with the roots in the air. A very beautiful example of the structure of the fibre and spongiole, may be observed in the little Duckweed, (*Lemna minor*,) which is found floating like a green scale, in every piece of stagnant water. From the centre of each leaf hangs down a single fibre into the water, with a little cup at its extremity: under a microscope, the structure of these is very beautifully developed.

The force with which the roots absorb fluid, and the quantity of sap thereby formed, are remarkable. Experiments have been made, by which this force may be measured, and it is found to be very great. If the stem of a vine be cut off, in the spring, when the sap is ascending, and a piece of bladder be tied firmly over the section of the part which remains, it will soon burst from the force with which it is distended. The attention of several distinguished observers has been directed to the explanation of the means by which the absorbing action of the roots and the force which accompanies it, are produced, and such investigations have resulted in the adoption of the theory of *Endosmose* and *Exosmose*. M. Dutrochet was the first to promulgate this theory, and his experiments seem to have established its truth. It has been before stated, that although vegetable membrane has no visible pores, yet liquid will pass through it. The same is found to be the case with animal membrane. If, then, a thick syrup, or a mucilage, be enclosed in a funnel-shaped glass vessel, over the mouth of which a piece of bladder is tied, and then immersed in water, a portion of the sugar or gum will pass through the bladder into the water, and a portion of the water will pass upwards into the vessel. It is the same with milk or any other liquid. If, on the other hand, the vessel were filled with water, and immersed in syrup, the result would be reversed. The general law, deduced from such experiments, according to M. Dutrochet, is, that when two fluids of unequal density are separated by a membrane, the denser fluid will attract the less dense. The principal current, or that from without inwards, he calls Endosmose, (flowing in,) and the one from within outwards, Exosmose (flowing out). Now all the conditions of this action are found in roots. The fluid already absorbed by them is rendered denser than the water around, by the mixture of the descending sap; and the partitioning membrane is supplied by the spongiole. Thus, as long as the fluid within is more dense than that without, absorption will continue. The Exosmose is shown to take place, by growing a plant with its roots in water, when the fluid is soon found to be impregnated with the peculiar substance formed by the plant, and contained in the descending sap. Thus a Poppy would saturate the water with a flavor of opium, and a Spurge would give it an acrid taste. The theory of Endosmose has given rise to considerable discussion among botanists, and some have used strong arguments in opposition to its truth. Our limits forbid more than a bare statement of the principle on which it depends.

Roots appear to have a certain power of selecting the proper matter for their nourishment, and will absorb some substances in the fluid around, and reject others. If a stalk of Wheat, and a Pea, grow in the same soil, the former will absorb all the *silex*, or flinty matter which the water can dissolve, and this is deposited in the stem. On melting a wheat straw with the blowpipe, there will remain silex enough to form a glass bead, and in some other grasses, as the Bamboo, it is often collected in the joints, in large masses, and in the Rattan, it is so abundant as to turn the edge of the best tempered knife. The Pea, on the other hand, will reject this, and confine its selection to *calcareous* substances, or those formed of lime. As to the nature of the fluid absorbed by roots, their food, and the manner in which they are nourished, we shall speak hereafter.

FOSSIL BOTANY.

NUMBER THREE.

Fossil remains of plants are found in various conditions; sometimes little changed in their appearance. Sometimes their substance is completely saturated with mineral matter, and yet both the external and internal structure completely preserved. There are fossil trees which so nearly resemble decayed wood, that the utmost scrutiny cannot detect the difference, until the weight and hardness are ascertained. In some cases, the most delicate tissue of the original is to be seen, and is most distinctly and beautifully displayed. The husks and shells of some fruits, the cones of the pine and fir, the parts of fructification of the ferns, the resinous secretions of pine, and even the pollen of some coniferous plants, have been found in good preservation. But vegetables occur not in such conditions only, but in beds of great extent, consisting wholly of plants transformed by the process which vegetable matter undergoes, when under great pressure, and excluded from the air, into masses of lignite and coal. " There are stages in this process, when the form and structure of the plants can be distinguished, and a gradual transition may be traced from the peat and submerged forests of modern periods, in which leaves, fruits, and trunks of recent species are found, to those accumulations of the ancient Flora, whose vegetable origin the eye of science can alone detect."

As fragments of the stem, or branch, or a single leaf, may be the only vestiges of a fossil plant, some knowledge of the internal structure which characterizes the principal divisions of the vegetable kingdom, is obviously necessary. Here we see one of the advantages of the Natural method. Were there no other way of arranging plants, except that depending on the construction of their flowers, the classification of fossil plants would be impossible. By referring to our articles on the Natural System, and on Vegetable Physiology, and to the engravings in the article on the latter subject in the present number, the following remarks on the mode of investigation of fossil plants will be readily understood.

Messrs. Lindley and Hutton, the distinguished authors of the British Fossil Flora, remark, that a few isolated, and often very imperfect data, exclusively afforded by the remains of the organs of vegetation, are the sole guide to the class, order, or genus of the fossil plants which are to be examined, and hence only a general idea can be obtained of the nature of the original. Their suggestions for the guidance of the student, in his investigations, form the basis of the following directions for the investigation of vegetable remains. If the wood in a transverse section of the stem be disposed in concentric circles, (see Veg. Phys., Fig. 11,) it belonged to an Exogen. If, on the contrary, the wood appears irregularly deposited in spots, (Fig. 9, *a*.) then the plant was an Endogen. If a transverse section show remains of sinuous, unconnected, layers, like arcs with their ends directed outward, imbedded in a looser tissue, then it belonged to an aborescent fern. Hereafter will be described the method of preparing slices of fossil wood for investigation by the microscope. If by means of such investigation, it is ascertained that the structure is entirely cellular, it belonged to the cryptogamia; if it consist of parallel tubes, and has neither pith nor rays passing from the centre to the circumference, it was endogenous; if any trace be present of tissue crossing the longitudinal tubes at right angles, this will prove the existence of medullary rays, and it must have been exogenous; and if the walls of the tubes are studded with glands, (Fig. 5, *c.*) it belonged to the coniferæ. If any vestige of a central pith be discovered, the exogenous nature of the original is undoubted. If the fossil has a distinct bark, it is exogenous, if it has merely a rind not separable from the inside, it is monocotyledonous, if neither bark nor rind, cryptogamous. The scars or cicatrices left on the stems by the separation of the leaf-stalks, afford important evidence, as they are often present, even when the trunk is flattened into a thin layer. By these scars the position of the leaves may be ascertained, and the form of the bases; their probable direction, whether they were opposite, alternate, verticillate, or spirally arranged, deciduous or persistent, imbricated or remote.

The texture and surface of the leaves are sometimes preserved in a fossil state, but generally only the outline of the leaf, its division and arrangement, and mode of venation, can be ascertained. The venation or form and distribution of the fibrous parts or veins of the leaf, is a most important character for our guidance, and the following suggestions on this point are offered by Dr. Lindley. If the veins be all parallel, not branched, or only connected by little transverse bars, and the leaves undivided, (see Fig. 10, *b*,) as in the lily and hyacinth, the plant was probably endogenous; but if the leaf be divided or pinnated, it may be referrible to the cycadeæ. Leaves having veins of equal, or nearly equal thickness, and forked, or very fine, and simply divided, belong to the fern tribe, the fossil genera of which have been constructed principally from the venation. If the veins be of unequal thickness, and reticulated, (see Fig. 12, *b*,) or arranged in a net-like form, the original was exogenous. Large leaves, having no veins, and irregularly divided, are to be referred to the fuci, or other marine plants. The application of these rules for the investigation of fossil plants, is quite easy, and by this means may be obtained some general indications of the nature of the original plant.

SEA WEEDS.

The last and lowest of all plants are the Sea-weeds and their allies. These productions, which inhabit water exclusively, and appear at one end of the scale of their developement in the form of enormous Fuci, many fathoms in length, but at the other as merely simple bladders sticking together in rows, form the link between the Animal and Vegetable worlds. Like Lichens and Fungi, they have reproductive organs of the most simple construction; in those species which have the most complex organization, the spores are stored up in peculiar receptacles, as in the larger and more perfect sea-weeds; but in others they are distributed vaguely through the whole substance of the plant, and start into life when liberated from their nests by the destruction of the individual that generated them. In the *Lavers*, whether of fresh or salt water, they lie clustered in threes or fours, in the substance of a green membrane; in the true Confervæ they are nothing but granular matter, locked up in little transparent tubes. It is of a vegetation of this latter kind that consist the green slimy patches which are seen floating in water, or adhering to stones and rocks from which water has receded.

What is most remarkable in these singular productions is their approach to the nature of animals; an approach which is not only indicated by the apparently spontaneous motions of some, but in a much more unequivocal manner by other kinds. No one has investigated this subject with more unwearied assiduity than Mons. Gaillon, from whose "Observations sur les limites qui separent le regne Vegetable du regne Animal," are translated the following amusing and surprising details.

On the rocks that are found at low water mark on the coasts of Normandy and Picardy, there grows a production called by botanists *Conferva comoides;* it consists of fine brownish-yellow threads, collected in the form of a hair-pencil, half an inch or an inch in length, and at low water spreads over the surface of the little round calcareous stones, to which it gives something of the appearance of the head of a new-born child. These threads are loosely branched, and are finer than the most delicate hair; the plant owes its apparent solidity to the clustering and entanglement of many such threads. Viewed under a microscope that magnifies 300 diameters, the threads seem to be rounded, slightly compressed, and about as large as a fine pack-thread. They are of a mucous nature, and contain immersed within their substance a number of small yellowish bodies, which look at first like dots, afterwards become oval, and end in something of the shape of a radish, leaving the ends transparent, and the centre marked by a patch of yellowish matter. If they are at that time separated from the mucous matter in which they are packed like herrings in a barrel, you may see them moving, expanding, contracting, advancing gravely and slowly, retreating in like manner, altering their direction, and finally possessing a spontaneous, incessant, measured, voluntary motion. These little creatures, which at most are not more than the thousandth of an inch long, when once they are separated from the thread that contains them, fall down in countless multitudes, in the form of a chocolate brown deposit on the neighboring rocks. Once there, they distend and emit a globule of colored particles, which are evidently their fry. Each particle gains motion and volume, and the little globular mass, lengthening and branching, reproduces, by the developement of the germs, that are collected together, the long green pencilled appearance, which has led botanists to consider this as a plant.

In another production, *green ditch-Laver*, (Ulva Bullata, or minima, or Tetraspora lubrica,) still more astonishing circumstances have been observed by M. Gaillon and others. This plant appears to the naked eye, a thin green membrane, within which the microscope reveals a number of green granules, arranged in forms. Let this membrane be kept in quiet water, and at a high atmospheric temperature, and the granules may be seen, under a powerful microscope, to present at their surface certain convexities and depressions, which are the effect of the repeated contraction and distension of these granules. If they are carefully watched for several days, the granules will be seen to be reciprocally displaced; after a certain time they separate from the membrane, and may then be perceived to have a rapid and regular movement, as if in chase of each other; cool with a drop of water, that in which the granules are floating, and their motions will become slower, they will attach themselves by some part of their circumference, and will acquire a swinging motion from right to left, and from left to right. In this sort of imperfect reeling and twirling, one sees the granules approach in pairs, just touch each other, retreat, approach again, and glide away to the right or left, staggering as it were, and trying to preserve their balance; at last, instead of pairs, fours combine to execute the movements of the dance. Imagine the field of the microscope covered, shortly after, with a hundred of these animated globules, whose diameter is not, in reality, more than the 4000th of an inch, chasing each other, retreating and intermingling, as if executing the mazes of a fantastic reel, and you have one of the most curious spectacles that the microscope can exhibit.

Such are, in part, the wonders revealed by the microscope in these ambiguous productions; many others of equal interest might be named, but what has been said will suffice to show how marvellous a store of curious facts remains to be collected by those whose time and disposition are favorable to such inquiries.—*Ladies' Botany.*

AN UNLUCKY BOTANIST.

Charles de l'Ecluse, better known under the name of Clusius, was one of the most excellent and learned botanists who ever lived, and the author of many works whose value will ever be appreciated. His mental ability was not more remarkable than his personal misfortunes. He was born at Artois in Flanders, in the year 1526. While yet a very young man he commenced a course of travel through Portugal, Spain, Hungary, England and other countries, in pursuit of plants, in those days no small undertaking. Through the excessive fatigue which he underwent in these journeys, he contracted, so early as in his twenty-fourth year, a dropsical complaint, of which he was afterwards cured. At the age of thirty-nine, on one of his botanical excursions, he had the mishap to break his right arm, and within a short time afterwards this calamity was followed by a second, which was no less than breaking his right thigh. When about fifty years old, he became director of the imperial Gardens at Vienna, and while there, in his fifty-fifth year, he dislocated his left ankle, and about eight years afterwards, his right hip. On account of the unskilful treatment of these injuries, he was ever afterwards obliged to use crutches. The consequent deprivation of his usual and natural exercise, brought on other diseases, among not the least distressing of which, were calculus and hernia. After remaining at Vienna for fourteen years, he finally returned to his native country, and was appointed professor of Botany at Leyden, where he gave botanical lectures for sixteen years, when he died in 1609, at the age of 73, overwhelmed by the multitude of his bodily infirmities, but retaining his powers of mind unimpaired to the last. In his honor was named the genus *Clusia*, the species of which are curious and beautiful trees, belonging to the southern parts of the American continent.

CINERARIA—THE CINERARIA.

Natural Order, Compositæ. Linnæan Class and Order, Syngenesia, Superflua. Generic Distinctions:—Receptacle, naked; pappus, simple. Involucre, simple, many leaved, equal.

C. lanata. Peduncles, one-headed; leaves, cordate, roundish, with seven angles, woolly beneath.—*Plate* 19.

This genus of well known ornamental flowers, is said to take its name from the Latin, *cineres*, ashes, in reference to the soft white down which clothes the lower, and often the upper surface of the leaves. The species are distributed over many parts of the world, but principally come from southern countries. Many of them are in great favor among those who admire and cultivate flowers, as well on account of their beauty, as the ease with which they are cultivated, and their capability of enduring the confined air of sitting rooms. By crossing one species with another, florists have succeeded in producing many splendid and graceful varieties. They bloom at all seasons, from January to December, according to the circumstances in which they are placed. All the species are herbaceous, or half shrubby plants, with perennial roots; the leaves are alternate, the flowers grow in a corymb, or panicle, and are often yellow, sometimes purple, white or blue, in the cultivated kinds. Although they are familiar to every one who has paid the least attention to floriculture, the following directions for the cultivation of the Cineraria may not be superfluous. The modes of cultivation are either by the seed, in which way many beautiful varieties are obtained, by cuttings, or by division of the roots. If the seeds are sown in the spring, the proper way is to fill shallow pans with a light sandy soil, and scatter the seed regularly over the surface, then cover them with a similar soil, supply them with a gentle heat and frequent waterings, until the young plants appear. As soon as they have put forth two or three pair of leaves, they should be transplanted singly into pots filled with peat-earth mixed with a small portion of garden mould, or almost any light soil will answer. If they can be kept in a green house the seed may

Cineraria lanata (Wooly Cineraria)

be sown as late as September, and when in pots the plants may be kept in-doors during the winter.

If it is desired to increase the number of the plants rapidly, cuttings may be used. Each of these should be placed close to the side of a pot, so as to touch it throughout its length; the pot should then be filled up with bits of broken pots, cinders and stones, to within two inches of the top, and over this should be placed a layer of moss, and the pot then filled with white sand, or light peat earth. The pot should then be placed in a shady and moist border, with a bell glass over it, and the cuttings must be watered each day. The root of the Cineraria, being perennial, all the stems die each year, when they have performed their functions, and are succeeded in the following season by new shoots from the main root.

This property of putting forth new shoots, or suckers, from the old root, is a very common property among herbaceous and shrubby plants, and advantage has been taken of it to increase the number of plants by dividing each root into as many pieces as there are incipient stems, provided each portion of the root so separated have also a sufficient number of fibres as purveyors of nutriment from the soil to insure vigorous vitality in the scion. For making this division of the roots of the Cineraria, August is considered the proper month. The professional florist commonly anticipates nature by removing the flower stems and old leaves as soon as the bloom has gone; by which means he causes the root to expend all its vigor in the production of new stems, and increases the strength of those which have not yet flowered; and for the purpose of promoting this tendency to the utmost, he places his plants, when so cut down, in a cold pit, where he allows them to remain for some weeks, keeping them for a while somewhat close, and when they begin to grow, a little air is admitted during the day, and excluded at night. If this has been done in proper time, when August arrives the roots will be in proper condition for being divided. The pieces of root are then to be planted in pots in a light soil, composed of peat, a little loam, and some exhausted dung, from a melon or cucumber bed. When this is done, the pots should be placed in a close frame until they have recommenced growing,

Tropæolum majus. (Great Nasturtium.)

and as they increase in size the plants may be transferred to larger pots, and supplied with water drained from a manure heap. This operation of division of the roots is applied to many other plants besides the Cineraria, and the foregoing directions may serve as general ones.

A bed of these plants, properly arranged, is very ornamental in the flower garden. A situation sheltered from the sun in the hot part of the day suits them best. The soil must be loose, and sufficient water afforded. As soon as the flowers have fallen, the care of the amateur must be exerted to promote the growth of the plant, so as to strengthen it for enduring the coolness of autumn and winter. Those plants which have bloomed in pots must then be turned out and planted in a situation where they will be protected from too much heat. The greater part of the ball of earth around the roots must be removed, the flower stems cut off within two inches of the base, and then set at about a foot apart. The crown of the root should also be sunk a little below the surface, by which means the shoots which are intended for separation will have acquired a sufficient supply of roots for their maintenance when the season arrives for their removal. When planted in the open air, they require frequent watering in dry weather, and the bed must be kept free from weeds.

TROPÆOLUM—INDIAN CRESS.

Natural Order, Tropæolaceæ. Linnæan Class and Order, Octandria, Monogynia. Generic Distinctions:—Calyx, of five united sepals, the lowest spurred. Petals, five, unequal. Stamens, eight. Ovary of three united carpels. Stigmas, three. Nuts, coriaceous, furrowed, three-celled, one-seeded.

T. majus. **Leaves, peltate, repand; petals, obtuse, some of them fringed. *Plate* 20.**

The name of this well known genus is derived from the latin, *tropæum*, a trophy. The leaf is shaped like a shield, and the flowers resemble an empty and blood-stained helmet, which defensive armor formed a part of those trophies which were anciently constructed in honor of a victory. The genus comprises several species which are familiar both as ornamental and culinary plants. Under the name of Nasturtion, or Indian Cress, the present species is cultivated very generally, for the sake, not only of its showy and curious flowers, its graceful and perfectly shaped leaves, but of its fruit, which, when pickled in salt or vinegar, forms an excellent pickle, used as a substitute for capers, to which it is decidedly superior. The flowers possess the same pleasantly pungent flavor with the fruit, and may be used as a salad. The cultivation of the Nasturtion is attended with no great difficulty. Trained over a frame work, it grows luxuriantly, and produces its showy flowers all summer. The only care necessary is not to tie the stems to the frame too tightly, since their softness and succulence renders them liable to be easily bruised. A curious fact was first observed, in regard to the flowers of this plant, by the daughter of Linnæus. During the evening they emit spontaneously, at certain intervals, sparks, like those from an electrical machine. This phenomenon may be witnessed on a warm cloudy summer evening to the best advantage.

There are about a dozen other species, all of which are natives of Peru. They agree with the Nasturtion in their properties, and are used for the same purposes. One species possesses a tuberous root, which is eaten in Peru, and another is in common use as an anti-scorbutic medicine.

CAMPANULA—BELL FLOWER.

Natural Order, Campanulaceæ. Linnæan Class and Order, Pentandria, Monogynia. Generic Distinctions:—Corolla, campanulate, funnel-shaped, or broadly tubular; stigma, three to five cleft; capsule, inferior, opening by lateral pores.

C. divergens. **Plant, pilose; stem, panicled; radical leaves, sub-spatulate, crenulate; cauline leaves, sessile, lanceolate, acuminate; peduncles, many flowered, diverging; lobes of calyx, acuminate.—*Plate* 21.**

Campanula signifies a little bell, and is a remarkably appriate name for the plants which in its generic application it includes. The species are very numerous, amounting to nearly one hundred, and are very widely diffused over the cold and temperate countries of the earth, very few of them being found in tropical regions. Their beauty, and the ease with which they are cultivated, has made some of the species familiar to every one. The subject of the plate resembles very greatly the common species, called Canterbury Bell. It is a handsome plant, bearing flowers of a very fine purple, which are erect when budding, but drooping when fully blown. It is a native of Hungary, and Siberia; from which two countries, it may be remarked, come several other elegant and much cultivated species.

Its cultivation is by no means difficult in this country. The seeds must be sown as early as the frost will permit, in the place where the plants are to grow; or if the cultivator has a green house, they should be sown in the winter, and planted out in April or May. The young plants should be well supplied with water, and they will grow luxuriantly, producing sometimes fifty flowers from a single root.

One of the most delicate of all the Campanulas is a native of the Northern and Eastern States. This is *C. rotundifolia*, known to many as the Harebell, or Bluebell. Its slender stem, delicate linear leaves, flowers of a lovely blue, the grace and sweetness of its whole aspect, make it one of our most interesting plants. It grows on rocks, on the sides of hills and mountains, frequently on the very verge of the deepest precipice, down which its blue eyes seem to gaze without terror, secure in its own beauty. To one who should gather it while in flower, the specific appellation, *rotundifolia*, would seem a sad misnomer, its only rounded leaves being the radical ones, which fall off before the blossoms appear. Another handsome species, commonly cultivated, is *C. Americana*, a native of some of the Middle and Western States. It is a tall, erect, ornamental plant, with blue flowers.

Of the foreign species, the best known are, perhaps, the pretty *C. speculum*, or Venus' Looking-glass, the polish of whose corollas, and their form, which is like that of a little, round, concave mirror, have given it a name so appropriate; *C. lilifolia*, with pale blue flowers; *C. glomerata*, with clustered, violet-colored flowers, and *C, persicifolia*, with large blue flowers. This last species,

Campanula divergens. (Spreading Bell Flower.)

with one or two others, have been much cultivated in France and Italy, and somewhat in Great Britain, for the sake of their roots, which are boiled till they are tender, and then eaten, either hot, with sauce, or cold, with vinegar and pepper. It is not known that the Campanulas possess any peculiar properties, medicinal or otherwise; their value arises almost entirely from their beauty.

NICOTIANA—TOBACCO.

Natural Order, Solanaceæ. Linnæan Class and Order, Pentandria, Monogynia. Generic Distinctions:—Corolla, funnel-shaped, or salver-shaped; limb equal; stamens rather unequal, inclosed or exserted; capsule opening by four parts at the apex.

N. tabacum. Leaves, sessile, oblong lanceolate, acuminate; lower ones decurrent; throat of the corolla inflately ventricose; segments of the limb acuminate.—*Plate* 22, *Fig.* 1.

N. multivalvis. Clothed with viscid hairs or down; leaves, fleshy, ovate lanceolate, lower ones petiolate; flowers, axillary, solitary; calyx, many parted; capsules, many celled.—*Plate* 22, *Fig.* 2.

This genus received its name from John Nicot, of Nismes, in Languedoc, who seems first to have made it known in Europe. The first tobacco plant raised in Europe is said to have been presented to the celebrated Catherine de Medicis, from which circumstance it was called *Herbe à la Reine*, a name which is still preserved by the French. The species commonly grown for the production of tobacco, the use of which has become more extensive than that of any other narcotic, are two, *N. rustica* and *N. tabacum*. The latter is the one more commonly called Virginian tobacco, and is cultivated over a great portion of the southern regions of this country. It is supposed to have been known in Europe as early as 1560, but was first introduced into England by Ralph Lane, in 1586. He brought some of it prepared for smoking, either from the island of Tobago, in the West Indies, or from the province of Tobasco, in Mexico, whence was derived its common name.

Nicotiana tabacum. (Virginia Tobacco.) 1.
Nicotiana multivalvis. (Many-valved Tobacco) 2

Sir Walter Raleigh was probably the first smoker in England. He acquired the practice in Virginia, and introduced it upwards of two centuries ago, and in commemoration of this rather questionable service to mankind, he took as the crest of his coat of arms, which is still to be seen in his house at Islington, a tobacco plant. A well known but somewhat apocryphal story relates that his servant, bringing in a tankard of ale to him in his study, and seeing, for the first time in his life, the mouth of his master emitting a cloud of smoke, in his anxiety to quench what he no doubt thought to be a case of spontaneous combustion, dashed the contents of the tankard over Sir Walter's head, to the great detriment of his beard and ruff.

Tobacco, as used by man, says Du Tour, gives pleasure to the savage and the philosopher, to the inhabitant of the burning desert, and of the frozen zone. Its use, either in powder, to chew, or to smoke, is universal; and for no other reason than a sort of convulsive motion (sneezing,) produced by the first, and a degree of intoxication by the last two modes of usage. A hundred volumes, adds he, have been written against it. Among these every one has heard of the "*Counterblaste*," of King James. The Grand Duke of Moscow forbade its introduction into his territories, under pain of the knout for the first offence, and of death for the second. The emperor of the Turks, the King of Persia, Pope Urban VIII, all issued similar prohibitions, but the object of their wrath steadily increased in popularity, till, at present, there is scarcely a government on the earth which does not derive a great portion of its revenue from tobacco. It is cultivated in Europe as far north as Sweden, and in Asia both the Chinese and Japanese raise it in great quantities.

The species mostly in use is *N. tabacum*, a flower of which is figured in our plate. Its appearance is so familiar to the American reader as to make a description unnecessary. In England its cultivation is prohibited in order to increase commerce with this country, and consequently it is principally raised for curiosity, as a border flower.

In most of the Southern States tobacco is a staple production, and vast quantities are yearly exported. To some north ern readers, the following description of the method of culture may prove new. The plants are raised on beds, early in the spring, and when they have acquired four leaves, are planted in the fields, in well prepared earth, at about three feet distance from each other. Twice a day they are examined in order to destroy a worm which often attacks them. As soon as they have eight or nine leaves, and are ready to put forth a stalk, the top is nipped off, in order to make the leaves longer and thicker, by directing all the energies of the plant to them. After this the buds, which spring from the axils of the leaves, are all picked off, and great care is taken to keep the leaves free from the caterpillar. When they are fit for cutting, which is known by the brittleness of the leaves, they are cut with a knife close to the ground, and after lying some time, are carried to the drying shed, where the plants are hung up by pairs on lines. When perfectly dry, the leaves are stripped from the stalks, and made into small bundles. These are laid in heaps, and covered with blankets. Care is taken not to over heat them, for which reason the heaps are spread out and laid open to the air from time to time, until no more heat is generated, when the whole is packed in casks for exportation.

In the manufacture of tobacco, the leaves are first made very clean, then moistened with water in which salt and some other ingredients are dissolved; the midrib of the leaf is removed, the leaves mixed together, cut to pieces with a fixed knife, crisped before a fire, then twisted into rolls. The tobacconist then cuts it into shreds by a machine like a straw cutter, for smoking and chewing, or twists it into rolls, or presses it into a mass for the latter purpose; and dries and grinds it for making snuff.

Some of the species, besides *N. tabacum*, are used in those places where they grow. The best Havana segars are made of *N. repanda;* and the Indians of the Rocky Mountains, and on the banks of the Columbia River, prefer for their tobacco the species *N. quadrivalvis*, figured in our plate. This is a strong, robust species, with leaves of peculiarly rank and powerful odor, sometimes almost fœtid. The flowers are very large and showy, the calyx is ribbed and inflated, and when ripe divides into several valves. It is often cultivated in England as a garden flower, and is grown in the open border early in the spring, when it blossoms in August and September.

THE NATURAL SYSTEM OF BOTANY.

NUMBER FIVE.

Order—MAGNOLIACEÆ. *The Magnolia Tribe.*

This order comprises only a few genera, but contains some of the noblest of vegetable productions. Several species of the genus *Magnolia* are familiar to the American reader. Of these perhaps the most magnificent is *M. grandiflora,* which is found in most of the Southern States, and less commonly, as far north as Pennsylvania. This splendid tree grows to the height of from sixty to eighty feet, its leaves are very large and of a brilliant green, and its flowers are white, fragrant, and nearly a foot in diameter. *M. glauca* is a native of New England, and is the species best known in the North, where it is usually called White Bay. Although inferior in height, and in the size and brilliancy of its flowers, to its gigantic brother of the South, it is yet one of the most striking objects in the forests of Massachusetts and Connecticut. Its leaves are of a regular, elliptical form, and have a bluish bloom on their lower sides. Its bark and berries, which latter are red, are in some esteem for the cure of coughs and some other diseases. Another American species is *M. acuminata,* also a large and handsome tree, which produces cones of fruit, having some resemblance to a small cucumber, whence its common name, Cucumber Tree. "It is in the East, however," says Lindley, "that the Magnolia tribe has its fragrance most elaborated. In the dwarf Talauma of the Chinese, (*Magnolia Pumila,*) with its yellow and brown flowers, and the *Tsjampaca,* the most beautiful of trees, beneath whose majestic foliage the native Indian constructs his cottage of Bamboo stakes and palm leaves, the essence of the Magnolia perfume is developed in all its power. These trees are indeed the living altars from which a perpetual cloud of incense is ascending unto heaven, day by day, as if in gratitude for the profusion with which the gifts of Nature are so prodigally poured forth from the lap of earth in those favored regions."

It would hardly be supposed that there should be any relation between these stately princes of the vegetable kingdom, and the insignificant Ranunculus, and yet an examination and comparison of their flowers shows a near alliance. The calyx of the Magnolia consists of three sepals, and the corolla of six petals; within these are placed many stiff stamens, arranged in several rows upon a conical receptacle; each anther has two cells so situated that the pollen falls outward towards the petals. The carpels are numerous, each containing a single cell, and terminated by a narrow, thread-like stigma. These cells grow together into a solid pistil, and ripen into a cone-shaped fruit. This structure of the flowers and fruit differs very little from that of the Ranunculus, but there is a difference by which the Magnolias may with certainty be distinguished. Many plants possess, at the base of each leaf-stalk, a pair of small leafy bodies, called *stipules*, which are to the leaves very much what bracts are to the flowers. Now the stipules of the Magnolia are large, and perform an important function. Each of the branches is terminated by a horn-like projection springing from the base of the last leaf. This horn is a pair of stipules rolled together for the protection of the next leaf which is to be unfolded; and that next leaf has a similar pair of stipules that roll up over the still younger leaf lying in its bosom, so that if the horn be cut through, several generations of leaves will be found thus enfolded within each other. This is the characteristic peculiarity of the Magnolia tribe, by which it may at once be distinguished from the Crowfoots and other allies. It is not only a curious, but important and interesting mark of distinction. The bud is very tender, and requires protection from the air, from cold, and from accidents. This protection is afforded by many different contrivances of nature, and in this instance by the stipules. The seeds of the Magnolias are attached to the inner suture of the carpels, from which they are suspended by long cords; in which peculiarity, as well as in the consolidation of the carpels, they also differ from Ranunculaceæ.

Besides the Magnolias, there is another fine tree belonging to the same order, which inhabits the United States. This is the *Liriodendron tulipifera*, or Tulip Tree, one of the most remarkable in American forests. It is found in the Atlantic States, from Massachusetts to the Carolinas, and is particularly abundant in the Western States. It grows to the height of eighty, and sometimes even one hundred feet. The trunk is straight, and the branches disposed with great regularity. Its flowers are large, marked with spots of green, yellow and purple, and when abundant, present a most brilliant display. The leaves are very singular, being truncated, so that they appear as if cut off at the end, and having very much the shape of the body of a violin. The whole appearance of this tree is indeed so peculiar as to render a description of it unnecessary to any person of observation, who has ever lived in the regions which it inhabits. The Tulip Tree has been introduced into Europe, and is now common, both in France and Italy; and in England it forms a conspicuous ornament to the pleasure grounds of many of the gentry.

The Magnolia tribe all possess a tonic and stimulating principle, and their bark has been used with success for medical purposes; that of the Tulip Tree having been considered equal to the Peruvian bark.

Very closely connected with this tribe, in which, indeed, it was formerly included, is the small order, *Wintereæ*, which contains the genus *Illicium*, the seeds of one species of which, *I. anisatum*, produce a very fragrant oil, are burned by the Chinese in, their temples. and under the name of *aniseed* are employed by Europeans to flavor liqueurs. A very pleasant cordial, which owes its taste and aroma to these, is well knowr as Anisette de Bordeaux. Two or three other species are found in the southern parts of North America.

Berberidaceæ. *The Barberry Tribe.*

This is an humble, but still very interesting tribe. Every body is well acquainted with the common Barberry, *Berberis vulgaris*, of the Northern States, and not a few New England farmers have a strong prejudice against it, and take every opportunity to root it up, on account of their belief that it injures the corn near which, along the fences, it so generally grows. Notwithstanding its bad character, it is by no means an ill-looking shrub, either in spring, with its pendulous racemes of yellow flowers, or in the autumn, with its branches of brilliant red berries. The leaves have a very pleasant acid taste, and the berries make an agreeable jelly when preserved in sugar, and are also made into pickles. The branches are covered with very sharp spines, sometimes divided into several parts. The manner in which these are formed is curious, and will serve to illustrate the theory, now generally adopted, which considers all the parts of plants as different developments of the leaf, and which will be stated fully in the course of our articles on physiology.

These parts, (we quote from Prof. Lindley,) are not prickles like those of the Rose, for they are regularly arranged over the stem, and will not break off by a slight pressure sideways; nor spines like those of the Hawthorn, for in the Hawthorn the spines originate in the bosom of the leaves, but in the Barberry the leaves originate in the bosom of the spines. These parts are an exceedingly curious state of the leaf. They are the first kind of leaf that the Barberry produces when it shoots forth from the bud; but immediately after, or perhaps at the same moment with, their production, other perfectly formed leaves break out from their axils, and thus at nearly the same instant, the branches are covered with spines for their defence, and with leaves for their adornment. That these spines really are leaves you may easily ascertain by looking for a very vigorous shoot of the Barberry, when you will find some of them with the space between the stiff spiny lobes filled up by a web of parenchyma, (the fleshy portion of the leaf between the veins) others with the web hardly visible, and others with the spines only remaining. The leaves are themselves bordered by spiny teeth, which are the points of their veins, and there is a little joint near their base by which they are articulated with their stalk.

From the midst of a cluster of leaves appear the yellow flowers, in a drooping raceme something like that of a currant. Each flower consists of three little external scales tipped with red; they are the outermost sepals; then of three petal-like parts, the inner sepals; and within these of six genuine petals. The great similarity between the parts thus differently designated shows that the distinction between a calyx and corolla is in many instances very arbitrary, although in other instances it may be plain enough. At the base of each of the true petals are two parallel yellow oblong glands, the nature and use of which are unknown. Between these glands, and opposite to the petals are the stamens, six in number, consisting of a filament somewhat thickened at its upper end and an anther, whose lobes, growing to each side of the end of the filament, have a singular mode of opening. At first the lobes resemble those of any common anther, but when the time comes for the fertilization of the stigma, instead of splitting along the middle, the anther opens at the edge all round, except near the point, and liberates its valve or face, which curves back and allows the pollen to drop out. This is a very curious phenomenon, and is technically called *bursting by recurved valves.* The ovary is oblong, the stigma flat, round and sessile, and in its centre is an opening which leads to the single cell of the ovary.

The two essential characters of the Barberry tribe are stamens as many, or twice as many as the petals, and opposite to them, and anthers opening by recurved valves.

This tribe contains, besides the Barberry itself, several interesting plants, among which in the United States, is the May Apple or Wild Mandrake, *Podophyllum peltatum*, which is a native of various parts of the Northern and Eastern States, and is curious for its peltate leaves, and its reticulated petals. It is a low, neat looking plant, with a drooping white flower often overshadowed by the broad leaves, and the fruit, from which its common name of May apple has been given it, is about the size of a plumb, has a pleasant acid taste, and is often eaten, and its root is an excellent cathartic. Another singular little plant is the *Jeffersonia diphylla*. It was named from President Jefferson, and is remarkable for the curious structure of its seed vessel, which opens with a lid like a snuff box. In Ohio it is in some repute as a medicine, and is termed Rheumatism Root. The *Leontice*, or Pappoose Root, is another plant of this tribe, very commonly known in New England. It is proper to remark that the two first of these genera were separated from the Barberry tribe, and formed into another order, whose type was Podophyllum, but on no good ground, as it would seem, since they have been replaced by the best American authorities in Berberideæ.

We must not forget to notice a curious instance of irritability which occurs in the flower of the Barberry. The stamens are in a recumbent position when the flowers first open, lying back close pressed upon the petals. But, if you touch one of their filaments with a pin, the stamen rises gently up, and strikes its anthers against the stigma, just as, says Lindley, the figures in old fashioned clocks strike their hammers upon the bells when chimes are sounded. No one, continues our authority, knows the cause of this curious habit; it is one of those certain but inscrutable facts, the explanation of which is probably beyond the faculties of man. There is one thing, however, connected with it that deserves to be noticed, although it does not throw light upon the nature of the phenomenon. If you dose the Barberry with laudanum or any opiate, the stamens are stupified and lose their elasticity; and if you poison the plant by some corrosive substance, such as arsenic, which produces inflammation in animals, a sort of vegetable inflammation is produced in the stamens of the Barberry. We are not, however, on that account to conclude that this plant approaches animals in its nature, but merely that the principle of life which pervades all nature is the same in its essence, and is affected by similar causes, whether it exists in an animal or a vegetable.

There are two small orders, nearly allied to the Magnolia Tribe, the members of which belong to tropical countries, One of these, ANONACEÆ, or the Custard Apple tribe, is distinguished by the structure of its seed, the inmost coat of which forms several folds or plaits. The fruit of some of the species is well known by the name of Custard apple, and is eaten very commonly in the West Indies. Its taste is a pleasant sub-acid.

Another order, intermediate between the last mentioned and the Barberry tribe, is MENISPERMACEÆ, the Moon Seed, or Cocculus tribe. They are twining, shrubby plants, chiefly distinguished by the deficiency of parts in their flowers, the same flower never having both stamens and pistils, and some of them are diœcious. The number of carpels varies, as does also the degree of their adhesion, so that it is difficult to characterize the order. The genera, however, correspond in their medicinal characters. Their roots are bitter and aromatic. That called Colombo Root is much used as a tonic, in dyspepsia, diarrhœa, and dysentery. Their seeds, on the other hand, are mostly narcotic, in various degrees. The drug called Cocculus Indicus, is the seed of an East Indian species, and has been much employed by brewers in England, and perhaps in this country, to heighten the intoxicating properties of their malt liquor, and to such an extent was this practice carried, that an act of parliament has made it illegal for a brewer even to have the article in his possession. Mixed in the form of a powder, with crumbs of bread, and thrown into the water, the fish who swallow it become intoxicated, rise to the surface, play strange antics, like all other drunken beings, and are easily taken. This method of capture is sometimes resorted to among us, by boys, or poachers, but never by gentlemen or anglers. Of this tribe one species, *Menispermum Canadense*, is a native of the Northern States: it climbs among the hedges, bears small yellow axillary flowers in July, and is known by the name of Moon Seed.

There are two other small orders which may be mentioned here. The order CABOMBACEÆ, or Water Target tribe, contains only two genera. They are curious aquatic plants, and one species, *Brasenia, or Hydropeltis purpurea*, grows in the fresh water ponds of New England, in company with the Water Lily. The leaves are perfectly elliptical, and float on the surface of the water : the petioles are inserted exactly in the centre, and are very long and slender. The flowers are purple, on similar stalks, and the whole under surface of the leaves, together with the stem, is covered with a white slime. The order NELUMBIACEÆ comprises only one genus, a species of which, *Nelumbium luteum*, or Water Chinquapin, is a fine plant, growing in the lakes of the South and West, but sometimes met with in some parts of New England. The nuts are roasted and eaten, or are ground into a kind of flour.

VEGETABLE PHYSIOLOGY.

NUMBER FIVE.

FORM AND STUCTURE OF THE STEM.—The stem may be defined as that part of a plant, which, proceeding from the root, either extends under ground, or ascends into the air, and supports the leaves and flowers, and its chief office appears to be to elevate these into the most favorable position for receiving the influence of heat, light, and air, on which their due action depends. All flowering plants are furnished with stems, though in some instances the stem does not rise above the ground, or is so short as to appear wanting. In annual plants the stem is generally herbaceous, consisting mostly of soft cellular tissue, but containing some woody fibre and spiral vessels, which are traceable in the stalks of the leaves, and in the *strings* of such vegetables as the Asparagus. In longer lived plants, however, the stem becomes more and more solid, by the formation, each year, of new bundles of this fibre, which, in time, nearly displaces the soft tissue.

We have already seen that the stems of flowering plants are not all formed in the same way, but that there are two different modes in which the woody matter is arranged: that one set of plants increases by the deposition of this matter in the interior of their stems, and another by its deposition on the exterior ; that the former are called Endogens, and the latter Exogens ; and that the Exogenous stem consists of pith, wood, and bark. The pith is a soft, spongy substance, occupying the centre. Under a magnifier, it is found to consist entirely of cellular tissue, containing, when young, a good deal of fluid, but when old becoming dry, and often nearly disappearing. This is the first formed portion of the stem, and is the remainder of the cellular structure which originally formed the whole, but which has gradually given place to the woody texture, which is deposited on its outside, and has gradually compressed it into the centre. The pith of a branch is always an extension of that of the parent branch, and if the latter be cut through, just where a bud is rising from it, the bud will be seen to consist mostly of a prolongation of the central pith.

Around the pith are disposed the woody layers, at first in the form of strings, arranged in a circle between it and the bark, and separated from each other by prolongations of pith, which is thus connected with the bark. When the stem grows older, a second circle of woody layers is formed, beneath the bark, and enclosing the first layer, and as it increases in age, circle after circle succeeds in the same manner, till the pithy processes between becoming narrower in each ring, appear at length merely as lines diverging from the centre, and are then called medullary rays. Their office is to maintain a constant connexion between the interior portion of the stem and the bark. These rays form what is called *silver grain*, so conspicuous in several kinds of wood, such as Maple and White Oak, and which add so much to their beauty when polished. In general, in temperate climates, a single ring or layer of woody matter is added each year, so that the age of a tree may be reckoned by counting these in a cross section; but in tropical climates, where many trees have several successions of leaves yearly, there is reason to believe that a corresponding number of layers is formed. This may account for the great number of layers in the Baobab trees of Senegal, which have been supposed, reckoning their age in this way, to be more than five thousand years old. In most timber trees, the inner and older portion, called the *duramen*, or heart-wood, is much more hard and dry than the exterior *alburnum*, or sap-wood; and sometimes, in the hardest and heaviest woods, as lignum-vitæ and black walnut, the line of separation between them is very plainly marked. But in most cases this change is more gradual. It is produced by the consolidation of the interior portion, whose tissue becomes so pressed together, and its cells so filled up by different secretions, as to prevent the passage of any fluid through it. It then becomes of no use to the system, except to give it strength and durability, since it is through the new layers, or sap-wood, that the passage of the sap is effected. As the pith and the inner layers thus gradually become unfit for their original use, and as in the outer portion alone the processes of vegetation go on, the former may be removed without injuring the latter; and this operation is often produced by natural decay, which destroys the heart of an old tree, leaving the outside only a shell, though still capable of producing buds and branches.

A variety in the structure of exogenous stems, is that before mentioned as belonging to the Pines and Firs. Their annual layers are generally marked with great regularity and distinctness, especially in those which are natives of cold or temperate climates, where the process of vegetation is quite interrupted by cold after the formation of each layer, while in warmer regions they pass into one another more gradually. In the latter case, too, the thickness of the layers is nearly uniform, while in the former, it differs according as the seasons have been favorable or otherwise. In examining fossil plants, these facts are important and interesting, as will be seen.

In a circle around the pith, and between it and the first layer of wood, is arranged a series of spiral vessels, which seldom occur in any other part of an exogenous stem. This forms the *medullary sheath.*

The outermost coat, enclosing the wood, is the *bark.* This is also formed in regular layers, from the interior, which are so much thinner than those of the wood as not to be so easily distinguished. The oldest layers of course are on the outside, and become gradually lost, by decay, or by falling off, so that it is in general impossible to trace the same number as in the wood, although they are formed at the same time. As each new layer of wood is formed on the outside of the previous one, and therefore at the circle where it is in contact with the bark, and as the new layer of bark is added to the *inside* of the previous one, it is obvious that they are both produced at the same spot, and that the newest layers of both will always be in contact with each other. They seem to be produced in this way. In the spring, the bark becomes loosened, and may often be readily separated from the wood. A kind of mucilaginous fluid, called the *Cambium*, is then formed between them. This is gradually developed into cells, and from these are formed the ducts and cellular portion of the woody layer, and the layer of bark is at the same time added, both being intersected by the medullary rays. Bark sometimes is nearly all composed of cellular tissue, and becomes thick and spongy, as is the case with cork, which may be regarded as a kind of external pith. The inner bark, or *liber*, however, is usually thin and delicate in texture, and has been applied to various useful purposes. One of these is indicated by the meaning of the word liber, which signifies both a book and the inner bark. In fact it was used by the Romans for writing upon. By many of the Pacific Islanders, the liber of several trees is used for cloth, mats and sails. It is in the vessels and woody tubes of the alburnum that the fluid absorbed by the roots is carried through the stem, and these vessels communicate with those of the leaves, which receive it from them. In the liber, on the contrary, the fluid, after being elaborated by the leaves, and converted into nutritious sap, descends again through the trunk, for the purpose of nourishing its various parts. A part of this sap is carried inwards by the medullary rays, which thus diffuse it through the whole stem, as also through the substance of the roots, down which it is conveyed by their bark. In this descent it mixes with the ascending current, particularly at its lower part, and being much superior in density, adds to that of the ascending fluid, and thus maintains the conditions necessary for endosmose. The vessels of the bark down which the sap runs, form a complete network, in which it may be seen to move in various directions.

The endogenous stem is formed very differently. The woody bundles are distributed irregularly through the mass, and instead of being united into rings, remain separate, and only form any thing like hard wood, on the exterior, where they are pressed together by the addition of new matter within. Each annual set of woody bundles, proceeding from the leaves, passes down through the soft interior of the stem, and afterwards turns outwards, and interlaces itself with those previously formed. The cellular portion of the stem, which in exogens was separated by the wood into the pith and bark, here remains intermingled with the wood during the whole life of the plant. Each woody bundle contains ducts and spiral vessels, besides woody fibre, arranged so that the spiral vessels are on the side next the centre, and protected by the woody fibre on the exterior. From this peculiar structure endogenous stems increase little in diameter, the hardness of the outside preventing their enlargement. On this account too, their age is generally limited, since the exterior vessels become so compressed as to admit no further passage of fluid. A remedy for this is sometimes provided by Nature, in the splitting of the hard envelope which allows the interior to dilate; and this has been imitated by splitting the outside of a Palm with a hatchet, when its vigor was restored. The same cause which limits the age of endogens prevents them from being injured like exogens, by ligatures around their stems. If a cord be tied tightly around the trunk of a young cherry tree, it will prevent the sap from descending to the roots, and a protuberance will be formed above the cord, which will increase by the superfluity of nourishment afforded it, so as to bury the ligature beneath it. The same effect is produced by the embrace of several kinds of climbing plants, though as they generally wind in a spiral direction, the descent of the sap is not so completely prevented, but the woody matter accumulates above the whole line of the spiral, so that when the creeper is removed, a deep indentation is seen passing round the branch or stem from one end to the other. This never takes place in endogens.

The twining stems alluded to appear to have a peculiar tendency to turn to one side, which constantly operates in connexion with the general tendency of all stems to grow upright. The direction of this turning tendency is usually contrary to that in which the sun appears to move, but sometimes the same with it. The common direction may be observed in the case of most plants of the Pea tribe, the Convolvulus, and the Passion Flower, and the exception in that of the Hop. There is, however, in almost all flowering plants, some tendency to a spiral growth, and we shall find when treating of leaves, that their regular arrangement on the branches is in a spiral line. In many trees the bark, when stripped off, will follow a spiral direction, and spiral fissures are seen in many kinds of wood, after the bark is removed.

The stems already described have been solid, but both Exogens and Endogens often have hollow stems; as among the former, such as those of the Angelica and Hemlock, and among the latter, those of the grasses. In these cases the hollowness is due to the expansion of the outer portion faster than the interior. The young stem is not hollow, and it is a beautiful instance of mechanical contrivance, that in such rapidly growing plants, which are to become independent of support from others, the limited quantity of hard tissue which they form should be disposed at such a distance from the centre as to give the greatest strength with the least expenditure of material. In hollow stemmed Endogens, as the Bamboo, and Sugar Cane, certain divisions of the stem are seen, which are called *nodes*, or knots. When the remainder is hollow, the stem is always solid here, and the partition becomes very firm from the interlacing of fibres from all sides; and when, as in the Sugar Cane, it is filled up with soft tissue, the knot is still solid. The space from one knot to another is termed the *internode*, and from each of these divisions leaf buds generally spring.

Some peculiarly modified stems are often confounded with roots. Such are what are usually called bulbous roots, as those of the Onion and Lily, which are in reality underground stems. The base of the bulb is the real division between the stem and the root, and the fibres proceeding downwards from this are the roots themselves. The scales of such a bulb are really but leaves, altered from their usual character, and at the base of each scale is a little bud, placed in just the same relation with the scale as the buds to the leaves on the higher portiens of the stem. In this case, then, the stem is in a contracted state, the internodes not being developed, and the leaves and buds of several nodes arising close together. Other stems sometimes creep beneath the ground or along its surface, producing buds which become new stems, or branches. Of this kind is the *rhizoma*, instances of which may be seen in the so-called *roots* of the Iris, the Solomon's Seal, and many kinds of Ferns, and in the part of the Ginger plant which is eaten as a sweetmeat. The *runners* of the Strawberry are also stems, which send down roots, and shoot forth buds at intervals. Several kinds of grass, possessing similar creeping stems, render themselves a dreadful nuisance to the cultivator, who finds it utterly impossible to exterminate them, since each node, having buds and roots, becomes a new plant.

One of the most distorted forms of the stem is that observed in the Potato. The *tuber* of this plant is evidently a form of the stem, as is shown by its power of producing buds at the points, called the *eyes*. When, therefore, the tuber is divided into pieces, each one of which has an eye, from which, when placed in the earth, a young plant will spring, the same method of propagation is adopted as that used in regard to the Sugar Cane, whose stem is divided into its internodes, each of which is planted separately. The nature of the potato is also well shown by an accidental case, (an engraving representing which is given by Dr. Gray,) in which some of the buds and branches above ground showed a strong tendency to develope in the form of tubers. The tubers of the artichoke are of the same nature. There are other subterranean modifications of the stem, such as the *Cormus*, a solid bulb, like that of the Colchicum, and the curious *bulblets* of some species of Lily and Onion, which grow in the axils of the leaves, or flowers, and spontaneously drop off to the ground, where they take root and form separate plants.

Buds and roots may spring not only from those parts of the stem which grow beneath or on the ground. Many trees exist whose branches naturally hang downwards, and reaching the ground, give rise to a new set of root, and becomes secondary stems. In this way are formed the celebrated Banyan trees (Ficus indica) of the East Indies, one individual of which sometimes forms a small forest. One of these possessed three hundred and fifty principal trunks, and more than three thousand smaller ones, each of which was casting out new branches, and hanging roots, to form future trunks. The space which it covered was so large that it was estimated that seven thousand persons might find room beneath its shade. Milton has mentioned this remarkable tree in the following lines:

> "The fig tree; not that kind for fruit renowned;
> But such as at this day to Indians known,
> In Malabar or Deccan, spreads her arms,
> Branching so broad and long, that in the ground
> The bending twigs take root, and daughters grow
> About the mother tree, a pillared shade,
> High over arched, with echoing walks between."

The Tree Ferns of tropical countries are the only flowerless plants which form true woody trunks. The stems of these are sometimes hollow, and sometimes contain a kind of pith. Their mode of growth differs from that of either Exogens or Endogens. When cut across, the stem is seen to consist of a number of hard woody plates, adhering rather loosely together, and these are found to be either continuations of the flattened footstalks of the leaves which crown the summit, or the remains of those which have dropped off. Each year the leaves fall off, and are replaced by a new set, formed above, so that the stem goes on increasing in length, but very little in diameter. It is generally the case in these and other cryptogamia, that the portions first produced undergo little change, and hence such plants have received the name of *Acrogens*, which signifies growth by the point, or by addition to the extremities alone.

THE HERBARIUM.

As the season has commenced for the enjoyment of the most delightful branch of botanical study, that of the collection of plants for preservation, with all its accompanying pleasures of free air, fine scenery, and the promotion of health, some directions in that behalf will no doubt be acceptable. To a quiet and contented mind there is no more pleasant and desirable recreation than that of roving the fields in search of plants, seeking them out in their own fair homes, and studying the structure of their delicate parts. It is a natural feeling which prompts the wish to collect and preserve what has afforded so much pleasure, and many a tender thought, many a dear recollection, many a loved scene, is suggested to the mind by the withered flowers which so delighted us when they were blooming and fresh.

The following brief directions for the examination, the collection, and the preservation of plants, are compiled from good sources, and contain some of the suggestions of experience.

For the examination and analysis of plants, a good magnifier is necessary, in order correctly to observe the more minute parts, such as the stamens, pistil and seeds. A very excellent single lens, put up in a compact and portable form, with proper conveniences, may be obtained at a very moderate price at Mr. Pike's, Optician, in Broadway. One of these will be found to magnify sufficiently for ordinary purposes, and should be carried in the pocket on all Botanical excursions. There are many curious flowers, which are so delicate as to wither in a very short time after they are gathered, and to examine these properly, the magnifier should be always at hand. The fresher, and more fully in blossom, the better is always a flower for such examination. It would be superfluous to enlarge upon the benefit to the botanist of the analysis and examination of the objects of his study. Without this all reading is of little avail, and more can be learned from correct observations upon the plant itself, even when it is dried, than by a thousand printed descriptions. During the flowering months, says that excellent New England botanist, Mr. Wood, the learner will often in his walks meet with plants in blossom, with which he is yet unacquainted, and he who is duly interested in his pursuit, will by no means fail to seize and analyze each specimen while the short hour of its bloom may last, and to store his memory with the knowledge of its names, habits and uses. Thus in a few seasons, or even in *one*, he will have grown familiar with nearly or quite every species in his vicinity. The student, then, should devote particular attention to collecting and preserving his plants so that he may at his leisure study their characters fully, compare them with each other, and arrange them correctly. To form such a collection, or Herbarium, the following apparatus is necessary. A tin box made in a portable form, say twenty or twenty-four inches long, by four or five in depth, with a close fitting cover. In this the plants are to be placed when first gathered, without bruising or breaking them. As much of the plant as possible, including, in the smaller herbaceous plants, a portion of the roots, should be taken, and of the larger species, entire flowers, and leaves, with the shoot from which they spring. If necessary, they may be kept in the tin box for several days. Next a press of some kind should be provided. For this purpose two thin boards about 12 by 18 inches, connected by hinges, are proper, or even the covers of a large book may be sufficient. Next, a few quires of printing paper, the smoother and more porous the better, should be provided. Between several thicknesses of this paper, the specimens should be placed in such a manner as to preserve as much as possible their natural form and appearance. This often requires some care in spreading out the leaves and arranging the flowers. The whole is then put into the press, or between the covers of the book, and subjected to a proper degree of pressure. This is effected by fitting the press with a screw, or more simply, and as well, by laying on weights, always taking care not to make the compression so great as to crush the plants. Some collectors recommend that they should not be meddled with, after this is done, until they are quite dry, but we have found the best plan to be, to expose them to the air daily for a short time, so as to allow the moisture to evaporate, until they are quite dry. By the other plan, succulent plants will often become mouldy. When they are perfectly dry, the next object is to arrange them properly. To do this, each one, or perhaps more, if small enough, and belonging to the same genus, should be fastened to a half sheet of good white paper, by loops of paper, or by stitching them down with a needle and fine thread. The ends of the leaves, or any thin part which will not lie flat without, may be touched with a little glue or gum Arabic. The name of the species should be written near the specimen, with any remarks as to its peculiarities, the place where, and time when it was gathered, or some other interesting circumstances connected with it. Let all the specimens of the same genus, be then enclosed in a sheet of different colored paper, with the generic name, and the names of all the species collected, written on the outside. The genera should then be arranged in their proper orders, (this supposes that the Natural arrangement is the one adopted,) those of each order being wrapped in a larger sheet, on which should be written the names of the order and of the genera. The orders may then be laid on the shelves of a cabinet, or in any other proper place. The collector should also take care to protect his specimens from the attacks of insects, and for this purpose, each one should be washed with a solution of camphor, or a piece or two of camphor gum, or sponge moistened with oil of turpentine, be placed among them. Large seeds or fruit, sections or branches of wood, and other such articles, which are too bulky to be pressed between paper, may be preserved separately on a shelf.

APRIL AND MAY FLOWERS.

In a preceding article, we have given some brief directions as to the best method of preserving specimens of plants. Of the importance to the botanist of collecting and forming into a herbarium the objects of his study, it is superfluous to speak. A student will learn more in a few botanical excursions rightly prosecuted, than by reading a thousand pages. He should make it a rule never to allow a single plant he meets with to escape the process of dissection and examination. "It may be asserted confidently," says an experienced teacher, "that there is not a botanist in the world, and there never can be one, who has not analyzed and prepared with his own hand, at least three hundred species of growing plants." For this purpose the productions of unassisted nature are far more proper than the often distorted monsters of the green-house and garden. Let the student, then, betake himself to the green fields, to the solemn woods, to the banks of brooks, to the dells of mountains, where he can find, in their unsophisticated beauty, the favorites of the sun and the air. And ever, as in some shady glade, with the fresh spring wind blowing cool on his brow, weary with walking, he seats himself to examine and admire the treasures he has been collecting, let their varied shapes, the harmony of their tints, the wonderful formation of their minutest parts, suggest to him humble thoughts of their divine Author and his, and fill his soul with admiration, awe and love.

Old Izaak Walton has drawn so charming a sketch of the feelings produced in a contented heart by contemplation of rural scenery, that we cannot forbear to quote it entire, since it is applicable as much to the botanist as the angler. "I sat down," says his pupil, "under a willow tree by the water side, and considered what you had told me of the owner of that pleasant meadow in which you then left me; that he had a plentiful estate, and not a heart to think so; that he had at this time many lawsuits depending, and that they both damped his mirth, and took up so much of his time and thoughts, that he himself had not leisure to take the sweet content that I, who pretended no title to them, took in his fields; for I could sit there quietly, and looking on the water, see some fishes sport themselves in the silver streams, others leaping at flies of several shapes and colors; looking on the hills, I could behold them spotted with woods and groves; looking down the meadows, could see, here a boy gathering lilies and ladysmocks, and there a girl cropping culverkeys and cowslips, all to make garlands suitable to this present month of May. I say, as I thus sat, joying in my own happy condition, and pitying this poor rich man that owned this and many other pleasant groves and meadows about me, I did thankfully remember what my Savior said, that the meek possess the earth; or rather, they enjoy what the others possess and enjoy not, for anglers (botanists) and meek, quiet-spirited men are free from those high, those restless thoughts, which corrode the sweets of life. There came also into my mind at that time, certain verses in praise of a mean estate and an humble mind. They were written by Phineas Fletcher, in which you shall see the picture of this good man's mind; and I wish mine to be like it.

'This certain life, that never can deceive him,
So full of thousand sweets and rich content;
The smooth leaved beeches in the field receive him,
With coolest shade, till noontide's heat be spent;
His life is neither tossed in boisterous seas,
Or the vexatious world, or lost in slothful ease:
Pleased and full blest he lives, when he his God can please.'"

Among the more common wild flowers of April and May, are several of the Ranunculaceæ. Everybody knows the Butter Cup, *Ranunculus acris*, which begins to flower in May, and soon covers whole fields with the brilliant yellow of its petals. Several other species flower about the same time, and some continue in flower till July and August. The Meadow Rue, *Thalictrum dioicum*, is also a May flower, and the *Anemone, nemorosa*, or wind-flower, is one of the earliest in April, except the *Hepatica triloba*, which is earlier than all. These two last are to be found on the sunny sides of hills, near old woods. Who that has pursued the "windings bright and mazy like the snake" of a trout stream in May, albeit intent on the capture of its speckled inhabitants, and ever and anon hooking, raising, playing, reeling in, and placing in his pannier the goodly fish, without waiting a moment before a new cast of his flies, to pluck and admire the dark green leaves and large bright flowers of the Marsh Marigold!—This *Caltha palustris*, (we give its botanical name for the benefit of the student, not of the aforesaid angler) is indeed one of the handsomest of our early flowering plants, and is in its way useful too for "greens"—every yankee, though personally a stranger to the *color*, knows what *they* mean. Towards the middle and last of the month, the red and white Baneberries, *Actæa rubra* and *alba*, are found in the woods, and earlier in the month, or even in April, the Blood-root, *Sanguinaria Canadensis*, with its reniform leaves and curious white flowers. Let us not forget to mention the wild Columbine, *Aquilegia Canadensis*, which in April adorns dry hills and rocks with its delicate flowers, far more delicate than any pet of the garden, nor those comical looking Araceæ, the Skunk Cabbage, *Pothos fœtida*, or *Symplocarpus*, or *Ictodes*, (for by all these names is it known to botanists) which well deserves its common appellation, with its purple spathe drawn like a cowl over and around its spadix; the *Orontium*, or Golden Club, with its clavate spike of yellow flowers, so curiously constructed, and the Arum itself, with its trifoliate leaves, hood-shaped spathe, and acrid roots, which we have wickedly, (for which sin of our youth may we be pardoned,) offered to some one of our school fellows, less acquainted with its properties than ourselves, as a rare and delicious morsel. Young reader, do not imitate this injudicious trick. These last are found in wet places, in low ground, by the sides of brooks and ponds. Of the Cruciferæ, only a few flower early, such as the *Draba*, or Whitlow Grass, the *Barbarea*, or Winter Cress, and the *Sisymbrium*, or Flax Weed—all, insignificant plants. In the open fields, spring up more than one species of the Violet, and open their blue or white petals to the first warm rays of the vernal sun. Nobody, whether a botanist or not, can mistake a violet for any thing else. In going through some old, open, moist wood, near the base of a rock, the eye of the rambler is often caught at this season by a cluster of delicate white flowers, veined with purple, terminating a slender stalk about half a foot high, with a single pair of opposite leaves. This is the *Claytonia*, one of the neatest of early flowers. The little *Houstonia*, or *Hedyotis coeulea*, now covers large patches of damp fields with the pale blue tint of its petals, varied, here and there, with a cluster of the more showy Dandelion. In dry, stony places, on high banks, from beneath a sheltering rock, peep out the small white flowers of the Early Saxifrage, while on the green slopes, the beautiful little Dog's tooth Violet, most delicate of lilies, *Erythronium Americanum*, shoots up from its bulbous root its spotted leaves, and drooping yellow corollas. The *Trilliums*, conspicuous for their whorls of broad green leaves, and nodding white flowers, are budding, though they can hardly be said to be fully blossomed till June. That low, small trailer, with woody stem and hairy evergreen leaves, and clusters of fragrant flowers, white, or shaded with pink or purple, is the *Epigaea repens*, sometimes called Ground Laurel. A more rare plant than any of these, is the May Apple, *Podophyllum peltatum*. It has two peltate leaves, from the fork of which, rises a single peduncle, bearing a white drooping flower, the calyx of which, falls off as the petals expand, succeeded by an eatable fruit about as large as a plum. The root of the May apple is used as a cathartic, in place of Jalap.

Of trees and shrubs, a great number produce their flowers in April and May. Among these are various species of the Elm, the Willow, the Birch, the Alder, the Ash, the Hazel, the Poplar, the Maple, and the Cherry. These will be readily recognised without description. One of the most conspicuous trees at this season, is the Shad Berry tree, *Amelanchier Canadensis*, or *Mespilus arborea*, whose large racemes of white flowers, make it remarkable at a great distance. The thickets too are fragrant, a little later, with that beautiful and well known shrub, the Wild Honeysuckle, or Swamp Pink, *Rhododendron nudiflorum*.

Our limits will not allow a further extension of this subject at present, and we conclude by assuring the student that he will have learned more than he can ever do from reading what we write, if during this month, he shall have collected, examined, properly preserved, arranged and labelled, specimens of the species here mentioned.

ON WINDOW GARDENING.

There are no plants which are looked upon with more interest, or attended to with more care, than those which are cultivated in the rooms of dwelling houses; and yet from our fair window gardeners imagining that there is something very difficult in the management of these plants, or from not properly understanding what that should be, they often fail in accomplishing what their labor and anxiety most richly merit. Now, there is in reality no great secret in the treatment of window plants. It must be a general principle in their cultivation, to give them all the light possible in winter, by placing them close to the window, and in the summer months in a sheltered situation out of doors. Although this situation is best in summer, yet in some places it may not be convenient, and in others it may be desirable to have them on the outside of the window, or on a balcony erected there for that purpose, where they will grow and flower under the eye, and perfume the air of the room when the window is opened on a summer evening. In this case it is necessary to have some protection from the burning heat of the mid-day sun, which is very much increased by the reflection of the rays from the wall of the house. Every one will readily invent something to answer this purpose; an awning, for example, or merely moving the plants to the inside of the window. Of course these remarks apply only to the summer season, when the sun's rays are very hot in the middle of the day, and to windows with a southern aspect. High winds are very injurious to window plants, and should be guarded against, and for this reason windows on the ground or second floor are best adapted to their cultivation.

Plants in a natural state send their roots in every direction in search of moisture and food. In this respect they differ from those grown in rooms, confined to pots, and supplied with water by artificial means. The latter are more liable than the former to suffer from dryness in summer, having fewer mouths to absorb the moisture evaporated from the leaves; and more liable to be injured by excess of wet in winter, owing to the drainage of the pots getting choked. It is impossible to say how often, and how much water should be given, because this depends upon the plant itself, its state of health, and the season. As a general rule, however, they should never be watered until the soil at the surface of the pot will readily crumble between the finger and thumb, and when in this state, as much water should be given as the soil will receive; in other words, never water till the plants are dry, and then give plenty of it. Rain water is by far the best, and should always be used in preference to that obtained from springs. In winter very little water is required, and it should always be cautiously given, because the air is more moist, and the light not so intense, and therefore less demand is made upon the roots by the leaves.

When the plants are inside the room, some contrivance is necessary to prevent the water from running through the pots and wetting the floor, and this is most simply done by placing the pot in a flat pan, which receives any superfluous water, which is absorbed by the roots when the soil gets dry. Pouring the water into these pans instead of on the soil, is not to be recommended. Watering over the leaves is of the utmost importance to the health of window plants, exposed as they are to dust, which forms a crust upon them and prevents the action of the pores. This operation should be performed every day in summer, in the afternoon, when the sun does not shine on the plants.

Pl. 23.

Potentilla atrosanguinea. (Dark Red Potentilla.)

Ackermans Lith.

POTENTILLA—THE CINQUEFOIL.

Natural Order, Rosaceæ. Linnæan System, Icosandria, Polygynia. Generic Distinctions: Calyx, four to five cleft, with an equal number of alternate exterior segments; petals, four to five, obcordate; stamens, numerous; filaments, slender; ovaries, collected into a head, seated on a small, dry receptable.

P. atrosanguinea. Stem, decumbent; leaves, ternate; leaflets, obovate, deeply serrated, clothed with white down beneath; petals obcordate, longer than the calyx.—*Plate* 23.

Potentilla is derived from the Latin, *potentia*, power, the plants belonging to this genus having been supposed to possess powerful medicinal properties. Like many other botanical names, however, it is misapplied here, since none of the species have been found to possess any healing principle. The genus contains several very pretty and ornamental species, some of which are commonly cultivated, and others are well known wild plants. On examining the flowers of the Potentilla, they will be found to bear a striking resemblance to those of the Strawberry, but the fruit will always distinguish the two genera; that of the Strawberry being juicy, highly flavored and delicious, while the Potentilla only bears a cluster of dry, tasteless seed vessels. All the species possess compound leaves. The common name, Cinquefoil, is from the French, and signifies five leaved; and a very common New England species, which flowers early in Spring, *P. Canadensis*, is called Five-Finger, for the same reason. Another native species, *P. argentea*, or Silvery Five-Finger, is curious on account of the silvery appearance of the down beneath its leaves, which is also characteristic of *P. anserina*, Silver-Weed, or Goose-Grass, one of the handsomest American species. There are more than thirty species of Potentilla belonging to North America, of which seven or eight grow in the Eastern States. The color of their petals is generally yellow.

The species represented in our plate, is one of the most beautiful of the cultivated exotics. It is a native of Nepaul, whence it was introduced into England about twenty-five years ago. It is a hardy plant, growing in any common garden soil, and producing its large, splendid dark crimson flowers from the ends of its decumbent shoots.

DELPHINIUM—THE LARKSPUR.

Natural Order, Ranunculaceæ. Linnæan System, Polyandria, Trigynia. Generic Distinctions: Calyx, petal-like, irregular, of five colored sepals, the upper one spurred; corolla, five petalled, irregular, the two upper petals drawn out into a tubular, nectariferous spur, enclosed in the spur of the calyx.

D. grandiflorum. **Leaves, palmately many-parted into linear lobes; pedicels, longer than the bracts; petals, shorter than the calyx; racemes, spreading, few-flowered, diverging.—*Plate* 24.**

The Greek word *delphin* is the original of, and means the same as our word dolphin, and from it is derived the name of this genus, on account of a fancied resemblance betwen the shape of the flower, with its curved and projecting spur, and that of the dolphin. From another supposed likeness between the same peculiar appendage and the foot of a bird, is taken also the common name, Larkspur. This is a well known genus of annual and perennial plants, some of which are among the most generally and easily cultivated garden flowers. They are usually tall and showy, their flowers arranged in a long terminal raceme, and their leaves are commonly divided into numerous lobes. Their flowers are never yellow, but always either blue, red, or purple, or some shade of these colors mixed with white. Of the garden varieties, which are very numerous, are several of the kind called the Bee Larkspur, "which look as if the insect from which they take their name were glued to their inside," Rocket Larkspurs, and Siberian Larkspurs. The genus is so large that it has been divided into sections, two of which contain only annual plants, and have only one petal, drawn out into a tail, within the spur of the calyx, and the other sections, which contain no annuals, have the appendages of two petals in the spur. In one of the latter, the species are all perennials, and the petals are bearded. This section is divided into the Siberian, and Bee Larkspurs. The other section consists of biennials, whose petals are not bearded, and whose carpels are ventricose. The leaves of all the Larkspurs are poisonous, and it is said that no insect will touch them. Only two or three species are natives of this country, one of which, *D. exaltatum*, an inhabitant of the middle, and rarely of the Northern United States, is a fine plant, with brilliant blue flowers.

Various kinds of the species in the plate are cultivated in gar dens, and they have the advantage of flowering all summer. *D. grandiflorum* was introduced into England, and thence into this country, from Siberia, in 1816. The flowers are larger than those of any other species, and when made double by cultivation, they form one of the most splendid objects in a border. The sepals are of a most intense blue, spotted with red, the outer spur being greenish. Two of the petals are very small, upright, and fleshy; the two others are nearly round, with an oblique claw, having a small hook at the base, near which is a slightly bearded yellow spot. The intense metallic hue of the flower is finely contrasted with these golden yellow spots. The varieties are all hardy, and are easily propagated by seeds or divisions of the root.

The flower of the Larkspur and that of the Ranunculus would seem to be so widely different as to cause their position in the same Natural Order a matter of surprise, which may be increased by contrasting the colors of the two. Our wild Ranunculus has always yellow flowers, the Larkspur never. "But," says Lindley, "setting aside this, which is of no botanical importance whatever, let us look at the calyx of the Larkspur. It is composed of five leaves, or sepals, the uppermost of which has a horn arising out of its back; so is that of the Ranunculus, excepting the horn. It has four petals, of which two have long tails, hidden within the horn of the sepal. Ranunculus has nothing of this, but five common petals instead. The Larkspur has a great many stamens arising from below the carpels: this is the first *essential character*

PL. 24.

Delphinium grandiflorum. (Large-flowered Larkspur.)

Ackerman's Lith.

of Ranunculus; it has also several carpels, (two or three,) which are not grown together; and this is the *second essential* character of Ranunculus, so that this plant has, in reality, no essential character by which it can be distinguished from the Crowfoot tribe." The Larkspur further agrees with nearly all Ranunculaceæ in the poisonous properties of its juice.

RANUNCULUS—THE RANUNCULUS, or CROWFOOT.

Natural Order, Ranunculaceæ. Linnæan System, Polyandria, Polygynia. Generic Distinctions: Calyx of five deciduous sepals; petals, five, rarely eight or ten, with a nectariferous pore at the inside of the base; stamens, numerous; seed vessels, numerous, ovate, crowded.

R. gramineus. **Leaves, lanceolate, or linear, quite entire; stem, erect, quite smooth, branching; scales of the petals, tubular; root, fascicled.—*Plate* 25, *Fig.* 1.**

R. amplexicaulis. **Leaves, ovate, acuminate, clasping the stem; stem, many-flowered; root, fascicled.—*Plate* 25, *Fig.* 2.**

R. aconitifolius. **Leaves. palmate, three or five parted; stem, branched, many-flowered; calyx, smooth.—*Plate* 25, *Fig.* 3.**

The plants belonging to this genus generally grow in wet, marshy situations, and hence the name, Ranunculus, derived from the Latin, *rana*, a frog, which animal lives in such places. This is a large genus, comprising several very common wild plants, and numerous garden flowers. The common name of some of the species, Crowfoot, is taken from the resemblance in shape of the divided leaves to a bird's foot, and the other as common appellation, Buttercup, from the rich golden yellow of the petals. The flowers, when not made double by cultivation, consist of five petals, numerous stamens, and carpels, each of which has a short, beaked stigma, without a style, all collected in a roundish head, on the receptacle.

The three species figured in our plate are among the prettiest of the genus. ***R. gramineus***, is a native of many parts of Europe, and is particularly distinguished by its grass-like leaves and large flowers. ***R. amplexicaulis***, comes from the

Alps, and is remarkable for its undivided glaucous leaves, which clasp the stem, and its white flowers, which have sometimes a tinge of pink or purple. *R. aconitifolius*, came originally from the middle of Europe, and a variety of it, with double flowers, as represented in the plate, is very commonly cultivated as a garden flower, under the name of the Fair Maid of France, or White Batchelor's Buttons. It is hardy and easy of culture. These species we have figured in preference to the common native species, since the latter are so well known as to make their appearance familiar to every one. Equally familiar is the very common cultivated species, *R. Asiaticus*, so many varieties of which are known to the lover of floriculture. The varieties are indeed innumerable, and scarcely any two plants raised from the seed will be alike. The following directions for cultivating the garden Ranunculus, in our climate, are given by Mr. Eley, a most experienced and skilful florist, of Hartford, Connecticut.

As this plant is rather more tender than the Anemone, and more liable to be killed by the frost and wet in this climate, unless it is well protected, the best way to secure a show of flowers, is to prepare a bed in the fall, (say October,) and plant the roots in the spring. Having selected the bed intended for them, spread it two or three inches thick with decayed cow manure, and dig it in pretty deep, laying the soil up in a ridge in the centre, to carry off the water. Early in April, level down the bed, and spread over a thin coat of sandy loam; mark with a rod some lines across the bed, six inches apart, place the roots carefully in the rows, with the crowns upwards, four or six inches apart, and lay a portion of sand round and upon each root; then cover them over with about two inches of the loam.

Never select the largest roots to plant in a flower-bed, for they generally divide into offsets, and seldom flower well; but choose those of the middle size, with the crown high and firm to the touch. It is indispensable that the roots never be allowed to come in contact with the manure or decaying vegetable substance, as they will become more or less injured. When the leaves appear above ground, choose a dry day, and press the soil firmly about the roots with the hand, as if the

PL. 25.

1. *Ranunculus gramineus.* (Grass-leaved Ranunculus.)
2. *Ranunculus amplexicaulis.* (Stem-clasping Ranunculus.)
3. *Ranunculus aconitifolius.* (Palmate-leaved Ranunculus.)

weather proves dry, and the crowns of the roots are exposed, they will suffer material injury. In dry weather, they require watering, and this must be continued, if necessary, until they are in full bloom.

In situations where the sun has great power, they should be shaded, or the leaves will become yellow, and few flowers will be produced. They should also be shaded while in flower, or they will soon fade. This shading may be effected either with an awning, or by bending hoops across the bed, and covering them with mats, always taking care to allow a current of air to pass underneath. As soon as they have done flowering, and the leaves have died away, take up the roots, clean them, dry them on a tray or in an airy chamber, not exposed to the sun, and when dry, place them in a drawer till the season for planting again arrives. If protected from frost or damp, the roots will keep for two years. They will flower at various seasons, according to the time of planting. Those set out in April, will flower in July, and those planted in May and June, will flower in August and September.

The Ranunculus also flowers well in pots in the green-house or room window. In August, fill some flower pots with rich sandy loam, nearly even with the rim ; give each pot a rap on the bottom, to settle the soil, but do not press it down ; level the surface, and lay on it a little sand ; then select the roots, and place them in a circle around the pot, about three or four inches apart, and put one in the middle ; press them gently down with the hand, and lay a little more sand over them, filling the pot level with the rim with soil, and give them a gentle watering ; then place the pots in a sheltered situation, until the appearance of frost, after which remove them to the green-house or room window. Supply the plants with water as they require it, and they will soon flower. Other plantings may be made monthly, during the winter, which will flower in succession. Roots that have been kept out of the ground one year, will be best for this purpose, as they will grow much quicker than those which were taken up the last season. The Ranunculus is increased by separating the offsets from the root, and by seeds from new varieties.

A very neat, smooth species, R. *abortivus*, not uncommon in

PL. 26.

1. *Dianthus arenarius.* (Sand Pink.)
2. *Viola cucullata.* (Hooded Violet.)

Ackerman's Lith.

damp woods in New England, is well worth the attention of the cultivator, as we are assured that with proper management it may be rendered a very ornamental plant. Indeed, there are several other native species which would well repay the care of cultivation, and would doubtless receive attention, if, instead of being native productions, they were only brought from India or New Holland.

VIOLA—THE VIOLET.

Natural Order, Violaceæ. Linnæan System, Pentandria, Monogynia. Generic Distinctions :—sepals five, unequal, auricular at the base; petals five, irregular, the upper one spurred at the base; anthers connate, the lobes diverging; capsule one celled, three valved.

***V. cucullata.*—Very smooth; leaves cordate, cucullate at the base, acute, crenate; peduncles longer than the petioles; stipules linear; inferior and lateral petals, bearded.—*Plate* 26. *Fig.* 2.**

The origin of the word viola, given by the Latins to this genus, is not satisfactorily explained The Greeks called it *ion*, which is supposed to be derived from Io, a mistress of Jupiter, who was transformed into a cow, for whose food the Violet was fabled to have been created; and it is conjectured that the Romans, adopting the Greek story, made viola from *vitula*, a young cow. Whatever may be the derivation of its name, no plants have been more celebrated in song and story, than those of this beautiful genus.

> Violets dim,
> But sweeter than the lids of Juno's eyes,
> Or Cytheræa's breath,—

have always been the poet's flowers, and truly their delicacy, beauty, and perfume, render them worthy of all that has been written and sung in their praise. The Sweet Violet, *V. odorata*, and the Pansy or Heartsease, *V. tricolor*, with their numerous varieties, have a place in every flower garden, from the conservatory of the prince, to the little patch of the peasant. The Sweet Violet, which is doubtless the species described by the ancients, is very widely diffused over the Eastern Continent, being found in the British Islands, all over Europe, and extending even through Asia to China and Japan, and to some degree naturalized in America. The most highly prized varieties are the Russian and the Neapolitan. The latter are pale blue, and very fragrant, and may be made to flower during the whole winter. The other species, or Pansy, also receives the attention of florists, and is made to produce very large and beautiful flowers. We are again indebted to Mr. Eley for his method of cultivating this plant. The seed, he says, should be sown in spring, or as soon as it is gathered from the plant in summer. In April or May, make the bed in which it is intended to sow the seed. It should be of rich soil, and in a shady situation. Lay just as much soil over the seed as will cover it, and gently pat it down, and, if the weather is dry, water the bed a little. In ten days or a fortnight the plants will be up, and when they are an inch or two high, transplant them with little balls of earth at their roots, into beds, placing them in rows four inches apart every way; and as this is the bed in which they are intended to flower, always select a moist situation, and keep them free from weeds. If any of the plants have remarkably fine flowers, they may be increased by layers or by dividing the roots. Layering should be done in May or September, and is performed by making a slight incision in the stem at a joint, and pegging it down about an inch in the soil. They can be taken up and divided at any time in Summer, except in hot, dry weather, and a moist, cloudy day should be chosen for the purpose. To ensure a fine show, it is necessary to renew the plants by seed, layering, or dividing the roots every year, as old plants invariably produce small flowers.

The species of which we have given a portrait is one which every one will recognise as our most common blue Violet. In almost every moist, grassy field, it is one of the earliest spring flowers. In New England we have at least twelve well distinguished species, several of which are worthy of mention. One, particularly distinct from all others, is the Pedate Violet, *V. pedata*. Contrary to the usual habit of the genus, it grows in dry, sandy soils. Its flowers are very large, and of a pale blue color, and its root stalk is very curious, appearing as if the lower part were bitten off, and furnishing an excellent example of the premorse root. The leaves are perfectly pedate, having from five to nine lobes. Another large and showy species, with yellow flowers, is *V. pubescens;* and *V. Canadensis,* a tall violet, with white or light blue petals with yellow bases, is considered one of the most beautiful of the whole genus. The smallest, most fragrant, and most delicate of our native species is *V. blanda,* whose sweet white flowers, streaked with slender veins of blue, are seen at this season near every brook side.

No plants are more changeable in their characters than the Violets; all their parts being more or less influenced by accidents of situation, soil and season. In consequence of this circumstance, considerable confusion has arisen, some botanists naming as distinct species, what others consider mere varieties. Indeed, it would be difficult to find two precisely similar descriptions of a single species.

THE PINK.

On the same plate with the Violet, we have figured a pretty and delicate species of Pink, remarkable for its deeply fringed petals. For the genus *Dianthus* itself, and another species, the reader is referred to page 60, in the February No. of this work. The present species was introduced here, in order to give an opportunity for some promised directions as to the cultivation of these favorite plants, and more especially of the Carnation. The species from which have sprung the numerous varieties called by the general name of Carnation, is the Dianthus caryophyllus. This plant is found wild in some parts of England, growing among old ruins, and in greater abundance on the south side of the Alps and Pyrenees. It has been cultivated in most parts of Europe, from time immemorial, and has always been in the greatest favor from its beauty and fragrance. From Germany and Italy, where it is cultivated to the greatest extent, are procured some of the best varieties. All the garden carnations are more or less variegated, and are divided into three classes, Flakes, Bizarres and Picotees, which altogether contain more than five hundred named varieties. Flakes have only a single color, running in stripes, quite through the petals, on a white or yellow ground. Bizarres are variegated in irregular stripes or spots, with not less than two colors on a white or yellow ground. Picotees have a white or yellow ground, edged or spotted in fine spots with some darker color, and the edges of their petals fringed. These kinds are again divided by their colors, as scarlet flake, purple bizarre, &c. We are again indebted to Mr. Eley for his very successful method of managing and propagating these flowers.

Carnations are usually propagated by layers. These are shoots buried in the ground so as to force them to take root at a joint, without separating them from the parent plant. This operation should be performed as soon as the flowers begin to fade, or the shoots are sufficiently long, which is generally about the end of July. A number of pegs, of wood or bone, about five inches long, with a hooked end, should be provided. The shoot of which a layer is to be made may have four or five joints, and the lower leaves next the root are to be stripped off, up to within two or three joints of the top of the shoot Next stir up the earth around the plants, and lay on an inch of fresh soil. Then, with a sharp penknife, the layer should be cut about half through, about a quarter of an inch below the second or third joint, on the side next the ground; then pass the edge of the knife upwards, splitting the stem through the centre of the joint, to about one half or three quarters of an inch above it, and lastly, cut off horizontally the small portion left below, and connected with the joint, quite close to the bottom of the joint, taking great care not to injure the joint itself, as it is from the lower outer circle of the joint that the root-fibres will spring. After the incision is thus made, the wounded branch is to be pressed gently into the soil, so as to avoid breaking it, and a peg pushed down, so as to bring its hooked end over the layer, securing it about an inch below the surface. The upper end of the layer should be raised as nearly upright as possible, the stem being only covered at the joint, and none of the leaves being buried. As soon as this is done, give them a watering, which may be repeated as often as the weather may render it necessary, and they will be rooted and ready to pot off in about six weeks. When they have struck root, or by the end of September, cut them from the parent plant, with about an inch of the stalk below the incision attached, and plant them in small pots, filled with good loam, and a little decayed manure, or leaf mould. When potted, place them in a sheltered situation, till the middle of October, at which time they should be removed into the house or frame for the winter.

Where a quantity of plants are prepared for the garden, the layers can be planted in boxes, twenty or more in a box, and be protected by a spare hot-bed frame, placed in the ground, in a warm situation facing the south. Dig out as much of the earth from inside the frame as will prevent the plants from touching the glass, and place the earth dug out around the outside of the frame as high as the top of it, beating it well down, so as to exclude the frost. Previous to placing the boxes in the frame, lay two or three inches of coal ashes on the surface, which prevents worms from penetrating, and allows the water to drain away. Put on the glass sash, and shade them from the sun a few days, until they are recovered from transplanting; then begin gradually to give them air, and increase it till dry warm weather, when the sashes may be taken entirely off. Take care to close them down again in the evening, and preserve them at all times from excess of wet, otherwise, mildew will infest the plants, which should be wiped off when it appears, or the diseased plants removed, and all decayed leaves picked off, and give a little water to those that appear dry. Follow this mode of treatment till the winter sets in, then shut the sash down close, and cover with mats, or straw and boards, and let them remain as long as the severe weather lasts; but when the weather changes and the days lengthen, give air as before, till the beginning of April, and a week or two before finally removing them, give full air, night and day. If it is desired to have them flower in pots, they should be shifted in March or April, into pots nine inches in diameter, in the following compost: two parts of good fresh loam, one part decayed manure, and one part of coarse sand, (and if convenient, leaf mould may be used,) mixed well together; give them a little water, and as soon as frost is over, plunge the pots in the ground where they are intended to grow until in flower, the rims being just level with the surface of the ground. Place a neat stick in each pot, to which tie up the flower stems as they advance in growth, and water them in dry weather. When the buds begin to open, the pots can be lifted and removed where they are wanted to bloom, and if they are placed on a verandah, or in some other situation where they are partially shaded, the flowers will last much longer, and be finer colored than if exposed to the full sun. When the calyx has swelled to nearly its full size, it is apt to burst and let out the petals on one side, which destroys the beauty of the flower, and to avoid this, the calyx should be tied neatly round with a piece of twine, or a narrow slip of bladder be placed round it, the ends of which should be lapped over each other, and fastened with gum.

Seeds are seldom used in propagating carnations, except for raising new varieties; but, says the *Florist's Directory*, when they are required, they should be chosen from those flowers that have not many petals, but their petals should be large, broad, substantial, and perfectly entire at the edge, and their colors rich and regularly distributed. Neither layers nor pipings should be taken from those plants which produce seeds; and as soon as the petals wither, they should be drawn carefully out of the calyx, as the claws are apt to decay and engender mouldiness, which will destroy the seeds. The seeds, when ripe, should remain in the seed-vessel, and be kept in a dry room till May, when they should be sown in pots, in light, rich mould, or carnation compost, and kept in the open air, or in an airy part of the garden, shaded from the heat of the sun, till the plants are about three inches high, when they should be planted out in a bed of good rich mould, about ten or twelve inches apart, and kept there till they flower, when it will be seen what are deserving of being kept, and what should be thrown away. No carnations are esteemed that are not round, and regularly formed, and clear in color.

THE NATURAL SYSTEM OF BOTANY.

NUMBER SIX.

Order—Papaveraceæ. *The Poppy Tribe.*

This Order contains many plants well known for their peculiar properties, and much cultivated. The inspissated juice of several of the poppies forms the much used, and much abused drug, opium. The order is nearly related, in some respects, to Ranunculaceæ. The leaves are generally deeply divided, and the stamens are numerous, and arise from underneath the carpels. In these points, the resemblance to the Crowfoot tribe is very strong; but on examining any of the common species of Poppy, the carpels, instead of being separate, will be found to have grown together into a single ovary; the styles are wanting, the stigmas are elevated hairy ridges, which radiate from the centre to the circumference, of the top of the ovary, forming a kind of star-like crown. On opening the ovary, a single cell or cavity will be seen, with several little partitions projecting from the sides towards the centre of the cavity, and covered with a great number of very small ovules, or young seeds. The calyx of the Poppy has only two sepals, which completely enclose the bud before it expands, and the corolla has four petals. These are the usual numbers, but some of the tribe vary to three sepals and six petals. When the stem of a Poppy is broken, a thick, milky, turbid juice exudes, which contains the narcotic principle which gives its value to opium. We have seen before that the juice of all the Crowfoots is clear and watery—so that this is another striking means of distinguishing the two orders. As the ovary of the Poppy ripens, the outside becomes very hard and brittle, and forms a hollow capsule, with a brownish shell, and the seeds separate from their attachments, and when shaken rattle in their case. The shell of the capsule becomes so firm and hard, that the seeds could not find their way out, unless by some especial contrivance. The lid, or top of the capsule, is so firmly united to the lower part, that it will not open, and to remedy this, there are a number of little valves which open between the stigmas, and through these the seeds drop out. The structure of the Poppy capsule may be understood by conceiving that the several carpels have adhered together, their walls being flattened against each other, but that the union of these not being complete, the partitions do not reach the centre. These partitions, to which the seeds are attached, are called *placentas*, and in this case they are *parietal*—that is, they spring from the wall of the seed vessel, and not from its centre.

The essential characters of this Order are, then—Stamens, very numerous; Carpels united into one central ovary, with a single cavity; Juice, milky. If, now, the reader has procured, (as he should always do in studying the Natural Orders,) a flowering plant of the Ranunculus, and another of the Poppy, and has examined all the parts as we have described them, and compared the characteristics of the two together, he will have fixed the difference in his mind, and learned the nature of two important tribes of plants, so that he will never be in danger of mistaking the one for the other.

There are several plants belonging to this Order, which differ considerably from the true Poppy, in the formation of their seed vessels, and to save mistakes, it is well to notice one or two of these. In No. 4, Pl. 16, of this work, is the portrait of a member of this Tribe, called the Horned Poppy. In this the fruit differs from that of the true Poppy, in being very long and slender, instead of short and globose. The reason of this is, that in the true Poppy there are a greater number of carpels grown together, being just as many as there are stigmas, while in the Horned Poppy there are only two carpels. On opening the fruit, however, it will be found to contain, like the other, only a single cavity, with parietal placentæ.

There is a small plant generally known as Celandine, which is not uncommon in this country, growing by road sides, and under fences, whose yellow flowers are in umbels, and whose fruit is a long pod very like that of the Horned Poppy. Its juice is yellow, and is frequently used by school boys, with no great success, to cure warts.

Another curious American member of this Order, is the

Blood-root, *Sanguinaria Canadensis*, a neat early spring flower, with a single large reniform leaf, and a scape bearing a single white flower. Its juice is very dark colored, nearly red, and is emetic and purgative. Its pod is oblong, and acute at each end.

There is a genus, *Chryseis*, which comes from California and Oregon, one or two species of which, under the name of Escholtzia, are commonly cultivated in gardens, which presents a curious anomaly. The flower, before it expands, is enclosed in a pointed green sheath, which is pushed up as the petals open, and at length falls off. This extinguisher-like organ is somewhat puzzling at first, but if examined, is found to be the calyx, the two sepals of which have grown together so firmly that they will not separate, in the usual manner, to admit of the expansion of the flower, and since it must be got rid of in some way, its attachment to the receptacle is made so loose, that it separates all round at that point. Similar instances of the adhesion of two parts which grow near each other, are not uncommon in plants, and sometimes prove difficult of explanation.

All the Papaveraceæ possess narcotic properties in more or less intensity, but these properties are only manifested by those parts which yield the milky juice. The seeds abound in a kind of oil, which is much used in the manufacture of varnishes, on account of its being colorless, and drying easily. This oil does not partake of the narcotic quality, though the capsules, before they are ripe, supply the largest quantities of the milky juice from which opium is derived. There is a syrup, well known to nurses, under the name of White Poppy Syrup, by the effects of which, when improperly administered, there is no doubt that the lives of many infants have been lost, and equally fatal effects have been produced by some popular medicines, as Godfrey's Cordial, in the composition of which opium forms a large proportion. It ought to be known that infants are far more susceptible of the influence of narcotics, than of that of other medicines, so that these should never be administered except under the direction of a competent physician.

All the Papaveraceæ belong to the Linnæan class and order, Polyandria, Monogynia.

Order—Cruciferæ. *The Cruciferous Tribe.*

This is a very large and important order, comprehending nearly nine hundred species, among which are many of the most useful and ornamental plants. The Turnip, Cauliflower, Cabbage, Mustard, Cress, Radish, are universally cultivated as edible vegetables, and the Wall flower, and Stock gilliflower, as showy garden flowers. They all possess a peculiar acrid, stimulating principle, dispersed throughout every part, often accompanied with an etherial oil. Their flowers are generally small, but marked with such obvious characters that they can hardly be mistaken. One of these characters is the number and arrangement of the stamens, which is scarcely subject to the least variation, and which is peculiar to this order. The number of stamens is six, of which two are shorter than the rest, corresponding to the most natural of the Linnæan classes, Tetradynamia. Their arrangement, as well as that of the petals, is somewhat in the form of a cross, from which the name of the order is derived, the four long stamens being placed above and below, and the two shorter at the sides. There is a very common little weed, known to every body under the name of Shepherd's Purse, (*Capsella bursa-pastoris*) which grows by every roadside, producing its minute white flowers all summer. Its name seems to have been given it from its seed vessel having small pockets, with minute flat seeds, like fairy coins. Let the student procure a specimen of this, and examine its construction. The flowers are arranged in a raceme, and are quite destitute of bracts, the absence of which is a mark of this tribe. Observe, I pray you, says Lindley, how very useful it is to be aware of this. Imagine yourself cast away upon a desert island; and there, surrounded with plants of unknown forms and tempting looks, none of which you dare use from fear of their proving poisonous. Among them, however, you remark a good many of the same kind, one of which is just beginning to bear its tufts of flowers: the blossoms are too young to be examined, but old enough to show you that they grow without bracts; the leaves you would easily see were those of Exogenous plants, and you would immediately know that this species at least would be not only harmless, but the very best kind of vegetable for you to consume; a salad which might be eaten with the utmost confidence.

To return to the Shepherd's Purse; the sepals are four, and the petals four, arranged in the form which gives rise to the appellation of Cruciferæ, or Cross-bearers. The pistil is green, wedge-shaped, and bears the short style and flat stigma on its summit. If the ovary be cut open, it will be found to contain two cells, in each of which are a number of ovules, hanging by slender thread-like stalks, and originating, not from one pillar, like central placenta, but from a kind of partition which extends quite across the ovary to its sides. This shows the reason why in this order the ovary is often one-celled, and also explains the peculiar mode of dehiscence of the seed vessel. The fruit becomes a triangular, wedge-like body, heart-shaped at the summit, and is composed of three pieces, two of which, the valves, separate from the third, the *dissepiment*, and it is to the edges of this last piece that the seeds are united. The mode in which this curious seed vessel is formed will serve as another illustration of the theory which refers all parts of plants to different developments of the leaf. In this case, each valve is considered to be a carpellary leaf, the two edges of which are not entirely folded in, and the ovules arise, therefore, from a placenta formed by the thickened edge of each leaf, so that there are really four separate placentæ, and the ovules lie in four different directions. But the contiguous placentæ of the two carpels unite together, and project towards the middle of the ovary, and in this instance the opposite ones meet together and form a complete partition. In many other Cruciferæ, they do not meet, so that the ovary is one-celled, and the placenta parietal. This whole examination must of course be conducted by the aid of the microscope, and may be somewhat obscure and difficult, but the student will have learned the means of recognising with certainty the characters of this great tribe of plants, so widely diffused over the globe, all of which are quite harmless when eaten, and some of which are most excellent and salutary.

The fruit of many Cruciferæ differs from that which we have examined, and it is on this difference that the Linnæan orders of the corresponding group are founded. Instead of having a pod nearly as long as broad, called a *Silicle*, like that of the Shepherd's Purse, that of Cabbage, and Turnip, and others, is very long and slender, and is called a *Silique*. This difference is not made use of in dividing the Natural Order, however, but the genera, (which are so numerous as to make a division necessary,) are arranged in groups, founded on certain minute distinctions in the structure of the embryo.

The Cruciferæ are all herbaceous, and most of them annual plants. It is remarkable that while the characters of the order are so constant, those of the individual are liable to so great variation, under the influence of cultivation. This is shown in those which are cultivated for the beauty of their flowers, such as the Stock and Wall flower. Both these, says an often quoted authority, however lovely in their wild and single state, are chiefly cultivated when their flowers have become what is called double, that is to say, when the parts which are usually stamens, and pistils, and sepals, are all transformed into petals; by which means, the quantity of gaily colored parts is much augmented. It may be a subject of wonder how these double flowers are increased, for if the stamens and pistils are converted into petals, it would seem that no means are left for multiplying the race. This would doubtless be so, if all the stamens and pistils were really thus transformed; but among many flowers, some are found in which a perfect stamen or two remain; and others, in which a perfect pistil or two can be found. If the stigmas of the latter are touched with the pollen of the former, ovules are fertilized, and seeds are produced, which will grow into other plants, the flowers of which will be as double as those of their parents. No one knows why double flowers should be capable of being thus perpetuated; it seems as if any tendency which is once given to a plant, may be carried on from one generation to another, by a careful attention to stop all disposition to depart from the new character. In the Stock, any plant that produces flowers less double than usual, must have a tendency to depart from the double state, and, therefore, should not be allowed to bear seed. or to influence the seeds borne by others, but should be carefully eradicated as soon as its flowers are sufficiently expanded for their true character to be ascertained. By attention to such rules, Turnip-rooted and Long-rooted, White, and Scarlet, and Purple Radishes, and all the different races of Turnips, have been preserved for years; whereas, if great precautions had not been constantly taken to maintain them in their purity, they would long since have become thrown together, and reconverted into the wild form from whence they sprang.

The varieties of Cabbage and Cauliflower, are very numerous, and many are too well known to require mention. One or two are, however, very remarkable for their size. The Palm-Kale, which is much cultivated in the islands of the British Channel, grows to the height of ten or twelve feet, and another kind, the Tree-Kale, used in France as fodder for cattle, sometimes attains the height of sixteen feet. A species of Brassica, very like the Turnip, furnishes Rape-seed, from which is pressed a much used oil, while the refuse is a nutritious food for cattle, under the name of oil-cake.

Among other Cruciferæ in common use, may be named the different kinds of Mustard, Cress and Horse-radish, and the *Isatis*, from which the blue dye called Woad is obtained.

The plants of this order are more abundant in Europe than in any other quarter of the globe, only ninety out of the nine hundred species being peculiar to America. Their general character, as already stated, is to possess, in some degree, acrid and stimulating properties, such as are observed in mustard and horse-radish. None of the order are poisonous, and most of the species are very useful remedies for that dreadful malady, the scurvy, which, until late improvements in provisioning vessels, was a terrible scourge to crews upon long voyages. In this connexion ought to be mentioned a striking illustration of the utility of a knowledge of the Natural System. During Lord Anson's voyage round the world, near the beginning of the last century, a very large proportion of his crew lost their lives, or were rendered unfit for service, by the Scurvy; and although new and unknown lands, teeming with luxurious vegetation, were constantly being discovered, yet the dread which the surgeon entertained of the men being poisoned, was so great, that he would allow them to use no other fresh vegetable food than grass. If he had been acquainted with the simple fact that none of the Cruciferæ are deleterious, and that all possess, in a greater or less degree, those properties that render them more valuable than ordinary medicines in the treatment of that disease, he might have been able to restore many to health, by simply explaining to them the very evident marks by which this order is characterized, and encouraging them to seek for such plants, and to make use of them without apprehension.

OF FLOWERING, AND ITS RESULTS.

The article on Vegetable Physiology for the present month is delayed for the purpose of preparing some necessary wood cuts for its illustration, and in its place we offer the following interesting remarks of Dr. Gray on the subject of Flowering.

Plants begin to bear flowers at a nearly determinate period for each species, which is dependent partly upon constitutional causes, that we are unable to account for, and partly upon the requisite supply of nutritive matter in their system. For, since the flower and fruit draw largely upon the powers and nourishment of the plant, while they yield nothing in return, fructification is an exhaustive process, and a due accumulation of food is requisite to sustain it. When the branch of a fruit tree, which is sterile, or does not perfect its blossoms, is ringed or girdled by the removal of a narrow ring of bark, the elaborated juices, being arrested in their downward course, are accumulated in the branch, which is thus enabled to produce fruit abundantly; while the shoots that appear below the ring, being fed only by the crude ascending sap, do not bear flowers, but push forth into leafy branches. So also a seedling shoot, which would not flower for several years if left to itself, blossoms the next season when inserted as a graft into an older trunk, from whose accumulated stock it draws. The actual consumption of nourishment in flowering may be shown in a variety of ways; as by the rapid disappearance of the farinaceous store in the roots of the Carrot, Beet, &c., when they begin to flower, leaving them light, dry and empty; and from the rapid diminution of the sugar in the stalk of the Sugar Cane (as also that of maize) at the same period. The stalks are therefore cut for making sugar just before the flowers expand, as they then contain the greatest amount of saccharine matter. The consequence of this exhaustion may be illustrated by the facility with which annual plants are converted into biennials, or their life prolonged indefinitely, by preventing their flowering; while, whenever they bear flowers and seed, whether during the first or any succeeding year, they commonly perish. So a common annual Larkspur has produced a double flowered variety in the gardens, which bears no seed, and has therefore become a perennial. So, also, cabbage stumps, which are planted for seed, may be made to bear heads the second year, by destroying the flower shoots as they arise; and the process may be continued from year to year, thus converting a biennial into a kind of perennial plant. The effect of flowering upon the longevity of the individual, is strikingly shown by the *Agave*, or Century Plant—so called because it flowers in our conservatories only after the lapse of a hundred, or a least a great number of years; while in its native sultry clime it generally flowers in the course of five or six years. But whenever this occurs, the sweet juice with which it is filled at the time is consumed at a rate correspondent to the astonishing rapidity with which its huge flower stalk shoots forth, and the whole plant inevitably perishes when the seeds have ripened. So, also, the *Corypha*, or Talipot-Tree, a magnificent oriental Palm, which lives to a great age, and attains an imposing altitude, (bearing a crown of leaves, each of which is often thirty feet in diameter,) flowers only once; but it then bears an enormous number of blossoms, succeeded by a crop of nuts sufficient to supply a large district with seed, while the tree immediately perishes from the exhaustion consequent upon this over production.

Flowering and fruiting, then, draw largely upon the plant's resources, while they give back nothing in return. In these operations, and perhaps in these alone, do vegetables act as true consumers; decomposing their own products, and giving back carbonic acid and water to the air, instead of taking these materials from the air. It is in flowering that they actually consume most. In fruiting, although the plant is robbed of a large quantity of nourishment, this is mostly accumulated in the fruit and seed, in a concentrated form, for the future consumption, not of the parent plant, but of the new individual enclosed in the seed. The real and immediate consumption of nourishment by the flower, is shown by the action of flowers on the air, so different from that of leaves. While the foliage withdraws carbonic acid from the air, and restores oxygen, flowers take a small portion of oxygen from the air, and give back carbonic acid. While leaves, therefore, purify the air we breathe, flowers contaminate it; though of course only to a degree which is relatively and absolutely insignificant. When carbon is consumed as fuel, and by the aid of the oxygen of the air converted into carbonic acid, an amount of heat is evolved uniformly and directly proportionate to the quantity of carbon consumed, or of carbonic acid produced. The same amount is more slowly generated in the slower decomposition of an equivalent amount of vegetable matter, by decay,—a heat which is employed by the gardener, when he makes hot-beds of decaying tan or leaves, or by the breathing of animals, where it maintains their elevated temperature. Now, since flowers consume carbon, and produce carbonic acid, acting in this respect like animals, they ought to evolve heat in proportion to that consumption. This, in fact, they do. The evolution of heat in blossoming was first observed by Lamarck, about seventy years ago, in the European Arum, which just as the flowers open, "grows hot," as Lamarck stated, "as if it were about to burn." It was afterwards shown by Saussure, in a number of flowers, such as those of the Bignonia, Gourd, and Tuberose; and the heat was shown to be in direct proportion to the consumption of the oxygen of the air; or in other words, of the carbon of the plant. The increase of temperature in these cases was measured by common instruments. But now that thermo-electric apparatus affords the means of measuring variations inappreciable by the most delicate thermometer, the heat generated by any ordinary cluster of blossoms may be detected. The phenomenon is most striking in the case of some large Aroideous plants, where an immense number of blossoms are crowded together and muffled by a kind of hood, or spadix, which confines and reverberates the heat. In some of these, the temperature rises at times to twenty or even fifty degrees (Fahrenheit) above the surrounding air. The increase of temperature occurs daily, from the time the flowers open until they fade, but is most striking during the shedding of the pollen. At night the temperature falls nearly to that of the surrounding air; but in the course of the morning, the heat comes on, as it were, like a paroxysm of fever, attaining the maximum, day after day, very nearly at the same hour of the afternoon, and gradually declining towards evening. The source of the heat in flowering is evident. As to its object, we cannot say whether its production is the immediate end in view, and the plant burns some of its carbon merely as fuel, or whether the evolution of heat and the formation of carbonic acid are incidental consequences of certain necessary transformations. We have remarked that the principal consumption takes place in the flower; and that a store is laid up in the fruit and seed. But much even of this is consumed, with the evolution of heat, when the seed germinates. It may be said, therefore, that in the Century Plant, which, after living a hundred years, consumes itself for the benefit of its offspring, who literally rise from its ashes, we have the realization of the fabled Phœnix.

There is another condition, which, if not essential to the production of flowers, exerts an important influence. When plants are in continual and luxuriant growth, rapidly pushing forth leafy branches, they seldom produce flower buds. Our fruit trees, in very moist seasons, or when cultivated in too rich a soil, often grow luxuriantly, but do not flower. The same thing is observed when our northern fruit trees are transported into tropical climates. On the other hand, whatever checks this luxuriance, without affecting the health of the individual, causes blossoms to appear earlier and more abundantly than they otherwise would do. It is for this reason that transplanted fruit trees incline to flower the first season after their removal, though they may not blossom again for several years. A season of comparative rest is essential to the transformation by which flowers are formed. It is in autumn, or at least after the vigorous vegetation of the season is over, that our trees and shrubs, and most perennial herbs, produce the flower buds of the ensuing year.

The requisite annual season of repose, which in temperate climes is attained by the lowering of the temperature in autumn and winter, is scarcely less marked in many tropical countries, where winter is unknown. But the result is brought about, in the latter case, not by cold, but by excessive heat and dryness. The Cape of Good Hope, or the Canary Islands may be taken as illustrations. In the Canaries, the growing season is from November to March—the winter of the northern hemisphere—their winter also, as it is the coolest season. But the rains fall regularly, and vegetation is active; while in summer, from April to October, it very seldom rains, and the mean temperature is as high as 73°. During this dry season, when the scorching sun reduces the soil nearly to the dryness and consistency of brick, ordinary vegetation almost completely disappears, and the Fig-Marigolds, Euphorbias, and other succulent plants fitted to this condition of things, alone remain green, not unaptly representing the Firs and other evergreens of high northern latitudes. The dry heat there brings about the same state of vegetable repose as cold with us. The roots and bulbs then lie dormant beneath the sun-burnt crust, just as they do in our frozen soil. When the rainy season sets in, and the crust is softened by moisture, they are excited into growth under a diminished temperature, just as with us by heat; and the ready formed flower buds are suddenly developed, and at once clothe the arid waste with a profusion of blossoms. This season of interruption to growth, produced either by cold or dryness, occurs in a more or less marked degree, through every part of the world.

These considerations explain the operations of *forcing* plants, by which we are enabled to obtain in winter the flowers and fruits of summer. The gardener accomplishes these results principally by skilful alterations of the natural period of repose. He gives the plant an artificial period of rest by dryness at the season when he cannot command cold, and then, by the influence of heat, light and moisture, which he can always command, causes it to grow at a season when it would have been quiescent. Thus he retards or advances, at will, the periods of flowering, and of rest, or in time completely inverts them.

WILD FLOWERS IN JUNE.

June, 'leafy June,' has come at last, though long delayed by the clouds and frosts of this late cold spring. It is remarkable to observe how the first warm weather has brought forward the foliage and flowers. It would seem as if the trees and herbs, having had their energies locked up so long, had made a redoubled effort, and burst forth at once into full greenness and beauty. Whoever has journeyed through any northern section of the country during the past month, must have observed the striking difference between the aspect of the scenery, as it appeared a week ago, and as it appears now. Then scarcely a green thing broke the dull gray monotony; now buds are springing, flowers are blooming, birds are singing. Then, the farmer, as he looked upon his frosty fields, almost despaired of the fulfilment of the promise of seed time and harvest; now he is merrily watching the result of his toil and patience, in his growing crops. It is a difficult thing, among the thousand fair productions of Nature, all at once expanding, adding fragrance to the air and glory to the earth, to select those which are most interesting. Many May flowers continue to blossom during a great part of this month. A few days ago we found the Wild Columbine in full flower upon the highest rock of a craggy mountain in Connecticut, giving grace to a savage scene, with its slender upright stems and nodding flowers. Now will be seen, among the thickest foliage of the forest, the showy white involucres of the Dogwood, *Cornus Florida,* and, in the undergrowth, its humble, though scarcely less conspicuous relative, *C. Canadensis.* Of shrubs indeed a great number are in flower. The Swamp Pink, *Rhododendron nudiflorum,* with its fragrant flowers, so winning in their beauty that the most careless hand hesitates to pluck them from their leafy home; and the large spreading corymbs of red and white, and shining leaves of the Large Laurel, *Kalmia latifolia*, make the road-side through the woods like the borders of a great shrubbery, while the sandy level of the open glades is blue with the Pedate Violet. The Wild Cherry, *Cerasus serotina*, puts forth its racemes of white blossoms, giving to the feathered people promise of summer sustenance. On the warm hill sides, under the sheltering hedges peeps up the sweet little Milkwort, *Polygala paucifolia*, with its curiously fringed purple blossoms, so large in proportion to its height, and near and around it grow its neighbors, *Convallaria*, *Uvularia*, Geranium, and a hundred other "vagram posies." Now is the time to look for the Side Saddle Flower, *Sarracenia purpurea*, that vegetable spider, which is nourished in part by the unlucky flies who enter its hollow leaves. The Sarracenia is generally to be found in low, muddy, wet places, by the side of swampy ponds, among moss, and its nodding flower, with the singular peltate stigma, is quite as curious as the leaves. For its singularity this plant well deserves cultivation, and if taken up with a considerable portion of its native soil, with the Sphagnum, or White Moss, which almost always surrounds it, and planted in a large pot, which must be set into a pan or tub of water of sufficient depth to reach nearly the rim of the pot, it will thrive very well. We have found that a shady situation is also necessary. The pretty little Wood Sorrel, *Oxalis violacea*, with its frail purple blossoms, and one or two other less handsome species of the same genus, the Golden Alexanders, *Smyrnium*, or *Zizia*, conspicuous for their yellow umbels, the great Cow Parsnep, *Heracleum*, the delicate creeping Pennywort, *Hydrocotyle*, the Sweet Cicely, with its aromatic root, and other Umbelliferæ, are June flowers. As to Wild Roses, now is the season for their greatest profusion, and towards the latter part of the month, and the first of July, they perfume every thicket. We need not describe them; every one knows the Roses. Now the white blossoms of numerous Raspberries and Blackberries promise an abundant supply of their delicate fruit for the later months, and the Wild Currant promises to the same effect, but performs not. The

Honeysuckles, *Lonicera*, or *Caprifolium*, are now twining among the shrubs, and displaying their pale and fragrant blossoms, and those fine shrubs, the Hobble Bush, Arrow Wood, and the other species of *Viburnum*, are adorning the wood-sides, while under their shade creeps the delicate Partridge Berry, *Mitchella repens*. Let no one fail to examine and admire its wax-work petals. Only a few of the Compositæ flower so early, and those which do, are the less beautiful species, such as those of *Erigeron*, *Senecio*, and *Gnaphalium*. *Pyrola rotundifolia*, one of the neatest of plants, with its broad leaves and drooping fragrant white flowers, together with several other species of the same genus, will now delight the student, who seeks them among the dead leaves of old woods. Some of the Orchidaceæ are expanding their unique and puzzling flowers. *Orchis spectabilis*, *Arethusa bulbosa*, *Pogonia ophioglossoides*, *Cypripedium acaule*, and *parviflorum*, are all among the most curious and interesting plants which the collector will meet with. We shall shortly have a word to say about the cultivation of these and other natives of the same order, our especial favorites. The large blue flowers of the Iris are showing themselves among the grass by the pond side, along with the more humble Speedwells, *Veronica*. Along by the fences, near rocks in open grounds, may be found the Silk weed, *Asclepias syriaca ;* but the handsomer species of Asclepias do not flower till nearly a month later. Among the high grass in the meadows, the eye of the rambler will be attracted by the yellow flowers of the Star grass, *Hypoxis erecta*, and the blue flowers of the *Sisyrinchium anceps*, which show, indeed, as if they might have suggested the thought which

> **Spake full well, in language quaint and olden,**
> **One who dwelleth by the castled Rhine,**
> **When he called the flowers, so blue and golden,**
> **Stars, which in Earth's firmament do shine.**

One of the most showy of native plants is the Lupine, *Lupinus perennis*. We stopped the other day, after a long ride, with a thunder shower coming on, to collect specimens of it, which were covering the side of a sandy wood with the blue tint of their long regular racemes. The Celandine, *Cellelidonium majus*, is displaying its yellow flowers, and smooth spreading leaves, under the fences. *Mitella diphylla* is a pretty plant, which is now in flower. One glance at its two opposite leaves about half way up the stem, and its beautifully fringed petals, is sufficient for recognising it. It grows in the woods, and with it is often found a near relation, *Tiarella cordifolia*, which much resembles it in general appearance. Let the student pay particular attention to the peculiar capsule of both. On the roots of old trees, that curious parasite, the Indian Pipe, *Monotropa uniflora*, will attract the eye to its white, pellucid stem and leaves, and solitary flower, which give it very nearly the shape which suggested its common name. Its woolly brother, *M. lanuginosa*, does not flower till August. The Loosestrifes are, two or three of them, in bloom, and one, *Lysimachia quadrifolia*, will be noticed for the regularity of its whorls of leaves, each with a flower in its axil. One of the same Order, (Primulaceæ,) is remarkable, not only for its pretty star-like white flowers, shining leaves, and delicate aspect, but for its being the only native example of the Linnæan Class, Heptandria, having seven stamens, and seven divisions of the calyx and corolla. It is a low, neat plant, and must be handled carefully. It is very strange to observe with what singular inappropriateness botanists have in many cases given names to plants. They appear to be the least judicious of all sponsors. Now here is a plant all in sevens, and not at all in sixes, and yet it is called from *triens*, the *third* part of a thing, *Trientalis Americana*. Among the high grass of wet meadows, the most indifferent observer must notice the brilliant scarlet bracts of the Painted Cup, *Euchroma*, or *Castilleja, coccinea*. This beautiful plant is figured in a former number of this work. A few others of the Labiatæ are in flower, such as the *Prunella*, and *Galeopsis*, and some of the Mints, but most of the Order do not bloom till autumn. A rough, coarse stemmed plant, with very handsome violet-colored flowers, in open fields and waste places, is the Bugloss, *Echium vulgare*, and another of the Boragineæ, rougher and coarser if possible, and known also as Bugloss, is *Lycopsis arvensis*. It is not exactly a native, but has been here long enough to have become naturalized. Along fences, by the sides of woods, the flowers of the small Bindweed, *Convolvulus arvensis*, are conspicuous, and the long, slender, twining stem, with its hastate leaves, is easily recognised. A larger flowered species, but with similar leaves, *C. Sepium*, is found in the same places. On the surface of stagnant waters at this season will often be seen patches of green, which when examined will be found to consist of a collection of small floating leaves, each about an inch long, with a cleft in one side, from which proceeds a minute flower, with two stamens and a single style. From the centre of the leaf hangs down into the water a solitary root, with a kind of sheath at the end. This is *Lemna minor*, Duck-meat, and is well worth placing under the microscope. A more rare plant than almost any we have mentioned, is that slender and delicate vine, which may sometimes be found among hedges, with its three-nerved, heart-shaped leaves, and fascicles of small greenish flowers. This is *Dioscorea villosa*, a species of the same genus which produces the Yam. It is presumed that the collector has already, if he has been at all among the woods and thickets, had his coat torn and his hands scratched by that nuisance, the Bull Brier—called so, we suppose, from its being strong enough to stop the progress of the maddest of the Vaccine family—with its long thorny stems. If he has made its acquaintance in this way, we need only direct his attention to its umbels of green flowers, and remind him that its name is *Smilax rotundifolia*. As to the Grasses, Cyperaceæ, and Juncaceæ, hundreds of which are now flowering, we can but hope that the reader will have patience to study them.

THE DUCKWEED.

As we have mentioned the Duckweed (*Lemna minor*) among those plants which flower in June, the following description of its structure may induce the reader to seek for and examine it :—

In Duckweed there is nothing but a fleshy floating green body, which looks like a green scale, and which is in reality a compound of both root and stem. Most people fancy that Duckweed never flowers. If, however, you will fix your eyes attentively upon a mass of it, on a still sunshiny day in the month of June or July, you will probably discover exceedingly minute straw-colored specks here and there on the edges of the plants; they have a sparkling appearance, and notwithstanding their minuteness, readily catch the eye. These are the anthers, and they being found, you have only to carry home the plants, and place them under a microscope, when all the secrets of their flowering stand revealed. Where the anthers have caught the eye, will be seen a narrow slit, out of which they peep; if you widen this slit with your dissecting instruments, you will be able to extract the blossom entire; and you will have before your eyes the simplest of all known flowers, as Duckweed itself is the simplest of all known flowering plants. The flower consists of a transparent membranous bag, split on one side; within it are two stamens, and one ovary with a style and simple stigma. The fruit contains but one cell, in which are one or more seeds; its shell is a thin, cellular integument.

Such are the simple means that Duckweed possesses of propagating itself; means, however, which appear to be abundantly sufficient, if we are to judge from the immense quantities which sometimes rise to the surface of our ponds. Besides the species under consideration, there are three others, which appear to be common both to Great Britian and North America. We have here no other genus belonging to the same natural order; but in tropical countries, its place is occupied by a plant called *Pistia*, which is a sort of gigantic Duckweed, with broad lobed leaves, like some Lichens, and a more highly organized flower.

EFFECT OF PLANTS UPON THE AIR.

All nature is in a continual state of decay and renovation. The perishing remains of animals and plants exhale putrid effluvia, which mix with the atmosphere, and render it impure; the incessant action of respiration through the whole animal world, increases the impurity by abstracting the vital air or oxygen, and substituting foul air or carbonic acid. This combined action has been going on from the beginning of the present order of created things, and yet it does not appear that the air we breathe is less suited to our constitutions now, than it was in the beginning. This is owing to the agency of plants, which existing wherever man or animals can exist, are perpetually at hand to catch up and consume the impure particles of the atmosphere, as fast as they are generated, and by fixing the carbonaceous part in their own systems, and again liberating the vital air or oxygen with which the former was in combination, they restore to the air all the purity which it had lost. Here, then, you have another of those admirable proofs of wisdom and design that meet the philosophical observer at every step. Plants are Nature's eternal laboratories for the decomposition of what would be injurious to man and other animals; the means by which the nicest equipoise is maintained between two most important opposite principles. Hence it is that the most tiny grass, or the most obscure weed, becomes in the hands of Providence an efficient means of working out the great designs of the creation.

This is not a phenomenon, liable to derangement or interruption, but ordered with the most admirable precision in every portion of its details. Thus, for example, although it is through the agency of leaves that the salubrious effect upon the air is brought about, yet we are not to suppose that when the leaves have dropped from the trees, and the forest exhibits nothing but bare and naked branches, this agency is diminished. Leaves fall off indeed in winter, but at that time the corruption of the air, by the putrefaction of organized matter, is either arrested or very much diminished, and the green carpet which even in the driest countries springs up at that season, presents an elaborating surface of immeasurable extent, and amply sufficient to consume such gaseous impurities as may then be engendered. On the other hand, in the spring, when an elevated temperature sets rapidly at liberty the elastic impurities that the winter had bound in chains, leaves too are produced with renewed vigor, and still carry off from the atmosphere all that the rapidly decaying matter is mingling with it, separating for themselves what man is incapable of respiring, and generating in its room, in infinite abundance, that vital air or oxygen, without which, living things would perish.

> Hence in bright floods the vital air expands,
> And with concentric spheres involves the lands;
> Pervades the swarming seas, and heaving earths,
> Where teeming nature breathes her myriad births;
> Fills the fine lungs of all that *breathe* or *bud*,
> Warms the new heart and dyes the gushing blood;
> With life's first spark inspires the organic frame,
> And as it wastes, renews the subtle flame.

These very beautiful lines are from the "Botanic Garden" of Darwin, a writer of an ingenious and philosophical mind, whose poetry is now forgotten, although it has some splendid passages, and contains numerous descriptions of natural phenomena, expressed in language remarkable alike for its magnificence, and for its fidelity to what were, in the author's time, considered facts.—*Ladies' Botany.*

CYPRIPEDIUM—LADIES' SLIPPER.

Natural Order, Orchidaceæ; Linnæan System, Gynandria, Diandria. Generic Distinctions:—Corolla, four-petalled, spreading; lip, inflated, ventricose, obtuse; column, terminated by a petaloid lobe; capsule, three-valved, one-celled.

***C. acaule.*—Scape, leafless, one-flowered; leaves, two, radical, elliptic-oblong, rather acute; petals, lanceolate; lip, longer than the petals, cleft before.—*Plate* 27.**

Cypripedium is compounded of two Greek words, meaning Venus' Slipper, in allusion to the form of the lip, which, however, bears no very striking resemblance to that of a slipper. The genus contains several very curious and beautiful plants, of which the one in our plate is perhaps the best known in the Northern States. It is not easy to mistake this species for any thing else, or to confound it with any other Cypripedium. It differs from all others of the same genus in having no stem leaves. The leaves are never more than two; they spring from the root, are large, plaited, and downy. The scape is from eight to twelve inches high, the flower single, nodding. The petals are four, of a purplish green color, the two lateral ones twisted. The chief beauty of the flower consists in the lip, or nectary, which is a large, veined, inflated bag, of a delicate pink color. This plant grows in old, dark woods, not uncommonly, in most parts of New England, and blossoms in June.

Three other species are natives of the United States. One of these, *C. parviflorum*, is readily known by its leafy stem, and yellow flowers, and another, *C. arietinum*, often called Ram's Head, has a much smaller flower than the rest, with linear petals. The most beautiful, and largest species, is *C. spectabile*. It is more than two feet in height, with large leaves, and a white purple striped lip at least two inches long.

We ought to add, that the portrait in our plate was lithographed from a drawing of a fine fresh specimen of the plant itself, and is a very correct likeness.

The Natural Order to which these plants belong, contains

Pl. 27.

Cypripedium acaule (Ladies Slipper).

Ackermann's Lith. N.Y.

some of the most singular and interesting species of the Vegetable Kingdom. They are almost always remarkable for the vivacity of their colors, the singularity of their organization, the grotesque appearance of their tortuous roots and stems, or the delicious perfume of their flowers. They are distributed in abundance over the whole earth. In tropical countries they often constitute the chief beauty of the forest, many of them being epiphytes; and hanging from the branches of trees, or springing from prostrate trunks, of dead timber, they adorn the one with bright hues and rich odors, and render the other more beautiful in death than in the full vigor of existence. To detail the singular traits of these plants, and to explain the peculiarities of their structure, belongs to the notice of the order, which will come in in its proper place. There are several other well known and very beautiful and curious American genera, which we shall hereafter have occasion to mention, and figures of some species of which we shall offer.

The Ladies' Slipper may be cultivated with ease, by taking up with the roots a portion of the black earth in which it grows, setting the plants out in a moist, shady situation, and giving them plenty of water. They may be increased by planting the seeds; and in order to have the seeds fertile, it is a proper precaution, to take some of the pollen from the anthers and apply it to the stigma.

GENTIANA—THE GENTIAN.

Natural Order, Gentianaceæ; Linnæan System, Pentandria, Monogynia.

Generic Distinctions:—Calyx, four or five cleft; corolla, campanulate, tubular at base; border, four or five cleft; stamens, four or five, included; capsule, two-valved, one-celled, many seeded.

***G. Saponaria*.—Leaves, oval, lanceolate, three-nerved, acute; flowers, in whorled heads, sessile; corollas, ventricose, clavate, campanulate, closed at top, ten-cleft, the inner segments plicate and fringed.—*Plate* 28.**

The name of this genus is derived from Gentius, a king of Illyria, who is said to have discovered its tonic properties. The species are widely distributed over the temperate parts of Europe, Asia, and America. Their properties are tonic, and many of them are intensely bitter. The flowers are often very handsome, and generally of a blue color. We have several elegant North American species, of which the one here engraved is perhaps the most showy. It is not uncommon by the sides of streams, in meadows and moist ground, and produces its flowers in September. The stem is about a foot in height, with smooth, opposite, three or five nerved leaves. The flowers are deep bright blue, in bunches on the top of the stem, and are singular, from their never fully expanding. They might indeed be easily taken for buds, and one not acquainted with this peculiarity, would naturally wait for them to open. By drawing apart the outer segments of the corolla, the fine fringe of the inner segments will be seen. The color of the flowers sometimes varies to purple or white in different shades. Another very beautiful and delicate American species, is the Fringed Gentian, *G. crinita*, which may be at once known by its large light blue flowers, and the elegantly fringed borders of the petals. There are numerous other species of Gentian, growing in various parts of the Eastern continent, some of which are in request as garden flowers, and others are of use as affording medicinal substances. *G. lutea*, an European species with yellow flowers, is the one which produces the bitter so much used in tonic medicines, under the name of *gentian*, from its roots, which are thick and yellow. According to Dr. Gray, any of our native species may be substituted for it.

G. Saponaria, as well as the others, may be cultivated in almost any light, rich soil, and may be increased by sowing the seeds, or by dividing the roots. It is said that the seeds should be sowed as soon as they are ripe, as, if left for a few months, they are not likely to germinate.

ASCLEPIAS—SWALLOW-WORT, OR SILKWEED.

Natural Order, Asclepiadaceæ; Linnæan System, Pentandria, Digynia. Generic Distinctions:—Calyx, small; petals, united at base, reflexed; corona, (nectary,) five-lobed, with five averted horns at the base of the lobes; antheridium, (connate mass of anthers,) five-angled, truncate, opening by five longitudinal fissures; pollinia, (masses of pollen,) in five distinct pairs; follicles, two, ventricose; seeds, comose.

A. tuberosa.—Hairy; branches, spreading at the summit; leaves, distant, alternate, oblong-lanceolate; umbels, numerous, sub-corymbose, terminal.—*Pl.* 29. *Fig.* 1.

Asclepias is the Greek name of Esculapius, the god of medicine and physicians, and was applied to the plants of this genus, in reference to their supposed sanitary virtues. In some respects, these plants are very curious. All of them are filled with a milky juice, which, when the stem is broken, flows most copiously, and abounds in the substance called caoutchouc, or Indian Rubber. The most common American species, *A. syriaca*, is well known from its juice, which is reputed to cure warts, and is usually called Milkweed. There are about ten or twelve native northern species, several of which are very ornamental. Of these, the one which forms the subject of our plate is the most showy, neat, and beautiful. It is commonly called Butterfly-weed, from the circumstance of its flowers being great favorites with the Butterflies, and often covered with those elegant insects. The construction of its flowers is very singular, and the description of them in the following notice of the plant, by Dr. Bigelow, will guide the student in his examination of other species, the flowers of all having the same peculiarities.

The root of this plant is large, fleshy, branching, and often fusiform. It is only in comparison with the other species, that it can be called tuberous. The stems are numerous, growing in bunches from the root. They are erect, ascending, or procumbent, round, hairy, green or red. Leaves scattered, the lower ones pedunculated, the upper ones sessile. They are narrow, oblong, hairy, obtuse at base, waved on the edge, and in the old plants sometimes revolute. The stem usually divides at the top into from two to four branches, which give off crowded umbels from their upper side. The involucrum consists of numerous short subulate leaflets. Flowers numerous, erect, of a beautifully bright orange color. Calyx much smaller than the corolla, five-parted, the segments subulate, reflexed, and concealed by the corolla. Corolla five-parted, reflexed, the segments oblong. The nectary, or stamineal crown, (corona,) is formed of five erect cucullate leaves or cups, with an oblique mouth, having a small, incurved, acute horn, proceeding from the base of the cavity of each, and meeting in the centre of the flower. The mass of stamens, (antheridium,) is a tough, horny, somewhat pyramidal substance, separable into five anthers. Each of these is bordered by membranous, reflected edges, contiguous to those of the next, and terminated by a membranous, reflected summit. Internally they have two cells. The pollen forms ten distinct, yellowish, transparent bodies, of a flat and spatulate form, ending in curved filaments, which unite them by pairs to a minute dark tubercle at top. Each pair is suspended in the cells of two adjoining anthers, so that if a needle be inserted between the membranous edges of two anthers, and forced out at top, it carries with it a pair of the pollen masses. Pistils two, completely concealed within the mass of anthers. Germs ovate, with erect styles. The fruit, as in other species, is an erect, lanceolate, ventricose follicle, on a sigmoid peduncle. In this it is green, with a reddish tinge, and downy. Seeds ovate, flat, margined, connected to the receptacle by long silken hairs. Flowers in August.

Another very handsome species is *A. incarnata*, which is rather taller than the Butterfly-weed, with large leaves, and deep purple or rose-colored flowers. Another remarkable species is *A. verticillata*. The stem is very slender and delicate, the flowers small and greenish white, and the leaves in whorls of five or six. This plant is reputed in some parts of the south and west to be a cure for the bite of the rattlesnake, and it is said that the Indians will sometimes, by the use of it, prevent any injury from that venomous reptile, which for a little whiskey they will allow to bite them. Whether in such cases the fangs of the snake had not, by a well-known operation, been previously drawn out, our authority does not state.

Asclepias tuberosa (Butterfly-weed) Fig. 1.
Chimaphila umbellata (Wintergreen) Fig. 2.

Ackermann's Lith. N.Y.

CHIMAPHILA—THE WINTERGREEN.

Natural Order, Ericaceæ; Linnæan System, Decandria, Monogynia. Generic Distinctions:—Calyx, five-parted; petals, five; stamens, ten, erect; anthers, fixed by the middle; style, very short and thick; capsule, five-celled, opening from the summit.

***C. umbellata.*—Leaves, in fours or sixes, lanceolate, cuneate, toothed; flowers, corymbose; style, immersed in the ovary.—*Pl.* 29. *Fig.* 2.**

Chimaphila is compounded of two Greek words, signifying winter, and to love, a kind of translation of the common name, Wintergreen. This, and the genus *Pyrola*, in which it was once included, are composed of low, small plants, some of them half shrubby, and bearing very pretty and neat flowers. They are all called Wintergreen, though the spicy aromatic shoots, and scarlet berries sold in the New England markets under that name, and used for flavoring beer, are produced by another plant of very similar habit, *Gaultheria procumbens.* The species figured in Pl. 29, is one of the most common and handsome. The root is creeping, and woody, sending up angular stems.—The leaves grow in whorls or clusters of from four to six. They are evergreen, coriaceous, on short petioles, wedge-shaped, serrate, smooth and shining. The flowers are in a small corymb, on nodding peduncles, which are furnished with linear bracts. The calyx has five roundish teeth or segments, much shorter than the corolla. The petals are five, roundish, concave, spreading, cream colored, with a tinge of purple at the base. The stamens are ten, each with a two-celled anther, each cell opening by a tubular orifice. The ovary is roundish, depressed, furrowed, with a funnel-shaped cavity at top. The style is straight, inversely conical, inserted in the cavity of the germ, and concealed by the stigma, which is large, peltate, convex, and moist. The capsules are erect, five-valved, five-celled, and the seeds chaffy, very minute and numerous. It inhabits dry woods, flowering in June and July, and sometimes is found in great abundance.

Another beautiful species, very striking in its appearance, is the Spotted Wintergreen, *C. maculata.* Its leaves are curiously

Pl. 30.

Salvia fulgens (Brilliant Sage.)

Ackermann's Lith. N.Y.

variegated with white lines along the mid-rib and nerves. Both these species, as well as the Pyrolas, are cultivated and highly prized in England, and doubtless we should see them often in American collections, if they were not natives of our own soil. They may be cultivated with ease in shady situations in gravelly ground, and require frequent waterings.

SALVIA—THE SAGE.

Natural Order, Labiatæ; Linnæan System, Diandria, Monogynia. Generic Distinctions:—Calyx, tubular, striate, two-lipped, the upper lip entire or three-toothed, lower lip bifid; corolla, ringent; the upper lip straight, or falcate, lower lip spreading, three-cleft, emarginate; stamens, two; connectile, transversely articulated to the filament, supporting at each end a cell of the dimidiate anther; achenia, four.

S. fulgens.—Leaves, cordate ovate, crenate, woolly below. Flowers, verticillate; bracts, ovate, long, acuminate; calyx, trifid; helmet of the corolla, hairy.—*Pl.* 30.

Salvia is from the Latin *salvere*, to save, in allusion to the salutary properties of the genus. The species are very numerous, and widely distributed over the world. They are all herbs or somewhat shrubby plants, with leaves generally wrinkled or rough, an aromatic smell, and flowers in spikes. They are all easily cultivated, and some of them are in great favor as ornamental garden flowers. *S. officinalis*, in such common use as a culinary plant, in various operations of cookery, is a native of the South of Europe. It was once in great repute as a sudorific and antiseptic medicine, and sage tea is still an approved prescription in many womanish ailments. Several other species are in use for various purposes, and all agree in possessing tonic and aromatic qualities. Only seven or eight species are natives of North America, of which a single one, *S. lyrata*, with blue flowers, inhabits the Northern States.

S. fulgens, is undoubtedly the most splendid species, and its superb scarlet flowers make it very ornamental. It is a native of Mexico, and has for some years been introduced into our northern gardens. The stem is about four feet in height, shrubby at the base, dividing into numerous branches, thickly covered with whitish hairs. The leaves are wrinkled, and hairy on both sides, the hairs on the lower side being so dense as to make it appear white. It only needs to be planted in the open border in a very rich soil, and it will flower abundantly all summer. In frosty weather it should be protected, and may be propagated by cuttings, planted out in the spring.

Another very beautiful Mexican species, is *S. patens*, with very large flowers, of a most intense and brilliant blue

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A VISIT TO CHATSWORTH.

The celebrated seat of the Duke of Devonshire, at Chatsworth, with its conservatories and gardens, the most extensive and best managed probably in the world, have been for years a source of great curiosity and interest to all travellers who have a taste for the cultivation of plants. The grounds are under the management of Mr. Paxton, the editor of the splendid work, "Paxton's Magazine of Botany." The following description of Chatsworth, by a correspondent of "The Magazine of Gardening," will be new and interesting to many American readers:—

I went to Chatsworth on business, with a letter of introduction to Mr. Paxton. On inquiring for his residence, I was directed to pass through the kitchen garden, which, I found to my astonishment, contained eight acres of ground. At the extremity of this gigantic potarium I found the house, a large and very handsome one, with two beautiful conservatories attached to it, filled with exquisite specimens of the rarest plants. Mr. Paxton was unfortunately gone to London, but we were shown into a drawing room exceedingly well and tastefully furnished, with a grand piano, pictures, &c.; and what interested us most, some dozen of silver cups, presented by various horticultural societies to Mr. Paxton. Mrs. Paxton, a very unaffected, nice woman, soon made her appearance; she expressed her regret that Mr. P. was from home, but she hoped we would amuse ourselves by seeing Chatsworth, and sent one of the gardeners with us to show us every thing. Where I shall begin with my description of the most complete, most extensive, and best cultivated garden I ever saw, whether in exotic plants, stove and hot-house fruits, kitchen stuff, hardy fruits, or herbaceous flowers, I hardly know. You must accompany me, attended by an intelligent gardener, into the two conservatories, attached as wings to Mr. Paxton's house, which were filled, on one side with stove plants, all gigantic but flourishing, and such as are in season in full flower, the parasitical plants falling from the roof in clusters of flowers; on the other side, conservatory plants, among the most conspicuous of which were some *Ericas* (Heaths) standing two or three feet high, and five or six feet in circumference, so covered with flowers as to leave hardly a space through which you could discern the leaves and branches. We next went to the succession fruit houses, consisting of eight ranges of hot houses, three in each range, and each range measuring two hundred and forty feet long. In the first six houses were Pine-apples in every state, from young plants to ripe fruit. In the next six houses were Grapes, each house in succession to the preceding one, and with the most superb crop of grapes you can conceive. Then came Peach-houses, filled with fruit; then Melon-houses, and last of all, Fig-houses, with full crops of figs just ripening. These houses, though very interesting, I have hurried you through to accompany me to the mushroom houses, or rather cellars; I dare not say what was the length of these, but I should think at least one thousand feet. We next walked through a part of the kitchen-garden, consisting of half an acre of asparagus beds, quarter of an acre of onions, the same of carrots, and the same of rhubarb, the finest I ever saw, and every other vegetable in the same proportion. "Why," said one of us to the gardener, "you can never consume these vegetables?" The reply was, "When the Duke is here, we make a pretty considerable hole in them, when you recollect we have one hundred mouths in the servants' hall, besides from fifty to sixty at his Grace's table, and the stewards' table, housekeepers' table, &c., to supply in addition." The orchard also consists of eight acres, and contains the finest sorts of apples, pears, plums, damsons, and other fruits; but I will not take you there, but walk across the park to the ornamental garden; first taking a peep into the orchideous house, which contains, I believe, specimens of every Orchidaceous plant known in England. The house is not ornamental, being built so as to suit the plants, but it covers an immense space of ground, and finer specimens, many in full blossom, I never saw. Now we cross the magnificent park, which I might fill a sheet by describing, as it is the most beautiful of parks by nature, and is improved by art to its highest perfection. I will only stop one moment to look at the mansion—or I ought rather to say small town, for it is the largest house I ever saw, (Buckingham palace would be lost in it) and of the purest Grecian architecture. Though splendid in the extreme, no part of it is gaudy or tinsel-looking, but every thing is noble and princely. The ornamental garden is a quarter of a mile distant from the house, forming one of the vistas from the windows, the beds of flowers cut out of the finest velvet carpeting of turf you ever saw; each flower having its own peculiar bed, the formality of it broken by standard rose trees, climbers, running up real antique pillars, baskets of flowers, or broken ruins covered with the tribe of rock plants; the garden backed by a fine wood, in front of which is the green house, filled with Camellias, five and six, and even ten feet in height; Geraniums, Botany Bay trees, (for I cannot call them shrubs), Mimosas, Ericas, Palms, Musas; in fact, a mixture of the productions of all countries. An iron staircase leads from below to a gallery, so that after admiring the plants, you may go above and see their tops reaching ten or fifteen feet high. Nothing can be finer than the condition of these plants. From this we descended to the Italian garden, which is close under the windows of the house; stopping on our way to admire the different vistas over lakes of water, which as if by magic throw up fountains on different sides, the jet of one of which reaches sixty feet high in a single column. Arrived at the Italian garden, we might fancy ourselves really in Italy. It is a level plot of two or three acres, with marble divisions for the flowers, some in form of immense baskets, others in that of vases, others in that of immense sea-shells; in fact, every variety of form, all filled with plants in flower. The plants, being in pots, are taken away when out of flower, and replaced by others, so that under the windows of the house they make a perpetual flower garden. The formality of this arrangement is broken by large plots of roses, and the whole garden is formed in terraces, in the Italian style, each fenced with a stone balustrade.

We must now walk on, or our time will not permit us to see the waterfall, which terminates one of the vistas. The machinery of this is so good, and the deception so well managed, that you see a broad sheet of water, apparently falling 500 or 600 yards, perpendicular, when it falls over only a succession of broad steps, from the top of a hill about 200 feet high, being supplied with water from a resevoir of sixteen acres on the top. The water is amply sufficient, and falls with great force, occupying about three minutes in reaching the bottom, and there disappearing as if by magic, being conveyed under ground. Now we arrive at what will be, when finished, the wonder of wonders, the new conservatory, situated in a secluded spot, surrounded by magnificent oaks, which, sheltering it from the winds, do not shade it from the sun. I cannot describe it. The centre is finished, and consists of one oblong, oval dome, 60 feet high, 360 feet long, and 140 wide; with two wings, each 100 feet long, entered through an arch of rock-work, as if going into a cave, but the entrance large enough for a carriage to drive in, and a carriage road goes actually through the whole. The plants are all to be planted in the soil, without pots, and some idea of its size may be formed, when I tell you that the pipes for heating it would form a line six miles long. I never saw anything so magnificent; when we drove into the park, the sun was shining on it, and we took it for a sheet of water, surrounded by hanging woods. Our time has been so taken up with this immense conservatory, that we shall only be able to see the water garden on our road to the house. This garden consists of weeping willows and other trees, collected together in a clump, at a little secluded spot, which, on a sudden, throw jets of water from the point of every leaf, thus forming an artificial shower of rain; but, although very pretty, and certainly very ingenious, the trees being all artificial, still, after the princely grandeur we have been admiring, it seems small and insignificant.

Our space would not suffice, and the subjects are not suited to a floral work, to describe the splendor and magnificence of the interior of the mansion at Chatsworth, (a full account of which would indeed fill a large volume,) and we must be contented with alluding to a single room, in which is produced a most enchanting effect when lighted up at night. This is a large gallery, lighted from above, fitted with large specimens of oranges, lemons, Camellias, Rhododendrons, Bananas, and a great variety of other plants, in large tubs and boxes, placed on the floor, so as to leave plenty of space to walk about, and forming a complete promenade garden in the house.

ON THE CULTURE OF ROSES.

Roses may be planted either in autumn or spring; but many persons prefer the latter. The advocates of spring-planting say that it is almost impossible to take up roses without injuring their roots; and if planted with broken roots in autumn, when the plant is in a languid state, the wounded part is more likely to rot than to heal; whereas, in spring, when the sap is in motion, the vigorous state of the plant enables it to heal the wound immediately. However, though opinions may differ on this subject, there can be no doubt but that spring is the season for planting all the China, and other delicate roses, and that the first week in April, or as soon as the frost is out of the ground, is the suitable time.

The first point is to select a suitable situation, fully open to the sun and air; as, though some few kinds of roses may be planted as under-growth under the drip of trees, the greater part must have abundance of sun and air. The situation of the rosery having been chosen, care should be taken that the ground be well drained; and where the expense is not objected to, a bed may be excavated, two feet deep, and a layer of brickbats, stones and rubbish, six inches deep, laid at the bottom. The bed should then be filled up with a compost of nearly equal parts of turfy loam, or loam from old pasture land, and vegetable mould, or very rotten manure, mixed with about the eighth part of the whole of sand. When climbing roses are planted for forming pyramids or pillars, a pit about eighteen inches in diameter, or rather more, should be prepared in this manner for each rose; and a similar plan should be adopted in every situation where any particular rose is wanted to grow with great luxuriance.

The bed or pit having been prepared, and raised a little above the general level of the garden, to allow for the new ground settling, the roses should be taken up, and their roots having been carefully examined, and all the bruised parts cut off, they should be planted about two feet apart, if of the delicate growing kinds; or three feet apart, if of those kinds which are very strong and robust. Roses should always be planted carefully, with their roots well spread out; and they should be kept out of the ground as short a time as possible. They should be frequently watered for some time after planting, and a little fresh stable manure should be laid on the surface of the ground, over the roots.

The hybrid China roses are the best for forming pyramids and pillars, as they make shoots generally from six to ten feet long every season, and their branches are flexible, as well as vigorous. Their foliage is also very luxuriant, and healthy, and their flowers very beautiful, and of clear and delicate colors. They require a very rich soil, and when pruned, their shoots should never be shortened; but those that have become old should be cut of close to the main stem, and abundance of young wood left, as shoots two years old always produce the best flowers.

The season for budding roses extends from July to September; and as it is an operation admirably suited to ladies, from its requiring skill rather than strength, we shall here give some directions for performing it. The first thing necessary, is to procure a proper knife; that is, one with the haft made thin at the end, for the purpose of raising the bark after the incision is made. The knives usually sold for budding are sharply pointed, but if one can be procured with a round point, it will be found easier to manage. Some bast matting must then be pulled into ribbons or strands, and laid in water to be ready. A stock must then be selected, and this may be either an old tree-rose, or a wild brier transplanted from the hedges the preceding year, or a wild rose raised in the garden from seed, and two or three years old, or a sucker sprung from the roots of some garden rose. When the stock is selected, a small part of the stem must be chosen, and all the side shoots, above and beneath it, except those forming the head of the stock, must be cleared away. An incision should then be made in the bark, about half an inch long, horizontally, and from the centre of this a perpendicular cut one or two inches long must be made, downwards. The great art in doing this is to cut entirely through the bark, without wounding the wood; and it is for this reason that a blunt pointed knife is better than one with a sharp point, as with the latter it is very difficult to avoid wounding the wood. The bud must then be prepared, by cutting it out of a shoot of the current year's growth. This is done by inserting the knife about half an inch above the bud, and then cutting downwards, so as to take out the bud with the wood of about half the thickness of the shoot. This piece of wood must then be separated from the bark, without injuring the bud; and this is the most difficult part of the whole operation, as if it be done carelessly, the eye of the bud will be probably pulled away with the wood, and the bud will be rendered useless. The separated bark must therefore be carefully examined on the inner side, and if no hole is found where the bud is, it is in a proper state. The bark of the stock must then be carefully raised with the haft of the knife, on each side of the perpendicular incision, and the bud, being first reduced to the proper size, must be slipped carefully in. The bark of the horizontal incision is then raised to admit the upper part of the bud, and the operation is finished, except tying the stem several times round with the strands of bast matting, in order to keep the bud in its proper place.

In about a month, if the bud be found to look full and fresh, it has become united to the stock, and the bandage may be loosened to allow it room to swell; and when the operation has been performed in July, the head of the stock is generally taken off about a week afterwards, in order to throw all the strength into the bud. If, however, the operation be deferred until August or September, the head of the stock is generally left on till spring. All the shoots below the bud should be rubbed or pinched off as soon as they appear.

Magazine of Gardening.

THE NATURAL SYSTEM OF BOTANY.

NUMBER SEVEN.

Order—Violaceæ. *The Violet Tribe.*

After Cruciferæ, in the natural arrangement, come several orders, which comprise but few genera, and those of no great interest. Passing by these, we come to a small, but interesting order, which contains some well known and favorite plants. This is the order Violaceæ, the Violet Tribe. To study its structure, take the common garden Violet, or Heartsease, *Viola tricolor*, which is easily obtained, and the parts of which are larger and more readily examined than those of most other species. The leaf is narrow, oblong, and undivided. At its base are a pair of large, sessile stipules, deeply cut, and these give the leaf the appearance of being lobed. The sepals of the calyx are five, of unequal size, and prolonged at the base. The petals are also five, unequal, and two of them stand upright, so as to appear above the others, and a third has a horn or spur at its base. The stamens are also five, without filaments. Two of them have long projections which are hidden in the horn of the petal, and they are all terminated by a membranous expansion. The ovary is superior and one-celled, with three parietal placentæ, covered with young seeds. There is but one style, in one side of which is an aperture leading to the stigma. The reason of this peculiarity has not been explained. The calyx is persistent, and the fruit to which it adheres, after the other parts of the flower are gone, opens into three valves. The essential characters of Violaceæ are, then, a persistent calyx, irregular flower, anthers with a membranous crest, and a three-valved fruit, with a parietal placenta in the middle of each valve.

The order is not a large one, but contains several useful and ornamental species, some of which are among the most common favorites of the garden. The roots of nearly all the order possess emetic properties, and the Ipecac, so generally used in medicine, is produced by a South American species. For the genus Viola, the reader is referred to the last number of this work, where he will find more particular mention made of its species.

Order—Droseraceæ. *The Sun-dew Tribe.*

This is a small order, containing some very curious plants. They are all small and delicate, and are distributed in wet places over a great portion of the world. Two or three species of Drosera, from which genus the order takes its name, are found in the Northern States. A description of the most common species, Drosera rotundifolia, will show what singular characters belong to these plants. This Sun-dew may be found in bogs, on those roundish tufts which are surrounded by water, and on the muddy shores of ponds and rivers. It is a little plant, not more than four or five inches high. The leaves are nearly round, on long hairy stalks, lying flat on the ground. At first they are rolled up, but when spread out and full grown, they form a concave disk, covered with long, red, shining hairs, on the point of each of which is a drop of clear, clammy fluid, which appears like dew glistening in the sun. That it is not real dew is readily ascertained; since it is most conspicuous at mid-day, when the dew is entirely dried up. These hairs, when placed under the microscope, are found to consist of a great number of parallel cells, and to be most beautifully variegated with pink, green, and yellow. Each hair is tipped with a most brilliant red point, from which exudes the fluid, which is acrid to the taste. The hairs, when an insect alights on them, curve inwards so as to retain it. The flowers are very small, white, arranged on one side of the scape, and when young are coiled inwards. The sepals are five in number, as are also the petals and stamens. In their organs of fructification these plants are nearly allied to the Violets, but they have been placed in different positions in the natural arrangement. We have followed the best American authorities in assigning them a place next to Violaceæ. Dr. Lindley considers it probable that their true affinity is with the Side Saddle Flowers, Sarraceniaceæ.

There is another very remarkable plant of this order, which is a native of the Southern States, and is sometimes seen in northern collections. This is Venus' Fly Trap, Dionæa muscipula. The following description of it, taken from Mr. Curtis's Plants of North Carolina, will interest those who have never seen it in its native soil:

"The leaf, which is the only remarkable part, springs from the root, spreading upon the ground, at a little elevation above it. It is composed of a petiole, or stem with broad margins, like the leaf of the Orange tree, two to four inches long, which, at the end, suddenly expands into a thick and somewhat rigid leaf, the two sides of which are semi-circular, about two-thirds of an inch across, and fringed around their edges with somewhat rigid ciliæ, or long hairs, like eye-lashes. The leaf, indeed, may be very aptly compared to two upper eye-lids, joined at their bases. Each portion of the leaf is a little concave on the inner side, where are placed three delicate, hair-like organs, in such an order that an insect can hardly traverse it without interfering with one of them, when the two sides suddenly collapse and enclose their prey, with a force surpassing the insect's efforts to escape. The fringe or hairs of the opposite sides interlace, like the fingers of the two hands clasped together. The sensitiveness resides only in these hair-like processes on the inside, as the leaf may be touched or pressed in any other part, without sensible effect. The little prisoner is not crushed and suddenly destroyed, as is sometimes supposed, for I have often liberated captive flies and spiders, which sped away as fast as fear or joy could hasten them. At other times I have found them enveloped in a fluid of mucilaginous consistence, which seemed to act as a solvent, the insect being more or less consumed by it. This circumstance has suggested the possibility of the insects being made subservient to the nourishment of the plant, through an apparatus of absorbent vessels in the leaves. It is not to be supposed, however, that such food is necessary to the existence of the plant, though, like compost, it may increase its growth and vigor. But however obscure and uncertain may be the final purpose of such a singular organization, if it were a problem to construct a plant with reference to entrapping insects, I cannot conceive of a form and organization better adapted to secure that end, than are found in the Dionæa muscipula,—I therefore deem it no credulous inference, that its leaves are constructed for that specific object, whether insects subserve the purpose of nourishment to the plant or not."

Order—Cistaceæ. *The Rock-Rose Tribe.*

This is a small order, containing some ornamental plants, cultivated in gardens under the name of Rock Rose. Several of the species are very handsome, and all are very singularly constructed. Their flowers are very frail, blossoming principally at night, and perishing under the heat of the sun. The leaves of some possess a very fragrant odor. From one species, the Gum Cistus, Cistus ladaniferus, a very popular garden shrub, and from one or two others, is extracted the gum called *ladanum*, the fragrance of which has caused it to be used in fumigating preparations. Most of the genus Cistus belong to the Southern parts of Europe and the Mediterranean islands. The American genera are of little note, either for ornament or use. The construction of the seed vessel, and of the embryo, is very curious, and forms one of the distinguishing peculiarities of the order. We shall offer a detailed description of it in another place.

Order—Caryophyllaceæ. *The Pink Tribe.*

Between the last mentioned order and this, there are two or three orders which possess no general interest, and contain no plants worthy of particular notice. The Pink Tribe, or Chickweed Tribe, as it is often called, includes some plants of great beauty, though most of its members are of little interest. Some very common weeds, such as Sandwort, Chickweed, and Carpetweed, belong here. The Pink, in all its beautiful varieties, is the genus which gives the order its name, and contains almost the only species remarkable in point of use or beauty. To examine the structure of the flower, any Pink may be chosen, so it is not a double one. The joints of the stem, at the points where the leaves are set on, are very much swoln, and this is one of the marks of the order. The calyx has five sepals separated only at the points. The petals are five, each having a stalk and a blade. The stalks or claws, are much narrower than the blade, and stand side by side in the calyx, the blade spreading over, and being fringed or lacerated at the outer border. The stamens are ten, rising from beneath a superior ovary, which has one cell and many seeds. The styles are two, and the stigmas are fringed. The capsule opens with four valves. The characters by which the Pink Tribe may be distinguished, are:—Stems, swollen at the joints; leaves, opposite and undivided; stamens, few and hypogynous; ovary, with many styles, one cell, and a central receptacle.

The order is divided into two sections, one of which has the sepals all distinct, and the other has them united in a tube. In the tubular division, besides the Pink, are contained the Catchfly, the Cockle, (*Agrostemma*,) the Ragged Robin, and a few others. In the other division are the numerous species of Chickweed (*Stellaria*) and Sandwort (*Arenaria*).

Order—Linaceæ. *The Flax Tribe.*

This order contains only a few plants, but these are very commonly distributed, and afford a product of the greatest importance. In some points the Flax Tribe bear a resemblance to the last order mentioned, and indeed were formerly included in it, but the difference is so plain and in so many important characters, that the separation is entirely proper. The stems of the Flax are not swollen at the joints, nor are the leaves generally opposite. The five sepals are arranged, three in an inner, and two in an outer series. The stamens, petals, and sepals, are always equal in number. The ovary contains ten cells, and the seed vessel opens into ten valves. By these differences the Flax Tribe may easily be distinguished from the Pink Tribe.

"Scarcely any plant is less affected than the common Flax, (*Linum usitatissimum*), by differences of soil and climate. The same species, with all its characteristics unaltered, flourishes in the cold as well as in the temperate regions of Europe, in North and South America, in Africa and in Asia. There are few plants which are made subservient to so great a variety of uses. It is from the woody fibre of its stem that all the thread is obtained, which has been from very early ages employed in the manufacture of linen fabrics, and it is now used for that purpose to a greater extent than ever, in spite of the degree in which it has been superseded by cotton. From the seeds is obtained, by pressure, linseed oil, and the dry cake which is left is used for feeding cattle. The seed coats also contain much mucilage, so that an infusion of the seeds, known as linseed tea, is often of great utility as a soothing remedy. Further, the seeds, when ground into meal, form a most excellent material for poultices; and great quantities are used for this purpose, especially in hospitals. The greatest supplies of Flax consumed in manufactures are furnished by Russia and Prussia. The annual imports into Great Britain are said to be from forty thousand to seventy-five thousand tons of flax, and nearly two millions of bushels of linseed. The best Irish linen, however, is made from flax cultivated in that country. In some parts of the United States it is also raised to a considerable extent; but the greater value of the corn crops has taken away the inducement to its general cultivation. The appearance of the common flax is so familiar as to make a description unnecessary, and our limits forbid an attempt to detail the operations requisite to prepare it for use.

Order—GERANIACEÆ. *The Geranium Tribe.*

This is an interesting order, on account of the great number of species which are favorite cultivated plants. Nearly all the species are commonly called Geraniums, though the exotics which are so much prized for their fragrance and beauty, belong to the genus Pelargonium. Several species of the real Geranium are natives of North America, and one, *G. maculatum*, usually called Cranesbill, is a common inhabitant of the woods and fields of the Northern States. This plant, like other Geraniums, has leaves lacinated, or cut in three or five parts, on petioles which are much swollen at the base where they join the stem. This is a character of the whole order. The flowers are in an umbel, or rather would be in an umbel if more than two grew from the same point. The sepals are five, and the petals five, purple, and strongly veined. The stamens are ten, disposed in two rows, of which the outer is shortest. In the cultivated Geraniums, or *Pelargoniums*, there is less regularity. The stamens are generally less than ten in number, and the two upper petals of the corolla are larger than the three lower, and stand apart so as to make the flower appear as if it had a pair of lips. The pistil of the Geranium consists of five carpels clustered together round a prolongation of the disk, and each cell contains a single seed. The styles adhere together so as to form a single column, divided at the top into five stigmas. The ripe fruit much resembles the head and long bill of the Crane, whence are applied both the common name Cranesbill, and the name of the genus, which is made of a Greek word signifying a crane. "This singular appearance is owing to a very simple circumstance. In most plants the styles shrink up or fall off at the same time that the flower fades, and by the time the fruit is ripe, entirely disappear. But in the Geranium, the styles continue to grow and harden as fast as the fruit itself; and when the latter is ripe, the styles project from the ovaries in the form of a beak. At the same time the seeds are shut up in the cavities of the ovary, so that one would wonder how they are to get out. If you would wish to catch the Geranium in the act of sowing its seed, gather a little branch of the ripe fruit in a fine summer's morning, before the dew is off, and place it in the sun. By degrees the fruits will dry, and if you watch them, you will be surprised by some of them, on a sudden, emitting a snapping sound, and you may see first one and then another of the ovaries quickly curving upwards towards the top of the style, opening, at the same time, by their face, so as to let the seed drop out. This is caused by the styles contracting from dryness, and shortening; they stick so close together at the points, that they cannot separate there, and so they actually pull up the ovary by the roots, and then roll up upon themselves as though frightened at what they had done."

The Geraniaceæ are extensively diffused over the globe. The chief residence of the cultivated Pelargoniums is at the Cape of Good Hope. By cultivation, and hybridizing, many new varieties have been raised. The effect of hybridizing is to produce in a single individual the characters of two others. Thus, if the pollen of a plant with blue flowers is placed upon the stigma of one with red flowers, the seed will produce a plant with purple flowers; or if a sort with large, coarse flowers, be intermixed with one which has small, neat flowers, the result will be a large and neat flower. The Pelargoniums intermix very readily, and this is the reason of the numerous varieties, and improved kinds. This intermixture, however, it must be remembered, will only be effectual among varieties of the same species, or among species which are very nearly related to each other.

The plants of this order possess an astringent principle, which, in our common spotted Geranium, is so powerful as to make its roots a valuable medicinal article. They also have an aromatic, resinous principle, which causes the dry stem of one species to emit when burning a most agreeable odor.

NOMENCLATURE.

We have desired to offer our readers an article on the important subject of nomenclature, and had partly prepared one; but we find the requisite information so concisely and properly summed up by Dr. Gray, that we are pleased to adopt his remarks in preference of our own.

The names of the Natural Orders, which are always plural, sometimes express a characteristic feature of the group; as for instance, *Leguminosæ*, or the Leguminous plants, such as the Pea, Bean, &c., whose fruit is a legume; *Umbelliferæ*, or Umbelliferous plants, so named from having the flowers in an umbel; *Compositæ*, an order having what were termed compound flowers by the earlier botanists; *Labiatæ*, so called from the labiate or two-lipped corolla which nearly all the species exhibit; *Cruciferæ*, which have their four petals disposed in the form of a cross. But more frequently, and indeed as a general rule, the name is formed from that of some leading or well known genus, which is prolonged into the adjective termination *aceæ*. Thus, the plants of the order which comprises the Mallow, (*Malva*), are called *Malvaceæ;* that is, *Plantæ Malvaceæ*, or in English, Malvaceous plants; those of which the Rose, (*Rosa*) is the well known representative, are *Rosaceæ*, or Rosaceous plants. This termination in *aceæ* being reserved for orders, should not be applied to sub-orders, or tribes; which usually bear the name of their principal or best known genus in an adjective form, without such prolongation. Thus the genus *Rosa* gives name to a particular tribe, *Roseæ*, of the order *Rosaceæ;* the genus *Malva* to the tribe *Malveæ* of the order *Malvaceæ*.

The number of genera in an order is quite as indefinite as that of the orders in a class, or other great division. While some orders are constituted of a single genus, as Equisetaceæ, Grossulaceæ, &c., (just as many genera contain but a single known species,) others comprise a large number; nearly nine hundred being embraced in the last general enumeration of the Compositæ. The names of genera are Latin substantives, in the singular number, and mostly of Greek or Latin derivation. Those which were known to the ancients generally preserve their classical appellations; as Fagus, Prunus, Myrtus, Viola, &c.; and even the barbarous or vulgar names of plants are often adopted, when susceptible of a Latin termination, and not too uncouth; for example, *Thæa* and *Coffæa*, for the Tea and Coffee plants, *Bambusa* for the Bamboo, *Yucca*, *Negundo*, &c. But more commonly, generic names are formed to express some botanical character, habit, or obvious peculiarity of the plants they designate; such as *Arenaria*, from *arena*, sand, for a plant which grows in sandy places; *Dentaria*, from *dens*, a tooth, for a plant with toothed roots; *Lunaria*, from *luna*, the moon, for one with crescent-shaped pods; *Sanguinaria*, from *sanguis*, blood, for the Blood-root; *Crassula*, from *crassus*, thick, for some plants with remarkably thick leaves. These are instances of Latin derivatives; but recourse is more commonly had to the Greek language, especially for generic names composed of two words; such as *Menispermum*, or Moon-seed; *Lithospermum*, for a plant with stony seeds; *Melanthium*, meaning black flower, for a genus whose flowers turn of a black or dusky color; *Epidendron*, upon a tree, for Orchideous plants which grow upon trees; *Liriodendron*, lily, or tulip, tree, for a tree which bears lily-shaped flowers. Genera are also dedicated to distinguished persons, a practice commenced by the ancients; as in the case of *Pæonia*, the Peony, which bears the name of Pæon, who is said to have employed the plant in medicine; and *Euphorbia*, *Artemisia* and *Asclepias*, are also examples of the kind. Modern names of this kind are given in commemoration of botanists, or of persons who have contributed to the advancement of natural history. *Magnolia*, *Bignonia*, *Lobelia*, and *Lonicera*, dedicated to Magnol, Bignon, Lobel, and Lonicer, are early instances of the practice; Linnæa, Tournefortia, Jussiæa, Gronovia, &c., bear the names of more celebrated botanists; and at the present day, almost every devotee or patron of the science is thus commemorated.

The names of species, as a general rule, are adjectives, written after those of the genera, and established on similar principles; as *Magnolia grandiflora*, the Large-flowered Magnolia; *M. macrophylla*, the Large-leaved Magnolia; *Bignonia* *radicans*, the Rooting Bignonia. The generic and specific names, taken together, constitute the proper scientific appellation of the plant. Specific names sometimes distinguish the country which a plant inhabits, as *Viola Canadensis*, the Canadian Violet; or the situation where it naturally grows, as *V. palustris*, which grows in swamps; *V. arvensis*, in fields; or they express some obvious character of the species, as *V. rostrata*, where the corolla has a remarkably long spur; *V. tricolor*, which has tri-colored flowers; *V. rotundifolia*, with rounded leaves; *V. lanceolata*, with lanceolate leaves; *V. primulæfolia*, where the leaves are compared to those of the Primrose; *V. asarifolia*, where they are likened to those of *Asarum*; *V. pubescens*, which is hairy throughout, &c. Frequently the species bears the name of its discoverer or describer, when it takes the genitive form, as *Viola Muhlenbergii*, Muhlenberg's Violet, *V. Nuttallii*, Nuttall's Violet. When such commemorative names are merely given in compliment to a botanist, unconnected with the discovery or history of the plant, the adjective form is preferred; as *Carex Torreyana*, *C. Hookeriana*, &c.; but this rule is not universally followed. Specific names are sometimes substantive; as *Ranunculus Flammula*, *Hypericum Sarothra*, *Linaria Cymbalaria*; in which case they do not necessarily accord with the genus in gender. These, as well as all specific names derived from the names of persons or countries, should always be written with a capital initial letter.

FLOWERLESS PLANTS.

Although the Cellular or Cryptogamous plants do not come directly within the scope of this work, yet they form too large and important a class to be entirely unnoticed. Some of them, though unadorned with the bright hues and delicate proportions which have made a love for flowers so universal, are yet both interesting and useful, and some of the phenomena connected with their organization are very curious. We propose to devote an occasional brief article to their history. The Mosses, perhaps the most abundant and widely diffused of the Cryptogamia, are found in all parts of the world in which the atmosphere is moist, but they are much more numerous in temperate climates, than between the tropics. In newly found countries, they are among the first vegetables which clothe the soil; and they are the last to disappear when the atmosphere ceases to be capable of nourishing vegetation. The first green crust upon the cinders with which the surface of Ascension Island was covered, consisted of minute mosses. This tribe forms more than a fourth of the whole vegetation of Melville Island, one of the most northerly spots in which any plants have been observed; and the black and lifeless soil of New South Shetland, one of the islands nearest the South Pole, is covered with specks of mosses, struggling for existence. Besides their power of resisting extremes of temperature, Mosses exhibit a remarkable tenacity of life, when their growth is checked by the absence of moisture; so that their life may often be restored, even after being dried for years. Hence, they offer abundant sources of interest to the observer of Nature, at a season when vegetation of other kinds is almost entirely checked. For it is most curious to observe how gay these little mosses are, on every wall during the winter months, and in the early spring, seeming like the only things which enjoy the clouds and storms of the season. They choose the most exposed situations, spread out their leaves, and push up their delicate urns amid rain, frost and snow; and yet there is nothing in their simple and tender structure from which we could infer their capability of resisting influences so generally destructive to vegetation. But it is with the plant as it is with the animal. The more simple and lowly the being, the greater is usually its tenacity of life under circumstances which depress the vital powers of higher kinds, while the influences which they require are often too powerful for it. Thus, Mosses and Lichens, over stimulated by heat and dryness, wither in summer; but vegetate freely at a season when there is no other vegetation, and when their humble fabrics cannot be overshadowed by a ranker growth. Mosses were fancifully termed by Linnæus, *servi*, servants, or workmen; for they seem to labor to produce vegetation in newly-found countries, where soil can scarcely yet be said to exist. This is not, however, their only use. They fill up and consolidate bogs, and form rich vegetable mould for the growth of larger plants, which they also protect from cold during the winter. They likewise clothe the sides of lofty hills and mountain ranges, and powerfully attract and condense the watery vapors floating in the atmosphere, and thus become the living fountains of many streams. They are sometimes so completely dried up by drought, that they escape notice, and then when moistened by rain, they appear to have suddenly clothed a barren heath, or overspread a dry wall with verdure.

THE CACTUS.

All the species of the Cactus tribe are destitute of true leaves, except when they are first beginning to grow. Just at that time they do indeed produce little succulent bodies, which we know to be rudiments of leaves; but such parts drop off soon after they are born, and the only representatives they leave behind are the stiff, hooked spines, with which so many species are covered. The parts which are mistaken for leaves in the Indian fig, or some of the more common species of Cereus, are only the flattened joints of the stem.

It would be difficult to find any race of plants, where a more obvious connexion exists between the manner in which they are constructed, and the situations it is their destiny to live in. The greater number grow in hot, dry, rocky places, where they are exposed for many months in the year to the fiercest beams of a tropical sun, without a possibility of obtaining from the parched and hardened soil, more than the most scanty supply of necessary food. Under such circumstances, plants of an ordinary structure would perish; but Cactuses have a special power of resisting heat and drought, and, like the Camel, they carry with them a supply of water for many, not days, but months. It usually happens that once a year, during several weeks at least, the air that surrounds them is saturated with moisture, and the soil they live in is drenched by ceaseless rains. At this time they grow fast, all the little cavities in their tissue, of which there are countless millions, are filled with liquid nourishment, and they may be literally said to gorge themselves with food. Then, when the rains cease, and the air dries up, and the Spirit of the desert reassumes his withering dominion over their climate, Cactuses are in the most robust health, and their cells are abundantly filled with provision against scarcity. But these supplies would be quickly consumed by plants only protected by a thin epidermis, and having their surface pierced by millions of breathing pores, all actively exhaling the evaporable matter that lies beneath them, and an early death would be the inevitable result. Such, indeed, is the lot of all the gay companions of the Cactus, which surround it during the season of feasting and prosperity, and to which Nature has given no special means of enduring the hardships to which their lot exposes them; a few days or weeks suffice to sweep their forms from the face of creation; their leaves rapidly consume the stores deposited in the stems; their stems turn in vain to the roots for a renewed supply, for after but a little while, the arid earth has nothing to part with, and then the leaves wither and fall off, the stems shrink up and crack with the dry heat, and the roots themselves, in many cases, follow the same fate. With Cactuses this is different; they have so tough and thick a hide, that what liquid substances they contain, can only pass through it in minute quantities; the breathing pores of their surface are comparatively few, and so small as to act with extreme slowness, when the air is dry; so that in proportion to the aridity of the air, and the heat to which such plants are exposed, is their reluctance to part with the food they contain. They digest and redigest it with extreme slowness, and may be truly said to live upon themselves during all those months when they cannot feed upon the soil or the atmosphere.

Ladies' Botany.

EMBRYOLOGY.

The peculiar construction of the embryo of the Cistaceæ is alluded to on page 210. The following notice, by Dr. Lindley, of this peculiarity, and incidentally of the method in which it is supposed that the impregnation of seeds is effected, will show the minute care and patience which have been devoted to this obscure subject.

The ovule of the Cistaceæ has a perforation or foramen at its point; all ovules have such a perforation, but not all in the same place. In most ovules it is next the base; in a few only does it exist at the point, as in the plants before you. The use of the foramen is not a little curious. You are aware that when the ovule is first formed, it is no more than a mass of pulp, in which little or no organization can be detected internally; but, in process of time, a small, cloudy speck forms in this pulpy interior, and keeps growing larger and larger, till at last it becomes an embryo. It has been observed that the speck always first becomes visible next the foramen; and there is great reason to believe that in reality the speck is introduced into the ovule through the foramen. Further, it is supposed that it is in the anther that this speck is first formed; that it originates in the inside of a grain of pollen; that when the pollen falls upon the stigma, the former puts forth an excessively fine tube, much finer than the most delicate hair; that the tube passes down the style, and continues to lengthen till it reaches the foramen; that the contents of the grain of pollen are discharged into the tube, and then, by some hidden and mysterious agency, carried down the tube; and that, finally, they are thus conveyed into the ovule through the foramen, and form the speck.

For all the evidence, and the many curious facts, connected with this part of Botany, I must refer you to modern Introductions to this subject; in this place, you must be satisfied with my assurance that this extraordinary statement is supported, not only by observations of my own, but by the concurrent testimony of all the most cautious and skilful microscopical observers who have engaged in the inquiry.

What I have already stated to you is extraordinary enough, and much cause as you have already found at every step to admire the wonderful care and skill with which all the actions of vegetable life are conducted, yet I think you must here find a fresh and unexpected source of admiration. You see that in the formation of the seed of even what we may deem the most worthless weed, there is the same unerring Providence, as in the preservation of the race of man. Only think for a moment, upon the long journey that the little speck, the tiny rudiment of a seed, has to take before it can arrive at the only place in which it is possible that its destiny can be fulfilled, or that it should be developed into a new being. Born in the pollen grain, it is originally enclosed in a double-guarded prison: its own little spherical vault, and the more extensive walls of the anther. The anther must open before the pollen can escape; and it must open too at a particular time, at the very moment when the stigma has secreted a clammy dew which will hold fast the pollen if it falls upon it. Then the pollen must fall on the stigma; to fall elsewhere is useless. This accomplished, the microscopic rudiment of the seed has to commence a long winding journey through all the intricacies of the style, and the ovary, till its guardian tube conducts it to the ovule, and deposits it in safety. And all this is so provided for that we find every adjustment exactly that which is best suited to the object in view; invisible springs in the anther, acted upon by the very same cause as that which renders the stigma clammy, combine their million little forces to pull open the sides of that case; to enable their forces to act with certainty, the sides of the anther are weakened in a particular line, which in every anther of the same species is constantly the same. It is supposed that the clamminess of the stigma is not merely to stick the pollen-grain fast, but also to cause the formation of the pollen-tube; to enable the latter to reach the ovule, notwithstanding its excessive delicacy, the whole texture of the stigma and style is loosened, so as to offer as little resistance as possible to the passage of the pollen-tube. In the Rock-Rose Tribe we have a still farther example of the facility with which obstacles to communication between the pollen-tube and the opening in the ovule are overcome.

If we suppose a grain of pollen to fall on the stigma of a Cistus, its tube may be easily understood to reach the place where the ovules grow; but when there, it is cut off from the foramen by the whole length of the stalk and sides of the ovule, for the foramen is at the other end of the latter. In order to overcome this difficulty, we are told by M. Adolphe Brongniart, that the pollen-tube does not follow the placenta till it reaches the ovule, but quits the style at the top of the cavity of each cell, and thence lengthens in the open space inside the ovary, in the form of the finest imaginable cobweb, till it reaches the foramen in the end of the ovules.

WATERING.

BY MR. ELEY.

Injudicious watering does more injury to plants in rooms and conservatories than most persons imagine, as plants suffer from too much water, as well as too little. Many persons think that they want water every day, and the more they give the better. Others, being very cautious, will scarcely give them sufficient to sustain life. When plants have had too much water, the leaves turn dark and flabby, and when too little, they turn yellow, and finally drop off. The best plan is not to water them till the soil in the pots appears dry, or their leaves droop: then give them sufficient water to wet the soil thoroughly down to the bottom of the pot, and do not give them any more until they become dry again. Pour the water on the top of the pot, and let it soak down to the roots, but do not let it stand in the pans under the pots, for it causes the roots to decay, and injures them very much. Of course, this does not apply in the case of aquatic plants, and such as require a more plentiful supply in the time of flowering. The water for this purpose should not be taken fresh from the pump or cistern in the winter season, but should stand in the room some time, or be a little warmed to take off the chill. When the weather is warm and dry, as it usually is at times in the spring and summer, and the plants in full flower, they will require watering freely every day, especially such as are in small pots, and the pots full of roots. Those in larger pots, with more room for their roots, will not require it so often. The best time to water plants in summer, is in the evening, as they will have the night to refresh themselves in ; and in the winter season in the morning, that the pots may be warmed in the sun, and they will not be subject to be chilled ; although in rooms heated by furnaces, where a regular heat is kept, it will make but little difference; they may be watered when most convenient. As some plants evaporate their moisture much faster than others, they will require watering more frequently, which will be indicated by the drooping of their leaves. In cloudy or rainy weather they will not need so much water, unless they are in the house, or the soil is dry. Plants accustomed to the house should not be set out in heavy rains in winter, or early in spring, as the rain is cold, and if they become saturated, it gives them a chill from which they are some time in recovering ; but in a warm rain in summer they may be set out for an hour or two, and then taken in again, which will greatly refresh them, and persons having only the house to keep them in, will find them much benefited in summer, by setting them out in the evening, to receive dew, and taking them into the house again in the morning. Plants in warm rooms at all times require to be kept a little moist, though they need most water when growing and flowering.

LATHYRUS—THE SWEET PEA.

Natural Order, Leguminosæ; Linnæan System, Diadelphia, Decandria. Generic Distinctions:—Calyx, campanulate, the two upper segments shorter; style, flat, dilated above; corolla, papilionaceous; stamens, diadelphous.

L. grandiflorus.—Hairy; stems, four-angled, winged; leaves, with one pair of ovate, obtuse leaflets; stipules, small, lanceolate; peduncles, two, three-flowered, longer than the leaves; teeth of the calyx, acute, longer than the tube; legumes, long, linear, tuberculous.—*Pl.* 31. *Fig.* 1.

Lathyrus is the ancient Greek name of the Sweet Pea, or some other leguminous plant. The genus is well known from the beautiful annual sweet peas which it includes, and which are so common in gardens. The species figured here, is a perennial, and is a very handsome climber, its flowers being as large and brilliant as the largest sweet pea, but destitute of fragrance. It is a native of the South of Europe, where it grows in great abundance among hedges and bushes. It is said to be particularly abundant in Sicily and on Mount Etna. It is somewhat cultivated in this country, where it will grow, like the common sweet pea, in any common garden soil. Its root is creeping, and when it has once taken possession of the soil, it is difficult to eradicate it. It is easily propagated by dividing the roots, or by planting the seeds.

There is an European species, *L. sativus*, which has been used in making bread, and the history of which is so singular as to be worthy of notice. The seeds being ground and mixed with wheat flour in half the quantity, produce a very good bread, which appears to be harmless. But bread made with this flour only, has brought on a most surprising rigidity of the limbs in those who have used it for a length of time, insomuch that the exterior muscles could not by any means be reduced, or have their natural action restored. These symptoms usually appeared on a sudden, without any previous pain; but sometimes they were preceded by a weakness and disagreeable sensation about the knees. Swine fattened with this meal lost the use of their limbs, but grew very fat lying on the ground. A horse, fed some months on the dried

1. Lathyrus grandiflorus. (Perennial Sweet Pea.)
2. Apios tuberosa. (Ground nut.)

herb, was said to have his limbs perfectly rigid. Pigeons, especially young ones, lost the power of walking by feeding on the seed. The effects of this plant were so dreadful, that the use of it was prohibited by the Duke of Wirtemberg, and his edict was enforced by two of his successors.

Other species of Lathyrus are well known ornamental plants, *L. odoratus*, the Sweet Pea, in particular. Another species produces tubers, which are highly esteemed as food in Holland.

APIOS—THE GROUND NUT.

Natural Order, Leguminosæ; Linnæan System, Diadelphia, Decandria. Generic Distinctions:—Calyx, campanulate, with four almost obsolete teeth, the lower one acute and elongated; keel, falcate, bent back upon the vexillum; ovary, sheathed at the base.

***A. tuberosa.*—Roots, tuberous: leaves, unequally pinnate; flowers, in axillary racemes.—*Pl.* 31. *Fig.* 2.**

Apios is taken from a word signifying a pear, in allusion to the shape of the tuberous roots. This is the only species of the genus. It is a very pretty little climbing vine, putting forth its handsome racemes of flowers among the hedges and woods, in July and August. The leaves have seven or five ovate lanceolate leaflets, and the flowers are of a beautiful purple. It grows in all the Northern States. The roots produce tubers, which are sweet, and very nutritious, resembling those of the Jerusalem Artichoke. It is not improbable that they would form a good substitute for the potato, if the crop of that plant should ever fail here. Indeed at present in Germany, the Apios is cultivated to considerable extent for the sake of its tubers, which are sold in the markets.

1. Jeffersonia diphylla. (The Jeffersonia.)
2. Claytonia Virginica. (Spring Beauty.)
3. Claytonia Caroliniana. (" ")

JEFFERSONIA—THE JEFFERSONIA.

Natural Order, Berberidaceæ; Linnæan System, Octandria, Monogynia. Generic Distinctions:—Calyx, of four sepals; petals, eight; stamens, eight, surrounding the ovary; capsules, opening by the whole circumference of the apex.

J. diphylla.—Leaves, cleft into two lobes; peduncles, one-flowered; petals, white; anthers, yellow; calyx, deciduous, colored.—*Pl.* 32. *Fig.* 1.

This pretty little plant is the only one of its genus, and was named by Dr. Barton after President Jefferson. The flower is large, regular, and grows at the top of a peduncle about half a foot high. The petioles are long, and have each a leaf so deeply cut as to make it appear like a pair of leaves placed base to base. The structure of the capsule is curious; it opens like a box, the upper part forming a regular persistent lid. The Jeffersonia grows in the Northern and Western parts of the United States, and in some places has considerable reputation as a remedy for rheumatism and similar disorders, whence it is often called Rheumatism Root.

CLAYTONIA—THE SPRING BEAUTY.

Natural Order, Portulaceæ; Linnæan System, Pentandria, Monogynia. Generic Distinctions:—Sepals, two; petals, five, obcordate, clawed; stamens, five, inserted on the claws of the petals; stigma, three-cleft; capsule, three-valved; two to five seeded.

C. Virginica.—Leaves, narrow, linear, obsoletely three-nerved; petals, emarginate; racemes, solitary, nodding; pedicels, slender.—*Pl.* 32. *Fig.* 2.

C. Caroliniana.—Root, tuberous; radical, leaves spatulate, cauline ones oblong; sepals, very blunt.—*Pl.* 32. *Fig.* 3.

This genus was named in honor of Dr. John Clayton, a Virginian botanist. The two species in our plate are not uncommon in the Northern States, flowering among the rocky hills very early in spring. They are both very elegant and delicate plants. They have tuberous roots, situated very deep in the ground, so that the length of stem below the surface is as great as that above. The tuber of C. Virginica, is about as large as a hazel nut; the stem is five or six inches high, with a pair of opposite linear leaves. The flowers are about eight or ten in number, on very slender pedicels, rose-colored or white, with purple veins. The tuber of C. Caroliniana is brown, and somewhat flattened. The root-leaves, if any, are spatulate. The stem-leaves are two, opposite, about half way up the stem, ovate, obtuse, and tapering into the petiole. The flowers are rather darker in color than those of the other species, and are beautifully veined with purple lines. These pretty plants are among the earliest spring flowers. They have been introduced into England, where they are often cultivated, and much admired. A peat soil is said to be proper for planting them in, and they may be increased from the seed, or by dividing the root.

ŒNOTHERA—THE EVENING PRIMROSE.

Natural Order, Onagraceæ; Linnæan System, Octandria, Monogynia. Generic Distinctions:—Calyx, four-cleft, tubular; segments, reflexed; petals, four; capsule, four-celled, four-valved, inferior; seeds, naked.

***Œ. macrocarpa.*—Stem, simple, prostrate, downy; leaves, lanceolate, quite entire, with the margins and nerves downy; petals, broad, obcordate; stamens, arched, shorter than the corolla; lobes of stigma, blunt, cylindrical; capsule, large, sessile, oblong, four-winged.—*Plate* 33.**

The roots of a species of this genus were formerly used as an incentive to drinking wine, as olives are eaten at the present time. From this circumstance is derived the generic name, which is compounded of two Greek words signifying wine, and to hunt. Many of the species are in common cultivation under the name of Evening Primroses. They all close their flowers during the heat of the day, and open them again in the evening, or when it is cloudy. This phenomenon is best observed in a common species, a native of the United States, Œ. biennis. The mode in which the flowers expand is curious. The

Œnothera macrocarpa. (Large fruited Evening Primrose.)

...gia. (Royal Catchfly.) 1. Silene Pensylvanica. (Pensylvanian Catchfly.)

3. Silene chloraefolia. (Chlora leaved Catchfly.)

petals are held together at top by the hooks at the end of the calyx, the segments of which first separate, and discover the corolla, a long time before it acquires sufficient expansive force to unhook the calyx at the top. When it has expanded sufficiently, the calyx suddenly bursts open with a perceptible sound, and the corolla expands almost instantaneously to a certain point, then stops, and after a little time spreads out to its full extent.

Most of the species are natives of North America, and they are about thirty in number. The one in our plate is perhaps the largest and most showy. The flowers are very large, and the tube of the calyx is sometimes more than four inches long. The stems trail near the ground, the flowers lying on the large leaves. It grows in several of the Western States, on the banks of the Mississippi River.

SILENE—THE CATCHFLY.

Natural Order, Caryophyllaceæ; Linnæan System, Decandria, Trigynia.

Generic Distinctions:—Calyx tubular, five-toothed, without scales at the base; petals, five, bifid, unguiculate, often crowned with scales at the mouth; stamens, ten; styles, three; capsules, three-celled, many seeded.

S. Pensylvanica. **Viscidly pubescent, radical leaves, spatulate; cauline ones, lanceolate; petals, obtuse, somewhat emarginate, subcrenate.—*Plate* 34. *Fig.* 1.**

S. regia. **Clammy, pubescent; leaves, ovate, lanceolate; flowers, large, panicled; calyx, downy, long, tubular; petals, undivided, crowned with bicuspidate appendages; stamens, very long.—*Plate* 34. *Fig.* 2.**

S. chloræfolia. **Very smooth, and glaucous; stems, branched; leaves, elliptical, pointed, upper ones cordate; flowers, in a terminal panicle, large; calyx, long, downy; petals, two-lobed.—*Plate* 34. *Fig.* 3.**

The ancient poets represented the god Silenus as being constantly drunk and covered with slaver. The plants of this genus have generally upon them a viscid, frothy secretion, and so are named from the aforesaid jolly god. This moist secretion is also said to attract flies, whence the common name, Catchfly. The species are numerous, and about fifteen are natives of North America. They are readily recognised by their resemblance to the Pinks, from which they may be at once distinguished by the absence of scales at the base of the calyx. Several species are not uncommon in gardens, and are of easy culture. S. Pensylvanica grows in most of the northern and middle states, where it is usually called Wild Pink. It is rather a pretty plant, being of low stature, with numerous stems, and frequently a great profusion of flowers. The calyx is long, and very hairy and glutinous. The petals are wedge-shaped, the edges generally slightly crenated. It is found in dry sandy soils, and flowers in June.

S. regia, or Royal Catchfly, is altogether the most beautiful and showy of all the species. In some of the Western States it often grows in great profusion, sometimes to the height of three or four feet, producing its splendid scarlet flowers in abundance. When cultivated, it will grow in any common garden soil, and thrives best in a mixture of peat and loam. The stems are hollow and jointed, and the leaves pale green.

S. chloræfolia is a neat, low plant, with large pure white flowers, and pinkish calyxes. It grows compactly, and its leaves are broad and of a good color, having but little of the clammy secretion of the others. It is a native of the West.

THE NATURAL SYSTEM OF BOTANY.

NUMBER EIGHT.

Order—MALVACEÆ. *The Mallow Tribe.*

THERE is a low, branching plant, with roundish leaves, and purplish flowers, growing commonly about houses, in cultivated ground, and producing those elegant little *cheeses*, of which every school-boy is so fond. This is one of the Mallow Tribe, and belongs to the genus Malva. To ascertain the characters of the important tribe of plants to which it belongs, let the reader get a specimen of this plant. The leaves are obscurely five-lobed, on long, hairy stalks, at the base of which is a pair of small stipules. The sepals are five, and are placed in a uniform whorl, and below them are three bracts. The petals are also five, and are curiously twisted together in the bud. The stamens are united into a tube, at the top of which, on short filaments, are a great number of kidney-shaped anthers. The pistil is composed of several united carpels, each of which has its own style, and the styles are grown together at the bottom, like the stamens, but separate at the top. The fruit, or cheese, is divided into numerous cells, each of which contains an ovule. When ripe, the carpels become dry, and are easily separated. All these characters are common to the order, except the number of petals and sepals, which varies in some of the species.

All the Mallows yield a transparent, mucilaginous fluid, which has been thought to relieve some pectoral complaints. The unripe fruit of one species, called *Ochro*, or *Gobbo*, is in great estimation in the West Indies, for thickening soup. Others have a coloring principle, and the petals of one species stain black whatever touches them. The Hollyhock, so universally cultivated, and all the species of *Hibiscus*, so esteemed for their showy and beautiful flowers, belong to this order; and fibres of the stems of some species are used for making cordage. "But it is the hairy clothing of the seeds of different plants belonging to a genus that botanists call *Gossypium*, which is of such pre-eminent importance as to claim for the Mallow tribe a rank in the vegetable kingdom second only to corn. That hairy substance is Cotton, which, for no conceivable purpose except to yield man the means of clothing himself, is formed in prodigious abundance upon the back of the seeds of the Cotton plants, whence it is torn by machinery, and afterwards cleaned and spun into thread." The fibres of Cotton are packed round the seeds, to which they adhere with such firmness as to make their separation very difficult. The invention of the Cotton-gin overcomes this difficulty in the most rapid and effectual manner. The usual color of Cotton is white, but there is a Chinese species which produces a yellow fibre, and it is from this that the stuff called Nankeen is manufactured. To give an idea of the quantity and value of cotton as an article of commerce, it may be stated that in the year 1838 there were imported into the British Islands upwards of five hundred millions of pounds, and of this was manufactured and exported in the form of woven stuffs, nearly seven hundred million yards, and of twist and yarn about one hundred and fifteen million pounds. The value of these, together with that of other cotton fabrics exported in that year, was over twenty-four millions sterling, or about one hundred and twenty million of dollars.

Order—Bombaceæ. *The Silk-cotton Tribe.*

The plants of this order differ little from the Mallows, except in habit and size. Their calyx is not exactly valvate, and the tube formed by the stamens has five divisions. Like Malvaceæ their juice is mucilaginous, and their properties are wholesome. The order is remarkable as containing some of the largest trees in the world. The *Baobab* trees of Senegal have long been the wonder of travellers. Their trunks are sometimes sixty, and even ninety or a hundred feet in girth. Their height is, however, not in proportion to their thickness, being generally but little more than their diameter, and spreading into huge, horizontal branches. In the interior of Africa, the natives cut off the heads, and hollow out the trunks, which serve them for tanks to hold water.

A far taller and more elegant tree is the Ceiba-tree (*Bombax Ceiba*) of the West Indies. This is one of the most magnificent of vegetable creations, sometimes rising to the height of a hundred and fifty feet. A description of the Ceiba-tree, as it appears in its native country, by an esteemed friend and correspondent, will be found on another page. This, as well as other species of Bombax, bears a kind of silky cotton, which is used for stuffing cushions and beds; but it cannot be spun into threads, like the true cotton.

Order—Bromaceæ. *The Cacao Tribe.*

This order is also nearly allied to the Mallows, from which it differs in some of the species having no petals, the stamens of some being often abortive, and the number of carpels being less. The most interesting plant of the order is the *Theobroma Cacao*, which produces the material used for making chocolate. This tree is a native of Mexico and South America, and usually grows to the height of from twenty to thirty feet; its leaves are large, oblong and pointed; the flowers are small, reddish, and without fragrance. The fruit is yellow or red, of an oval shape, about three inches long, covered with rounded protuberances, and marked by ten furrows. The seeds are imbedded in a whitish pulp, with a sweet, and not unpleasant taste. This pulp is removed from the seeds, after which they are dried in the sun, and then roasted, by which their hard husks are detached. The interior kernel is beaten into a paste, dried, and formed into rolls for exportation or use. In Mexico, chocolate is the common beverage, being, indeed, an article of prime necessity. Its use is also universal in the West India Islands, and immense quantities are consumed in Spain and France. In the United States, the prepared cocoa, made of the shells of the cocoa-nut, is generally preferred to chocolate, as being easier of digestion, and not so oily.

Order—TILIACEÆ. *The Linden Tribe.*

This order is also nearly related to Malvaceæ, as is shown by its characters. The calyx has four or five sepals, and the corolla as many petals. The stamens are numerous, and are not united into a tube. The pistil is made up of about ten united carpels, with an equal number of stigmas. The anthers are two-celled, opening lengthwise. They differ from Malvaceæ by the separation of their stamens, and by their two-celled anthers, and resemble that order in their general properties, and the quantity of mucilage which they contain.

Most of the plants belonging to this order are herbaceous or shrubby, and inhabit the tropics, but some species are large trees, and are found in temperate countries. Of these, the common Lime-tree, Bass-wood, or Linden-tree, (*Tilia Americana,*) is a well-known species, being native in most of the Middle and Northern States. It is a fine tree, growing to a large size, and its wood is much used in cabinet work. The inflorescence is singular; the flowers forming a cluster upon an oblique foot-stalk, proceeding from the centre of a long, narrow bract, or floral leaf. There are several European species of Tilia, the wood of which is in great use for carving. Many of the most splendid works in this department of art, such as the choir of Trinity College Library at Cambridge, are made of Lime-tree wood.

Order—CAMELLIACEÆ. *The Camellia Tribe.*

This is an important and interesting group of plants, whether considered in reference to the great beauty of the flowers of some species, or the universal use of the product of others. The elegant Camellia Japonica is cultivated and admired in every collection, and Tea is drank at every table. The characters of the order can be observed in any garden species of Camellia. The calyx is composed of from five to seven sepals, unequal in size, and somewhat overlapping each other. The petals are from five to nine, also occasionally imbricated, and sometimes adherent at the base. The stamens are many in number, and generally united at the base into several bundles. The ovary is formed of from three to six carpels, more or less united, with separate styles; each cell originally containing several ovules. In the ripe capsule, there are only three cells, each having but one seed, the other ovules not having been developed. This seed is large, with fleshy cotyledons, which contain a large quantity of oil, and are destitute of albumen.

The species are celebrated for the beauty of their foliage, and the fine colors of their flowers, which vary through every shade of red and white. To some remarks upon the culture of these plants, and upon the manufacture of tea, we shall devote a separate article.

Order—Aurantiaceæ. *The Orange Tribe.*

This order, which contains the Orange, Lemon, Lime, Citron, and Shaddock, is one of much interest. Its structure is very peculiar, and it possesses several characters which are singular. To man it is of great value, on account of the great quantities of wholesome, agreeable, and refreshing fruit with which it supplies him. These fruits are remarkable as being more easily preserved and brought to colder regions, than almost any other tropical productions; and in consequence, some of them are so cheap and plentiful in northern countries, as to place the enjoyment of them within the reach of all. To give an idea of the immense quantity of these fruits which are sent from their native countries, we may state, that of oranges alone, it has been calculated that about two hundred and seventy-two millions are annually brought to England. So great a supply could not be sustained unless the Orange-tree was very prolific. A single tree has been known to produce twenty thousand oranges fit for exportation, exclusive of the damaged fruit, and waste. It is partly due, also, to the construction of the fruit. The rind being thick and spongy, resists changes of temperature, and the immense number of minute receptacles filled with oil, in its surface, prevent the evaporation of the watery fluid within, and by their acridity, the attacks of insects from without. Hence, oranges will keep for a long time, if they are well ventilated, and free from moisture.

On examining the leaves of an Orange or Lemon tree, they will be found covered with minute yellowish or semi-transparent dots. These are filled with an oil of peculiarly pungent taste, and very fragrant smell, which is especially perceived when the leaves are crushed by the fingers. These little cavities exist not only in the leaves and fruit, but in the leafy parts of the flower, which owes to them most of its fragrance. It will also be observed that the leaves are jointed, or articulated at the junction of the blade with the petiole, and that the latter is expanded into a sort of supplementary leaf, by the developement of a narrow blade from each side. In some species, the leaves are pinnate; and it sometimes happens that the leaflet of one side only is developed, or that even both are absent, so that the petiole, then much enlarged, has to perform the functions of a true leaf. The calyx is cup-shaped, having three or five sepals, which fall off early. The number of petals is the same as that of the sepals, and in the orange their color is white, dotted with green. The stamens are equal in number to the petals, or twice that number; their filaments are flattened, sometimes united at the base, and sometimes free. The ovary is nearly globular, and composed of several adherent carpels. The style is thick, and the stigma slightly divided. Each cell of the ovary has a double row of ovules, a large proportion of which perish during the ripening of the fruit, and in the orange and its nearest allies, the cavity of the seed-vessel becomes filled up with a pulp consisting of separate vesicles, each containing a portion of the sweet-acid fluid. The aggregation of these vesicles cannot be distinctly seen in the usual state of the orange, but in an over-ripe specimen, they are very easily separable.

The various species of the Orange Tribe are nearly all natives of the East Indies and China, whence they have been introduced into other countries within or near the tropics. They nearly all contain sugar, citric acid, an aromatic essential oil, and a bitter principle, having tonic properties, combined in various proportions in different fruits. Thus, in the common Orange the sugar prevails, and the acid, when the fruit is ripe, is subordinate. In the Lemon, the acid is always predominant in the pulp, and the oil is more abundant in the rind. In the

Shaddock and Seville Orange, the bitter principle manifests itself. The fruit of the Orange and its allied species requires two years to come to maturity, and as the flowers are produced all through the summer, a healthy tree exhibits, during a considerable portion of the year, every stage of production, from the flower-bud to the ripe fruit. Most of the Oranges and Lemons intended for export, are collected before they are fully ripe, since otherwise they would be more likely to spoil. They are generally gathered in the autumn, while they would require until the spring following to ripen fully on the tree. It is also remarkable that the Orange trees from which the fruit is plucked while green, bear plentifully every year, while those on which the fruit is suffered to ripen, afford abundant crops only in alternate years. The best Oranges are those which come from St. Michael, where the tree was introduced by the Portuguese, as it was by the Spaniards into America. Into Spain and Portugal it was brought by the Moors, and is extensively cultivated in both countries. Near Cordova are Orange trees supposed to be six or seven hundred years old, and in Andalusia are extensive orchards which have formed the revenue of the monks for ages.

Order—Vitaceæ. *The Vine Tribe.*

This order is chiefly important as containing the common Grape Vine. Nearly all the plants belonging to it are climbers, and support themselves by tendrils. "Here let me pause to tell you what a tendril is; by its name you would suppose it some especial kind of organ formed expressly for the purpose of helping the Vine to raise itself among the forests, and to ascend from the shady thickets where it is born to the free light and air that are necessary to its existence. Not at all; this is not the plan of Nature. Plants are furnished with certain general parts, such as leaves, flowers, &c., and when any particular and unusual office is to be performed, some one of these parts is specially altered, in order to meet the emergency. Thus, in one instance, the stem is enabled to rise among other bushes, by the soft and yielding stalks of the leaves being changed into stiff, inflexible hooks; in the Sweet Pea, the same office is performed by the principal leaf-stalk, which lengthens, branches, and twists itself round bushes and the branches of smaller shrubs. In some plants, indeed, this office is actually performed by the tips of the petals. In the Vine, the arrangement is different from all those just mentioned, and equally simple; a considerable number of supernumerary panicles are prepared, on which no flowers are formed, but, in their room, a power of twisting round other bodies is communicated to the branches; and these form what we call tendrils."

The flowers of the Vine grow on short stalks which diverge from others, and these branch from the central stem; in this manner, when the fruit is ripe, a cluster is formed, differing considerably from that in which the fruit-stalks at once proceed from the stem, as in the Currant. The former arrangement is a panicle, the latter a raceme. The calyx is very small, and undivided into sepals. Within it are seen in the bud, five petals which are held together at the point, though separate at the base. The stamens are five, opposite to the petals, and alternately with the stamens are five small glands. The ovary is two-celled, and the stigma sessile. The fruit is, as every body knows, a succulent berry, with several hard seeds in the pulp. An additional character of the Vine, is the tendency of the branches to swelling near the points from which the leaves proceed; this is very strongly developed in the young plant. Most of the tribe differ so little in these peculiarities from the Grape, as to be at once recognised. The chief differences are in the size of their flowers and fruit, and the taste of the latter. In our native Fox Grape, for instance, the fruit is utterly unfit to eat, having a very disagreeable taste; and other species resemble it in this respect. In the common Virginian Creeper, (*Ampelopsis*,) the leaves are divided into five distinct segments, and every one has remarked the fine crimson color to which they change in the autumn.

The cultivation of the Vine may be traced to a very high antiquity. Its growth, and the preparation of wine from the fruit, were probably understood before the deluge, since we read that immediately after that catastrophe, Noah planted a vineyard, and became intoxicated by drinking the wine. It appears that the culture of the grape was practised in Egypt, from the earliest period. It spread, with the progress of civilization, from its habitation in Asia, to Greece, Sicily and Italy, and thence to Portugal, Spain and France. "The culture of the vine as an article of husbandry, extends over a zone extending from about the twenty-first to the fiftieth degree of North latitude, and consequently about two thousand miles in breadth, reaching in length from the western shores of Portugal to the north of India. The best wines are made at about the centre of the zone; those of the north being harsh and austere, while the juice of the grapes of the south too soon passes into the acetous fermentation, so that they are better adapted for being dried as raisins. Hence, in Spain and Greece, the vineyards of the higher grounds produce the best wines; while those upon the low, hot shores, have always to be dried. On the other hand, in Madeira and the neighboring islands, in which the near proximity of the sea on every side tends to prevent intense heat, some of the most highly prized wines are produced, although they are much nearer the southern border of the zone." "A vineyard, associated as it is with all our ideas of beauty and plenty, is, in general, a disappointing object. In France, the vines are trained upon poles, seldom more than three or four feet in height. In Spain, poles for supporting the vines are not used, but cuttings are planted, which are not permitted to grow very high, but gradually form thick and stout stocks. In Switzerland and in the German Provinces, the vineyards are as formal as those of France. But in Italy is the true vine of poetry, surrounding the stone cottage with its girdle, flinging its pliant and luxuriant branches over the rustic verandah, and twining its long garland from tree to tree. It was the luxuriance and beauty of her vines and olives that tempted the rude people of the North to pour down upon her fertile fields. In Greece, too, as well as in Italy, the shoots of the vines are either trained upon trees, or supported, so as to display all their luxuriance, upon a series of props. This was the custom of the ancient vine-growers, and their descendants have preserved it in all its picturesque originality. The vine-dressers of Persia train their vines to run up a wall, and curl over the top. But the most luxurious cultivation of the vine in hot countries, is where it covers the trellis work which surrounds a well, inviting the owner and his family to gather beneath its shade. 'The fruitful bough by a well' is of the highest antiquity."

The vine lasts to a considerable age, and spreads to a large extent, or, when supported, rises to a great height. Although it bears plentifully when only three or four years old, it is ascertained that vineyards improve in quality till the age of fifty years. In France and Italy there are vineyards still existing, and in full bearing, which were in the same condition at least three centuries ago. In England there are many vines more than 100 years old. The celebrated vine at Hampton Court, covers a surface of 22 feet by 72, and seldom bears less than 2000 clusters each season, every cluster weighing at least a pound.

VEGETABLE PHYSIOLOGY.

NUMBER SIX.

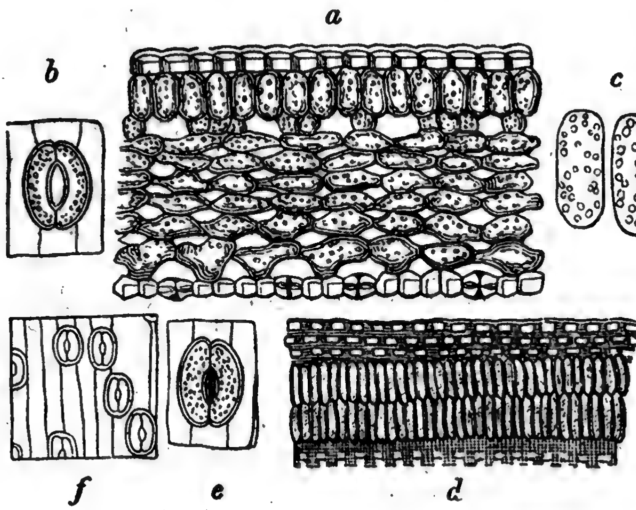
THE STRUCTURE OF LEAVES.

THE nutritious fluid, taken up by the roots, and diffused through the stem, requires exposure to the air, in order to make it fit for maintaining the life of the plant. Another requisite condition for the same purpose, is the influence of light upon the sap. To effect these objects, the green surface of the plant must necessarily be extended, so as to expose to both air and light a greater portion of the sap than can be done by the surface of the stem. The leaf, then, may be said to consist essentially of an extension of the skin or cuticle into an expanded surface, supported by a frame-work of ribs or veins prolonged from the woody tissue of the stem or branch, and, like the stem, is composed of cellular tissue, which forms the *parenchyma*, or soft portion between the veins, and of woody fibre, which forms the veins themselves. This woody portion has the same office in the leaves as in the stem, giving firmness to the softer part, and distributing the sap throughout the whole. The parenchyma is composed, as can be seen in many leaves with the naked eye, of separate cells, which when magnified, are found to contain each a globule of the *chlorophyllc*, which gives them their green color. These cells are arranged differently in different parts of the leaf, being usually more closely packed together near the upper surface than the lower, where there are more interspaces between them. The cuticle or outer skin of the leaf is furnished with *stomata*, heretofore described, by which watery vapor can pass out, and air can enter. These breathing pores communicate with the cells, so as to allow the passage of air through the whole interior of the leaf. When the plant is too full of sap, they open in a peculiar manner, so as to allow the escape of the superabundant moisture, and when it becomes dry, they close so as to retain a sufficient amount to sustain life. These pores are principally found on the lower surface of the leaf, since they are too delicate to endure the full influence of the sun.

The object of this arrangement, says Dr. Gray, will appear evident, when we consider that the spaces between the cells, filled with air, communicate freely with each other throughout the leaf, and also with the external air, by means of the stomata, and when we consider the powerful action of the sun to promote evaporation, especially in dry air, and that the thin walls of the cells, like all vegetable membrane, allow of the free escape of the contained moisture by transudation. The light and air necessarily being freely admitted into the texture of the leaf, the sap it contains would be liable to escape by evaporation faster than it can be supplied from the stem and roots; and the leaf consequently shrivel and perish just as it does when plucked from the stem. A safeguard against excessive evaporation is to some extent afforded by the more compact arrangement of the upper stratum, which is exposed to the direct action of the sun, as well as by the form and vertical position of these cells, which present the least possible surface to the sun's rays. This provision is the more complete in the case of plants indigenous to hot, arid regions, where the soil is frequently so parched for long periods as to afford only the scantiest supply of moisture to the roots.

The following figures will illustrate the difference in this respect between the leaf of the Lily, where the upper stratum contains but a single layer of barely oblong cells, and that of the Oleander, a native of dry and sun-burnt places in the East, the upper stratum of which consists of two layers of very long vertical cells as closely compacted as possible.

Fig. 13.



In Figure 13 *a* represents a magnified section through the thickness of a leaf of the White Lily, showing the parenchyma and the epidermis of both surfaces; the lower pierced with stomata. *c* shows the appearance of two of the cells of the upper stratum of parenchyma, detached and more magnified, showing the contained grains of chlorophylle. *f*, a magnified view of the hundredth part of a square inch of the epidermis of the lower surface, with the stomata, or breathing pores, it bears. These are unusually large in the Lily, so as to be visible by a very moderate magnifying power, and are proportionally few in number. One them is shown more magnified, at *e* in the closed state; and open at *b*. *d* is a magnified perpendicular section through the thickness of the epidermis and upper stratum of parenchyma in the leaf of the Oleander, showing the epidermis composed of three layers of thick-sided cells, and the upper parenchyma of very compact vertical cells.

A more effectual provision for restraining the perspiration of leaves within due limits, is found in the epidermis or skin, that invests the leaf, as it does the whole surface of the vegetable, and which is so readily detached from the succulent leaves of such plants as the Stone-crop and the Live-for-ever of the gardens. The epidermis is composed of small cells belonging to the outermost layer of cellular tissue, with the pretty thick-sided walls very strongly coherent, so as to form a firm membrane. Its cells usually contain no chlorophylle. In ordinary herbs that allow of copious evaporation, this membrane is made up of a single layer of cells; as in the Lily and the Balsam. It is composed of two layers in cases where one might prove insufficient; and in the Oleander, besides the provision already described, the epidermis consists of three layers of very thick-sided cells.* All these means of preventing evaporation might be injurious to the plant, by entirely checking the necessary evacuations; but Nature has provided against such a mischance by the stomata already mentioned.

Most leaves which grow in the usual position, are constructed similarly to those just described. There are, however, many leaves which grow upright, exposing each side equally to the light. In these both sides are generally alike, and their colors are the same. Each surface is equally furnished with intercellular surfaces and stomata. This is found to be the case in the common Iris. In other instances, the former plan is completely reversed, the stomata are only found on the upper surface, and the upper parenchyma is much looser in texture than the lower. In plants whose leaves float on the surface of the water, this is usually the case. In the White Water Lily, for example, the leaf is thick, and spongy, and contains large reservoirs of air which give it buoyancy; but these are all just beneath the upper surface, while in the lower surface which lies on the water, and therefore performs none of its usual functions, the cells are closely packed as in the upper surface

* These remarks, together with the figure, are extracted from Dr. Gray's "Botanical Text Book," a work of which too much cannot be said in commendation, and the principal inconvenience attending the possession of which is the overwhelming temptation to appropriate its contents.

of other leaves. How singular that in the wonderful adaptation of these different structures to the different circumstances and positions in which the plants are to grow, any one should fail to perceive the foresight, wisdom, and skill of a Divine Being. Many other instances of this adaptation of structure to circumstances might be given. It will be sufficient to refer to the organization of the Cactus, as described on page 219, which will also explain how those plants are enabled to endure for a long time the confined air of hot houses, in which ordinary plants will wither and perish.

THE FUNCTIONS OF LEAVES.

In the leaves, as already stated, that process goes on, which converts the crude moisture absorbed by the roots into nutritious sap, which supplies the necessary materials for the growth and production of new parts, and also for those products which plants offer for articles of diet, use, or medicine. This is called the process of *elaboration*, and in it several distinct changes take place. The first is the concentration of the fluid by the loss of a considerable portion of its moisture by a perspiration like that of animals, the leaves giving off, under certain circumstances, a quantity of watery vapor. That such a vapor is really exhaled may easily be tested by placing a large wide-mouthed glass vessel, with its mouth downwards, over a growing plant, or the surface of a meadow, in a warm summer day. Its interior will be rendered dim by the accumulation of the vapor, which will soon collect into drops, and run down the inner surface. It has been calculated that an acre of grass land transpires in this way no less than six thousand four hundred quarts of water in twenty-four hours. Experiments have been made to show that this transpiration takes place through the stomata. A very simple method of showing that this is the case, may be made by holding a piece of glass near the under surface of the leaf of a vigorous vine, when it will soon be found to be covered with moisture, while no effect will be perceived if it is held near the upper surface. When the stomata exist on both surfaces in equal numbers, they seem to transpire alike, and if on neither surface, no effect is seen. Again, if a plant, actively transpiring under the influence of sun-light, be carried into a dark room, the transpiration is at once, and almost entirely checked, and if the stomata are examined, they are found to be closed. This transpiration, or exhalation, is regarded as a kind of evaporation from the interior of the plant, and appears to be controlled by the stomata, which by admitting or excluding the air, permit or check it, according to the influence of light upon themselves. This is one way in which light influences the growing plant. If light be excluded, exhalation is prevented, and the fluid which is transpired must pass off by the slower process of evaporation, and absorption soon ceases, since the tissues can contain no more moisture. The share which the leaves have in promoting and maintaining the absorption of fluid by the roots, can thus be understood. The exhalation which takes place in the leaves occasions a new demand for fluid from below, as the combustion of oil in the wick of a lamp gradually exhausts the supply. If the flame be extinguished, the absorption ceases, and if the leaf no longer exhales, the root ceases to absorb. This connexion is shown by an experiment, which also goes far to explain the cause of the rising of the sap in spring, after it has remained stationary during the winter. If a vine be growing on the outside of a hot-house, and a single shoot be trained within, in mid-winter, the warmth to which the latter is exposed, will cause its buds to swell and unfold; while those on the outside are inactive. A demand for fluid will thus be occasioned along this particular branch, and this will be supplied by that existing in the vessels below. When these are emptied they will be again supplied from the parts below them; and thus the motion will be propagated to that division of the roots, whose fibres are connected with those of the vegetating branch, which will absorb fluid for its support, while all the others are completely at rest. In the spring of the year, when the cheerful rays of the sun call the whole of the buds into activity, the whole of the roots are similarly affected; and that the sap begins to move in the upper branches, before it commences ascending in the trunk, has been shown by experiment, notches having been cut at intervals, by which the period of its flow could be ascertained in each part.

Various experiments have been made at different times to ascertain the quantity of fluid thus exhaled by plants, and the results of some of them are very interesting. There is no great difficulty in ascertaining the amount upon a small scale; for if a plant be supplied with a known weight of water, and the weight it has gained during a certain time be deducted from this,—allowance being also made for the evaporation from the surface of the water in which its roots are immersed, the quantity of which may be easily estimated,—the difference must be the proportion exhaled. This differs much in different plants according to the rapidity of their growth. It has been ascertained that the young leaves and shoots of the Wild Cornel exhale twice their own weight of water daily. A common sized cabbage was ascertained by Hales, (one of the best experimenters upon this interesting subject) to exhale from fifteen to twenty-five ounces daily, according to the light and warmth to which it was exposed. This is more in proportion to the surface, than is given off by the skin of man in the same time. The transpiration of a Sun-flower in full growth, during fifteen days and nights, was carefully observed by Hales. This plant was three and a half feet in height, three pounds in weight, and the surface of its leaves was estimated at five thousand six hundred and sixteen square inches, or about two and a half times that of the human body. The average transpiration during the whole period was found to be twenty ounces per day; but in one warm dry day it was as much as thirty ounces. During a dry warm night, it lost three ounces—probably by simple evaporation; when the dew was sensible, though small, it neither lost nor gained; and by heavy dew, it gained two or three ounces. When this amount is compared with that perspired by man, it may be shown that, if their *surfaces* were equal, the man would perspire fifty, and the plant fifteen; but that, for equal *weights*, the plant exhales seventeen, while the man perspires one. Experiments upon single leaves, when not too long separated from the plant so as to lose their vitality, yield fully as striking results. Thus a leaf of the Sun-flower, weighing thirty-one and a half grains, absorbed in four hours, by its petiole immersed in water, twenty-five grains of that fluid; the leaf had increased in weight only four and a half grains; so that twenty and a half grains had disappeared by exhalation.

Experiments of this last kind may be very easily performed by any one who has command of a pair of scales adapted to weigh small substances; and it is well that the student should avail himself of such opportunities of learning how to "put Nature to the question" in matters of this simple character, in order to cultivate habits of accuracy and caution, which are useful in every condition of life. Let him take several leaves of different plants,—such, for example, as the Vine, Oak, Elm, Beech, Lime, Apple, Pear,—weigh them separately, and estimate as nearly as he can the comparative surface presented by each. He should then place their foot-stalks in glasses or bottles of equal size, into which has been poured a certain weight of water, carefully ascertained to be the same in each. All these should be placed in similar circumstances for a certain time, and a corresponding glass should be kept, without a leaf, in order to estimate the amount lost by evaporation from the surface of the water. By ascertaining how much had been absorbed by each leaf, and the weight each had gained, he would thus be easily enabled to calculate the quantity it must have exhaled; and then by comparing this with the extent of the surfaces of the different leaves, he would estimate the proportional rapidity of the process in the various species he had chosen. Care should be taken to select, in the first instance, trees in equal stages of growth, and leaves of a similar degree of freshness and development.*

Whenever the vapor given off from the skins of animals, for any cause exceeds the amount which the atmosphere can take up, it collects into drops, and forms sensible perspiration. In like manner, when the sun first rises, some plants exhale so rapidly, that the lower temperature of the air causes the fluid to accumulate in drops at the points of the leaves. This is often mistaken for dew, but that it is really condensed perspiration may be readily understood, by observing that it occurs not only on plants which are in the open air, but also on those under shelter, and to which the dew could not possibly have had access.

* Cyclopedia of Natural Science.

TEA.

NOTWITHSTANDING the many different kinds of Tea exported from China, there is good reason to believe that they are all the produce of one species; and that the differences of quality are the result of variations in the character of the plant, which are induced by differences of soil, climate, &c., in the extensive tract over which it is grown, and in the age of the trees, the time of gathering the leaves, and the mode of preparing them. The tea districts of China extend from about the 27th to the 33d degree of North latitude; but the plant may be cultivated in regions more distant from the equator, if the climate be mild and equable. It seems to succeed best on the sides of mountains, in dry rocky places, where there is but little accumulation of vegetable mould. The plants are raised from seeds sown where they are to remain. Three or more are dropped into a hole four or five inches deep, and come up without further trouble, requiring little culture except that of removing the weeds, until the plants are three years old. The first crop of leaves is then gathered, at three periods during the year,—about the middle of April, in June, and in August. After the shrubs have attained the age of six or seven years, their produce becomes so inferior that they are removed to make way for others. The gathering is performed with care and selection, the leaves being plucked off one by one. Those which are earliest gathered are of the most delicate color and flavor; leaves of the second gathering are full grown, and of less valuable qualities than the first; while those of the last gathering are still coarser and of still less value. The first form what is called imperial tea; but as to the other names by which tea is known in other countries, the Chinese themselves know nothing; and the compounds and names are supposed to be made and given by the merchants at Canton—who, from the great number of varieties brought to them, have ample opportunity of doing so. Formerly, it was thought that green tea was gathered exclusively from one species, but that is now considered untrue; though it is certain that there is what is called the green tea district, and the black tea district, and that the varieties grown in the one district differ from those of the other.

The tea leaves being gathered, are cured in houses which contain from five to ten or twenty small furnaces, each having at the top a large flat iron pan. There is also, a long, low table covered with mats, on which the leaves are laid, and rolled by workmen who sit around it. The iron pan being heated to a certain degree, by a little fire made in the furnace underneath, a few pounds of the fresh gathered leaves are placed upon it; being fresh and juicy, they crack when they touch the pan, and it is the business of the operator to shift them as quickly as possible with his bare hands until they become too hot to be touched. At this instant, he takes off the leaves with a kind of fan-shaped shovel, and pours them on the mats, before the rollers, who, taking small quantities at a time, roll them in their hands, while others fan them so that they may cool the sooner, and return their curl the longer. This process is repeated several times, before the tea is packed; so that the moisture may be more thoroughly dissipated and the cure more completely preserved. On every repetition the pan is less heated, and the operation performed more slowly and carefully. The tea is then separated into the different kinds, and deposited in the store for domestic use, or exportation. As more select sorts of tea, the blossoms and buds are used, and the strongest kind, which is called *yutien*, and is only used on occasions of ceremony, scarcely colors the water, and consists of buds and half expanded leaves.

Tea was first imported into Europe by the Dutch East India Company, in the early part of the seventeenth century, but it does not appear to have found its way to England until about the year 1660. The first historical notice of it is in an Act of Parliament of that year, in which it was enumerated as one of the beverages sold in coffee houses, on which a duty was to be laid. That it was not then a common drink is evident from an entry in the private Journal of Mr. Pepys, Secretary to the Admiralty, who says, Sept. 25, 1661, "I sent for a cup of tea, (a China drink,) of which I had never drunk before." In 1664, the British East India Company sent *two* *pounds* of tea as a present to the King. In 1667 they issued their first order to import tea, directed to their agent at Bantam, to the effect that he should send home 100 pounds of the best tea he could get. Since then, the consumption has gone on regularly increasing, and since the abolition of the monopoly of the East India Company, and the consequent reduction of prices, the amount imported into England has increased, so that in some years it has reached fifty million pounds.

JULY AND AUGUST FLOWERS.

One of the handsomest native plants which flower in the present month, is *Tephrosia Virginica*, sometimes called by the odd name of Cat-gut, probably from the roots, which are long, stringy, and yellow. It is a Leguminous plant; it grows about two feet high, with pinnate leaves, having ten or twelve pairs of small, regular leaflets. The flowers are in a short, thick, round, terminal raceme, and are very beautiful. The upper petal, or banner, is yellowish white, the wings are a fine red, and the keel white. It grows in bunches, in dry, sandy soils, near the edges of woods. This plant is worthy of cultivation, and would make a splendid ornament of the border. Another very elegant Leguminous plant now in flower, is the one of which a figure is given in the present number. This is the Ground-nut, *Apios tuberosa*. It twines its slender stems over bushes, and with its dark-purple flowers, and smooth pinnate leaves, it is worthy of observation. Another pretty little vine is *Glycine*, or *Amphicarpæa, monoica*. This is more delicate than the other. It has ternate leaves, and pale, purple flowers. Many species of *Lespedeza*, and *Desmodium*, are now in flower, among which may be mentioned the singular *D. uniflorum*. The flower-stalk of this is connected with the leaf-stalk, by a long stem which runs under ground, so that the two are frequently at the distance of a foot or more from each other. It would be a matter of surprise to one unacquainted with this peculiarity, on pulling up what appears to be a leafless stalk of flowers, to find that he is also gathering what appears a separate plant, with ternate leaves. The flowers are pretty, in a long, terminal panicle, of a purple color. *D. Canadense* is also a handsome plant, and is very apt to make the acquaintance of the rambler, by means of its pods, which are jointed, like those of all the species, and adhere to his clothes. July and August are, indeed, the especial season for the Leguminosæ; and various genera, as *Lathyrus*, *Vicia*, *Baptisia*, *Astragalus*, *Cassia*, *Crotalaria*, embellish the woods and fields at this time.

Now the ponds, where that splendid plant grows, are white with the fragrant flowers of the White Pond Lily, *Nymphæa odorata*, so appositely named after the water-fairies. Ah! in what profusion it lines the shores of a certain blue lake which we wot of; and how insufficient has been even the excitement, so well understood by the angler, of hooking, playing, and capturing those noble pike with which its depths abound, to withdraw our admiration from the glossy leaves, and glorious flowers of this queen of the waters; and what a picture did our fine five or six-pounders make, decorated, (we confess the profanation,) with those white petals, so contrasted with their swelling, dark green sides! In this lake, the vulgar *parvenu*, relative of the Nymphæa, *Nuphar advena* by name, does not grow; though its yellow flowers may often, in less deep and pure waters, be found at this season.

The curious little *Drosera*, Sundew, is now in flower, and we have observed the unfailing drops at the tips of its glandular hairs, during all this dry and hot weather. The *Hypericums* and the *Lysimachias*, are now among the most common plants in flower, and one of the latter, *L. quadrifolia*, is remarkable for the perfect symmetry of its whorls of leaves and blossoms. Now the Umbelliferæ are beginning to flower, and some of them are already in full bloom. Very few of these are interesting to the lover of floral beauty, their flowers being small, and of no brilliant colors, and their properties being often of the most dangerous nature. Every body ought to know the villainous Hemlock, *Cicuta maculata*, so as to avoid it as one would a murderer. It may easily be recognised by its tall, smooth, hollow, spotted stem, somewhat suggestive of a sleek, venomous snake, and its large umbels of white flowers. The mbels have no general involucre, and the partial umbels have each an involucre of acute, short and narrow leaves. The umbels, too, are not crowded together, but spread apart. In wet places now flowers that handsome shrub, *Cephalanthus occidentalis*, the Button Bush, with its globular heads of white flowers, bristling with the long projecting styles; and in dryer spots, among underbrush, the sweet-scented *Spiræa alba*, which ought to be cultivated. Now, too, the numerous Compositæ are flowering, and some of them continue in flower till the end of the autumn. Perhaps the handsomest native plants of this order are the species of *Liatris*, especially *L. squarrosa*. The stem of this is tall, bristly, and covered with linear, stiff, nerved leaves, and terminated with sometimes more than twenty heads of the most brilliant purple flowers. Why this fine plant, and another species scarcely less elegant, *L. scariosa*, have not been long ago introduced into the American flower garden, is only to be accounted for by that preference for everything foreign, which often displays itself in such ridiculous contrast with our republican institutions and professions. There is certainly no foreign species of Chrysanthemum, of Cineraria, or even of Aster, which can make so fine an appearance, as would a border of the neglected Liatris. Various species of *Eupatorium* are in flower, and the best known of these is *E. perfoliatum*, so commonly used in the formation of a tonic decoction, by old ladies, under the name of Thoroughwort. Perhaps the tallest herbaceous plant in this part of the country, is another species, *E. purpureum*, or Trumpet-weed, which sometimes grows to the height of eight or nine feet. The *Solidagos*, and the *Asters* seem to take precedence of all other plants in the months of August and September. There is scarcely a spot to be found without some species of one or the other genus; from the dusty roadside, and even the busy street, to the most retired and cool brookside, and the thickest depths of the forest. We need not describe any of these, the yellow racemes of Solidago, and the various colored corymbs of Aster being familiar to every one. The species of the latter, found in the Northern States, are reckoned at more than thirty, and of the former at at least twenty-five. A very handsome genus of Compositæ is *Rudbeckia*. *R. lacinata* is the most common species, and its high stem, with large yellow flowers, whose conical disk, and drooping rays will at once identify them, forms a very conspicuous object. The Sunflowers, *Helianthus*, of which there are five or six species, also are now in their glory; and *H. divaricatus*, especially, is very showy. This makes a very fine plant by cultivation. *Senecio aureus*, *Hieracium venosum*, *Nabalus albus*, or *Prenanthes alba*, *Mikania scandens*, are all Compositæ, worthy of examination. Several of the genera *Pyrola* and *Chimaphila* are in flower, and if an emblem of neatness is needed, you have it in *P. rotundifolia*. Both these Ericaceæ, indeed, are among our prettiest low plants. Their species are called by a variety of names, such as Prince's Pine, Wintergreen, Shinleaf, &c. Now is the time to look for those singular parasites—or supposed parasites,—*Orobanche*, and *Epiphegus*, called Broom-rape, and Beech-drops. Many of the Labiatæ and Scrophulariaceæ are blooming. These, though there are many handsome flowers among them, we must pass over for the present without much notice, merely giving the names of some of the more remarkable. Of the Figwort tribe, the Mullein, *Verbascum thapsus*, is in every field, and its neater relative, *V. blattaria*, is much more pretty and rare. *Linaria vulgaris*, or Toad-flax, is frequent, sometimes in large patches by the roadside, and its queerly formed yellow flowers are worth looking at. *Chelone glabra*, or Snake-head; *Mimulus ringens* and *alatus*, called Monkey-flower; *Leptandra virginica*, or Culver's (not our publisher, whose prescriptions are of a more satisfactory nature to us) Physic, a very handsome white flowered plant, by the way; several species of *Gerardia*, a good looking genus, are all the Scrophu—(the word is too long)—we have time to mention. Of the Labiatæ, are blossoming the mints, Spearmint, Peppermint, Horsemint; the very common *Lycopus*, called Water hoarhound; the Mountain mint, a pretty plant, with very variable flowers; *Pycnanthemum*; *Collinsonia*; *Hedeoma*, or Pennyroyal; *Scutellaria*, two or three species; *Prunella*, *Leonurus*, *Teucrium*, and several other genera. The Fringed Gentian, *Gentiana crinita*, is one of our prettiest flowers. The bright bluish purple corolla, so finely fringed at the margin, will attract the special attention of the observer. It lives in cool, wet places, by the sides of brooks and ponds.

There are numerous other noticeable* plants, which flower in July and August, but we must conclude with some of the Orchidaceæ. Among them a very curious one is the Dragon's-claw, or Coral-root, *Corallorhiza odontorhiza*. It has no leaves, but the stem is about a foot high, with several brown sheaths. The flowers are greenish, in a long spike, the lip being white, with purple spots. The root is a collection of small, fleshy tubes, branched and articulated like coral. Another splendid plant is *Orchis grandiflora*. This is the finest of the genus. It bears a spike of large purple flowers, sometimes more than six inches long, and we have made it by cultivation nearly twice that length. It will flower readily in the garden, if taken up with a considerable quantity of its native soil, and set in a shady situation. Several other species of Orchis are in flower. A very pretty and delicate one is *O. ciliaris*, with fringed flowers, of a bright orange color. This is not so common as most other species, and is found in swamps. All the species, indeed, are among our most curious and interesting plants. We have also found lately the beautiful *Arethusa*, worthy of its poetical name. It is slender and delicate; the stem with a few loose sheaths, bearing upon the summit a single large, nodding, fragrant flower, of the most splendid purple imaginable. *Pogonia verticillata* is a curious plant. Near the top of the stem is a single whorl of four of five leaves, and just above it a single flower, with most peculiar sepals, very narrow, twisted, brown, and two or three inches long. *Calopogon pulchellum* is perhaps the most perfectly beautiful plant of the whole tribe. It has a tuberous root, a very slender scape, of a foot or eighteen inches high, sheathed with a single long lily-like leaf, and bearing about five or six large purple flowers, which, for beauty of color, and delicacy of construction, are unequalled. *Goodyera*, with its curious radical leaves, conspicuously veined with white; *Spiranthes*, two or three species, with frail stems, and spirally twisted spikes; and the superb *Cypripedium spectabile*, with its white, purple-striped lip, and large plaited leaves, are all remarkable plants, and well worthy the attention of the curious. Why have we not a good Monograph of the American Orchidaceæ?

TROPICAL VEGETATION—THE CEIBA TREE.

BY H. H. B.

A native of the North travelling in Cuba, will find his admiration excited by a continual succession of strange and luxuriant tropical productions. Most attractive, from its novelty, is the Palm, which in its beautiful varieties is thickly scattered over the island. The royal palm (Elais ?) is perhaps the most symmetrical, though inferior in height to the wild Palms* of the *Vuelta-abajo*, which often raise their straight and slender stems more than a hundred feet above the savannahs. In the mountains may be seen the massy trunks and rich foliage of the mahogany ; and the dark cedar, so agreeably suggestive of "approved brands" and their fragrant contents. On the sea-shore the Mangrove stretches far into the waves, and pioneers the way for new accessions to the soil. The Bamboo, with its graceful and feathery arches, seems almost like the forest that might fringe Fairy-land. It forms, when stripped of its leaves, a sort of monstrous fishing-rod, almost large enough to "bob for whales," and worthy to have been used by that ancient Fisherman, of whose accoutrements it is said—

> "You would have sworn, had you looked on them,
> He had fished in the flood with Ham and Shem."

In some places the joints, which will hold a full gallon of water, are used as buckets.

One of the most singular vegetable curiosities is a plant called, I think, the *Majabue.* When it first rises out of the ground, it is a slender vine, twining round some forest tree. By degrees it increases in size, the stems and tendrils interlace, and cross each other in numberless windings, forming a kind of net-work around the body of the tree, until finally the whole becomes united into one firm shell, and encloses its prey in a living grave. It now forms a large and beautiful tree, with roots, trunk and boughs, having for its core the body of its dead victim.

* Areca Oleracea.

Far above all the rest, towers the gigantic Ceiba-tree.* This monarch of the forest, in its perfection, sends up a lofty column to the height of ninety or even a hundred feet, and then spreads forth horizontally in immense branches, each a huge tree. At its base large spurs or buttresses stretch forth, which serve to keep upright its enormous weight, and enable it to resist the storms, so violent in this region. The contrast between the light clay color of the trunk and the dark green of the leaves produces a fine effect. Its diameter above the spurs is from six to eight feet, and sometimes more, somewhat decreasing upwards towards the branches. Riding with a companion on the South side of the island, we found one which had fallen from decay and the application of fire to its roots. As it lay extended on a level surface, and we rode on either side, we could just see each other's hats over the trunk. The wood of the Ceiba-tree is very light, and of not much use except for making canoes. A single trunk, hollowed out for this purpose, will carry twenty hogsheads of sugar. The seed vessels produce a kind of cotton, which is not, however, fit for spinning, but is used by the poorer classes for stuffing cushions and pillows. It is considered as an ill omen to cut one of these fine trees from an estate, and as boding no good to the proprietor.

Many of them were prostrated by the furious "temporal," or hurricane which desolated the island in the autumn of 1844. While walking in the dismantled woods, and surveying the wrecks scattered on all sides by a storm of whose violence a north-man can form no conception, the sublime passage in Faust was most forcibly recalled:

"Hark! what a crashing through the forest! * * * Hark, to the splintering of the pillars of the evergreen palaces!, the crackling and snapping of the boughs, the mighty groaning of the trunks, the creaking and yawning of the roots!—All come crashing down, one over the other, in fearfully confused fall; and the winds hiss and howl through the wreck-covered cliffs!"

* Bombax Ceiba.

PÆONIA—THE PEONY.

Natural Order, Ranunculaceæ; Linnæan System, Polyandria, Di-Pentagynia.

Generic Distinctions:—Calyx of five unequal permanent sepals; petals, from five to ten, roundish; stamens, numerous; disc, fleshy, encircling the ovaries; carpels, from two to five, with thick bilamellate stigmas; seeds, numerous, somewhat globose and shining.

***P. Russi.*—Carpels, generally two; pilose, recurved; segments of the leaves elliptic, entire, somewhat pubescent beneath.—*Plate* 35.**

This is a very ornamental genus, and varieties of several species are among the most commonly cultivated plants. The name, Pæonia, is derived from Pæon, a Greek physician, who is said first to have used the plant in curing Pluto of a wound inflicted by Hercules. The Peonies are both shrubby and herbaceous. The former kind are varieties of the Tree Peony, *P. Moutan*, a native of China. Of the latter, there are several species and numerous varieties, which are great favorites, from the easiness of their culture, their hardiness, and their showy flowers. Their roots are composed of several tubers, somewhat like carrots—and, by separating these, their propagation is easily effected. The roots of one species, *P. edulis*, are eaten by the Siberians, who boil them in their soup. The most common Peony of the gardens is *P. officinalis*, which has been in cultivation in England for three hundred years. Its varieties are very numerous, having single, double, and semi-double flowers, of various shades, from white to crimson, and they are all easily propagated. It is a native of several parts of Europe.

The species engraved, is one of the rarer sorts. It is a native of Sicily, and has been cultivated since about 1820. Its flower is single, and of a bright crimson. The flowers are solitary, but there are usually several stems, arising from the same root. The leaves are usually whitish underneath. It is increased, like other species, by parting the roots, and by the seeds, and grows best in an open situation in a rich loamy soil.

PL. 35.

Pæonia Russi (Russ's Peony)

HELLEBORUS—THE HELLEBORE.

Natural Order, Ranunculaceæ; Linnæan System, Polyandria, Polygynia. Generic Distinctions:—Sepals, five, persistent, roundish, obtuse, large, usually green; petals, from eight to ten, tubular, nectariferous; stigmas, orbicular; capsules, coriaceous.

H. niger.—Radical leaves, pedate, quite smooth; scape, leafless, bearing one or two flowers and bracts.—*Plate* 36, *Fig.* 1.

H. lividus.—Stem, many-flowered, leafy; leaves, ternate, smooth, glaucous beneath; segments, ovate-lanceolate.—*Plate* 36, *Fig* 2.

The species of Hellebore are perennial plants, with a leathery texture, and a very disagreeable smell; generally evergreen, and flowering very early in spring. They have a creeping under-ground stem, the fibrous roots proceeding from which are the parts used in medicine. They are all poisonous; though in small doses one or two species are administered as cathartics. The name, Helleborus, alludes to their dangerous qualities, and signifies "deadly food."

H. niger is very commonly cultivated in England, where it is called the Christmas Rose. "Every one," says Mrs. Loudon, "knows that first harbinger of spring, the Christmas Rose, though but few people are aware how very well it looks as a window plant. In the open air, the delicate texture of its flowers is often injured by the frost or melting snow, which so often covers the ground at the dreary season when it appears; but when kept in a sheltered place, such as a room or a greenhouse, it becomes a very ornamental plant. The calyx of the Christmas Rose, consists of five large, white sepals, which are delicately tinged with pink. The petals are small and tubular, but not ornamental, as they are of a dingy green. They are, however, little seen, as they are nearly hidden by the numerous stamens which surround the eight or ten carpels that grow erect and close together in the centre of the flower. The involucre consists of two large bracts, which shade the flower in the bud, so as to resemble a green calyx. The leaves are very deeply cut, and the segments are disposed in a palmate manner, so as to look like separate leaflets. The

PL. 36.

1 *Helleborus niger.* (Black Hellebore.)
2 *Helleborus lividus.* (Livid Hellebore.)
3 *Trollius Europeus.* (European Globe flower.)

species takes its name from the black bark of its underground stem. It is a native of the Apennines, whence it was introduced into England before 1596. It will grow in any soil or situation; but it prefers a dry soil, and a situation open to the sun. It is propagated by dividing the underground stem in summer, after the leaves have decayed."

The Livid Hellebore is a native of Corsica, and is sometimes cultivated. Its leaves are evergreen, in three leaflets, serrated on the margin, and those of the stem have sometimes a dilated leaf-like petiole. It is more difficult to propagate than the other species, since it has not the creeping underground stem, and the seeds do not ripen well.

TROLLIUS—THE GLOBE-FLOWER.

Natural Order, Ranunculaceæ; Linnæan System, Polyandria Polygynia. Generic Distinctions:—Calyx of five, ten, or fifteen petal-like sepals; petals, from five to twenty, small, linear, tubular at base; stamens and ovaries, numerous; capsules, sessile, columnar; many seeded.

T. Europeus.—Sepals, fifteen, converging so as to form a globe, concealing the petals; petals equal in length to the stamens.—*Plate* 36, *Fig*. 3.

From the old German word *trol*, or *trolhen*, signifying round, is derived the Latin name which is applied to this genus, on account of the globular shape of the flowers. This shape is most remarkable in the European globe-flower—some of the other species differing in this respect. They all agree, however, in having their sepals much larger and more ornamental than the petals, which appear rather like abortive stamens. The leaves, like those of most plants of the same order, are deeply cut, and their petioles are dilated, and sheathe the stem, which is hollow, and yields an acrid juice. T. Europeus is a native of Great Britain and other parts of Europe, and has long been a favorite in gardens. The flower stem is erect and branched, each branch terminating in a single flower. The flowers are at first small, but they gradually become larger, though without opening; the sepals, which are numerous, preserving their globe-like form till they fall off, which they do long before the seed is ripe. The petals, which are entirely hidden by the converging sepals, are about the same length as the stamens; and indeed they look more like abortive filaments a little flattened, than petals. The stamens and carpels are very numerous. The leaves appear palmate, so deeply are they cleft into five distinct lobes. This plant never improves by cultivation; and those species which have been propagated from others kept in gardens for a great many years, produce flowers exactly similar to those which are found wild in the meadows. In gardens, the globe-flower will grow in any soil or situation, but it prefers one that is somewhat moist and shady. It is readily propagated, either by seeds or by division of the root.

The only American species of Trollius is T. Americanus. It is a native of all the Northern States, in swamps and low grounds. The leaves are five lobed; the sepals, unlike the European species, spread widely apart, so as to show the petals, which are very short and broad, and of a fine yellow color. Several stems, each bearing a flower, spring from the same root. It flowers in May and June, and is easily cultivated. A variety of this species, discovered by Drummond, near the Rocky Mountains, has white flowers.

OXALIS—THE WOOD-SORREL.

Natural Order, Oxalidaceæ; Linnæan System, Decandria, Pentagynia. Generic Distinctions:—Sepals, five, distinct, or united at base; stamens, monadelphous at base; stigmas, pencil-formed, rarely capitate or bifid; capsule, oblong or cylindrical.

***O. Bowiei.*—Stemless; leaflets, three, roundish, cordate, emarginate; peduncles, about the length of the leaves, umbelliferous.—*Plate* 37.**

This genus comprises a great number of species, which are found in widely separate regions of the world. From the Cape of Good Hope are brought many of the most beautiful kinds, while both Great Britain and our own country furnish others. They have long been cultivated, and are great favorites for their delicacy and beauty. In a late English work, the whole number of species, exclusive of florists' varieties, is reckoned at seventy-one. They bear so strong a family likeness, that it is not easy to confound them with any other genus. They are pretty little plants, some shrubby and some herbaceous. The root is usually tuberous, the bulbs consisting of fleshy scales, sometimes closely imbricate, sometimes loose and diverging. In a few, the subterraneous stem, and the terminating fibre of the bulb, produce little dog-toothed bulbs, in such abundance as to fill the pot to the very bottom. Sometimes the bulb strikes downwards a radical fibre, from the side of which grows a new bulb, which produces a new plant, while the former perishes. Some of the species have a proper stem, and others a scape, at the top of which are the flowers in an umbel. The leaves are usually petioled, and mostly ternate, in a few species binate and digitate. Almost all of them have an acid taste, on account of which they take their generic name, which means sour, or sharp. This taste is owing to the presence of oxalic acid, which is usually made from O. Acetosella. The expressed juice of this plant affords this acid in the form of a crystalline acid salt. It is used for taking iron and ink stains out of linen, for scouring brass, and for various other purposes. For taking out spots in linen, the stained part is dipped in water, sprinkled with a little of the powdered salt, then rubbed on a pewter plate, after which the spot is washed in warm water.

Many of the species ripen seeds, from which, or from offsets, they are readily propagated, and grown in a light soil, the best being a mixture of sand, peat, and loam. They are best kept in pots which will hold a great many roots. The earth should be so light and sandy, as never to become hard, but always soft enough not to resist the point of the finger when pressed upon it. When the flowering time is passed, the pots should be put aside, where they require neither care nor water. In the beginning of August, they should be placed in the open air, and moderately watered. About the middle of September, after the leaves have appeared, they should be placed in a very sunny, airy greenhouse, when they will

Oxalis Bowiei. (Bowie's Oxalis.)

flower well. Some of the species can be planted out in the open air, early in spring, when they will begin to flower in May, and continue through the summer.

The species in our plate is named from the gentleman who introduced it into England, from the Cape of Good Hope, and is considered the handsomest of all the species. The flowers are large, of a fine rose color, and produced in such abundance as to have a most brilliant effect in the garden. When placed in the open ground, says a cultivator, the plants flower in September and October; but by potting them, and keeping them quite dry, so as to allow them about a fortnight's rest in midsummer, or later, and then placing them in a stove, to start them, as the gardeners call it, they may be made to flower freely, and at any season required, according to the time when they are given their period of rest.

A very pretty American species, is *O. violacea*, which ought to be cultivated. The scape is very slender, about a foot high, bearing an umbel of large, elegant, violet-colored flowers. It grows in woods, and flowers in May. Three or four other species are natives of the Northern States.

SAXIFRAGA—THE SAXIFRAGE.

Natural Order, Saxifragaceæ; Linnæan System, Decandria, Digynia. Generic Distinctions:—Calyx of four or five sepals, more or less united; petals, five, entire; capsule, two-beaked, two-celled, opening between the diverging beaks; seeds, many.

***S. ligulata.*—Leaves, obovate, subcordate, denticulated; quite glabrous on both surfaces, but ciliated on the margin; panicle, dichotomous; petals, broad, orbicular.—*Plate* 38, *Fig*. 1.**

***S. stellaris.*—Leaves, wedge-form, serrate, pilose at the margin; stem, simple, naked; petals, acute; capsule, superior.—*Plate* 38, *Fig*. 2.**

This is also a very extensive genus, comprising many species, which are generally inhabitants of northern regions, all over the world. Some of the species are easily cultivated, and, although naturally mountaineers, are not incapable of breathing the more impure air of towns and valleys. They

1. Saxifraga ligulata. (Nepaul Saxifrage.)
2. Saxifraga stellaris. (Labrador Saxifrage.)

are mostly perennial plants, with thick roots, large fleshy leaves, and showy flowers, generally disposed in panicles. The name Saxifraga, signifies 'break stone,' in reference to a supposed medicinal effect of the plants, or according to one rather doubtful authority, "from their insinuating themselves into the crevices of rocks, and breaking them." The parts of fructification are extremely variable, the calyx being sometimes superior, and sometimes inferior, the stamens being inserted into the calyx in some instances, and beneath the ovarium in others. This has been the cause of dividing the genus into several others, though the new genera are not usually adopted.

The Nepaul Saxifrage is one of the finest of the cultivated species. The flowers are large, bell-shaped, and nearly white. The leaves are large, leathery, dotted all over with small punctures, and fringed at the margin with a border of fine short hairs. The root is horizontal and woody. It should be grown in very rich garden soil, and protected from the cold, in April and May, when it flowers. S. Stellaris is a pretty little plant, a native of the north of Europe, and America.

There are many other American species, some of which are among the earliest flowers which blossom in our Northern Spring. One of these, S. Virginiensis, opens its white petals in April, among the stones of every dry, rocky hill. It is a small plant, with obovate, pubescent radical leaves, and a stem of six inches high, bearing a panicle of numerous small flowers. The whole number of North American species is above forty, many of which are native in Canada, Labrador, and the far North. The genus contains in all, above one hundred and fifty species.

CULTURE OF THE CAMELLIA.

BY MR. ELEY.

Camellia Japonica, in the groves and gardens of Japan, is a lofty tree, much admired for its fine form, rich clothing of shining deep green foliage, and elegant red or white flower, single or double. It is equally admired in China as in Japan, and much cultivated in both countries. It is of frequent occurrence in Chinese paintings, with Hibiscus and Chrysanthenum, two of their great favorites. There are several varieties of C. Japonica in China, most of which have been imported, and their number increased from seedlings raised in this country. Yet its management is not generally understood, except by cultivators, and persons having large green-houses. Many persons are deterred from having them in their rooms and small conservatories, as they consider them difficult to manage. The chief complaint is that they drop their buds before flowering. This may be in a great measure prevented by attending to the following directions.

The chief points are to protect the plant from the sun in summer, to prevent the roots from matting around the sides of the pot, and not to give them too much water when they are not growing. When the plants are placed in the conservatory in the autumn, they should be shaded from the sun at noonday in September and October, and also in the spring, in April and May. If exposed to the full sun, the leaves are apt to turn yellow, and the plants get sickly. When placed out of the house in summer, they should be put in a shady situation, where, if they have any sun, it should be but little, and that early in the morning. When Camellias are flowering, and during their growth, they should be watered pretty freely, but not kept saturated, nor should they be suffered to become very dry before water is given them. In summer they should be kept moist, and be watered over their leaves in the evening, which is very beneficial to them; and during winter it is best to keep them rather dry.

As regards the temperature, if it is desired to bring them into flower at the natural time in the spring, they should be kept as cool as possible during winter, for as the heat comes on more gradually, there is less danger of the buds dropping off, which is caused by too sudden a change of temperature. It is astonishing to observe how very easily the flower buds, when nearly ready to expand, are acted upon by either heat or cold. The variation of only a few degrees will considerably effect them, so that attention is necessary at this time. Keep them as regular as possible in temperature and moisture, in order to ensure their bloom. Previous to taking Camellias from the green-houses into a warm room, water them freely on the leaves (if the flowers are not expanded,) and they will come into flower much better than if taken in without watering.

The Camellia is well adapted to flower during the winter months, when but few plants cheer us with their expanded blossoms. They should be placed in the conservatory early in the fall, before the weather is very cold, and by keeping the temperature as regular as possible, between 50 and 60 degrees of heat, (about 50 to 55, by night, and 55, to 60, by day,) keeping them regularly moist, and giving them air in mild weather, they will come into flower early, and provided they are good sized plants and well budded, they will flower a great part of the winter. It may be well to remark that Camellias are very full of buds, and will naturally drop some of them of their own accord, when they have more than the sap can supply, and therefore amateurs should not feel disappointed if they lose some of them. As soon as they have done flowering, which will be according as they flower early or late, from February to April, before the new shoots commence growing, they should be re-potted in fresh soil, and kept in the same heat as before, or the heat may be raised from 55 to 60 degrees by night, and 60 to 65 by day. Syringe over their leaves early in the morning, keep the soil in the pots moist, shade them from the hot sun, giving them as much air as the weather will admit of, which will cause them to grow regularly, and they usually complete their growth in about a fortnight. When the young shoots have done growing, which can be easily perceived by the terminal bud at the point of the shoot, the heat may be raised to 70 degrees, as this increase of heat will cause the flower buds to form with more facility and in greater numbers. But it should be observed, that such increase of heat should be applied immediately on the plants perfecting their growth, and before the wood becomes hard, or it will not have the desired effect; for such plants as form their flower buds in the conservatory, previous to placing them out for summer, can be brought to flower much earlier in the winter, or by the end of November, and any that have not formed their buds in the spring, will form them in summer, and come on in succession.

The soil for Camellias should be a mixture of loam and peat, with some decayed manure and sand, so that it will be of a sufficient texture not to dry too rapidly, nor bake too hard in the pots; for when potted in too hard a soil, or peat alone, an impenetrable ball is formed, impervious to water, which runs down the sides of the pots without watering the roots, and in consequence the plants will be impoverished, the leaves drop off, although apparently green and healthy, and the death of the plant soon follows. The best soil is, one-third of good peat, one-third of loam, nearly one-third of decayed manure, and the remainder fine sand. In shifting them, let the pots be proportioned to the size of the plant, and the quantity of roots. They may not always require a larger pot, but let them be taken out of the pots, a little of the soil removed from the sides, top and bottom of the ball, and the ball loosened a little, but no roots should be taken away, unless they are dead. The pots should always be well drained with broken potsherds of gravel, then place a little soil over the drainage, and return the plant and fill up the pot with the compost, pressing it down the sides with the finger or a piece of flat stick, leaving a little space between the soil and rim of the pot, to allow of watering. When Camellias are inclined to grow too straggling and tall, they should be pruned, the side shoots cut back, and the leader or top shoot shortened so as to reduce them to regular shape, which should be done as soon as they have done flowering. When they have completely set their flower buds, or by the beginning or middle of June, they will be sufficiently hardy to place out for summer; precaution is necessary to prevent worms from getting an entrance into the pot by placing a piece of board under it, but if any do find their way, they should be taken out, or the pots watered with lime water once a week, for two or three weeks, which will cause them to come out, but be careful not to give them too much lime water, as it may injure their roots. As long as the weather continues favorable, that is, without frost or excessive rains, they need not be taken in till the latter end of September or the beginning of October. Previous to taking them into the house, it may be necessary to take off a little of the old soil from the surface of the pot, but not deep enough to injure their roots, and topdress them with a little fresh compost, which will be very beneficial to them; syringe them over their leaves and wash the pots clean, and keep them in a cool situation, till they are required to flower. When placed out for summer, they should be put in as cool and shady a situation as possible, for if much exposed to the sun they will turn yellow and get sickly. The pots may be plunged about half their depth in the ground, provided the soil is dryish sandy loam; if it is a wet cold soil, it is a good plan to take a box and bore a few holes in the bottom to let water out, and set it on the ground, and place in the pots and fill in the interior with sand, as it will protect the roots from being injured by drouth, and they will not want watering so frequently.

Camellias to be cultivated or flowered in rooms, should be of good size, and strong healthy plants, for small plants are not suitable, as they are more liable to be affected by the heat of the room than larger ones, and the pots being so small they dry much faster, and are apt to lose their buds. When they are brought in from the garden in fall, and it is desired to have them flower as early in the winter as possible, they may be placed in the room they are to flower in, and if the windows are much exposed to the sun's rays they should be shaded a little; and they will come into flower according to the state of the plants, and the forwardness of the buds. If it is only wished to have them flower in the spring, they may be placed in a cool room where they will not freeze, and they will bear a darker room than most other plants, and can be brought into the parlor when they are wanted, and with the same attention they will soon come into flower. As in rooms there is not the same convenience for potting or shifting them as in a conservatory, they may be kept in such rooms till the season arrives for placing them out in summer, when they can be fresh potted if they require it, and they will perfect their flower buds by autumn.

Camellias are increased by grafting them on stocks of the single red variety, the cuttings of which may be taken off the parent plant at any season after the wood of the previous growth is ripe, and planted in pots of white sand, which should be well drained, and two or three leaves left on each cutting. Place them in a shady part of the green-house, for five or six weeks, and then plunge them up to their rims in a hot-bed, and when rooted, they should be separated into small pots, kept shaded when first potted, then nursed along till of fit size to graft.

PROPAGATION BY LAYERS AND GRAFTS.

In order to propagate any particular variety of fruit or flower, the cultivator reserves some of the leafy buds of the tree or plant, and places these in circumstances favorable to their growth. In many instances, the leaves or leaf-buds have the power of forming roots for themselves; and this is especially the case when the neighboring part contains a temporary supply of nourishment for them, such as the tuber of the potato imparts to the eyes, or buds, which it contains. Thus, if the young branches of a vine be cut into as many pieces as there are leaf-buds, and these be properly laid in a favorable soil, and stimulated to growth by heat and moisture, they will soon put out roots and become perfect plants; being at first supported by the nutritious matter contained in the wood to which they adhere, and afterwards by the products of its decay. It is in this way that sugar-cane is propagated; the plants that spring from these cuttings being more vigorous, and coming earlier to maturity, than those raised from seed. This method is often employed by the gardener; who sometimes varies it, by not detaching the bud from the parent stock, but by bending a branch into the earth, and letting it be partly supported by the juices of its parent, until it has put forth roots for itself. This is termed propagating by *layers*.

But there are many cases in which it is desirable not to trust to the power which the bud may possess of forming roots for itself; and advantage is then taken of the tendency which the growing parts of plants have to adhere and become united to each other. Such adhesions not unfrequently take place from natural causes. Thus, if two branches, either of the same or of different trees, be lying across each other, in such a position as to rub against one another when moved by the wind, the bark will be worn off from each, and a fluid will exude from the wounds, which will be in time converted into solid tissue. This is capable of conveying sap from one branch to the other; for a tree which has been thus united (for the sake of experiment) to two others, and has been thus cut off from all communication with the soil, has continued to live, without any other supply than that which it has derived through these trees. This natural adhesion of vegetable tissue is well seen in the ivy; the branches of which often interlace and graft together in various places, until the whole forms a rude net-work, enclosing the trunk of the tree on which it has climbed.

Now the gardener imitates this process, when he wishes to supply the separated buds of a tree or plant which he is desirous of propagating rapidly, with nourishment ready to be elaborated by its leaves. He chooses a *stock*, or stem deprived of its own buds, and cuts off its top in a sloping direction, so as to expose a large surface of wood and bark. He cuts the lower end of the young branch, or graft, in a similar manner, and then fixes them together, taking especial care that the bark and wood of the one should meet and join with the bark and wood of the other. If the operation succeeds, the stock and the graft become so completely united together, as to form in time but one tree, in which all mark of the original separation has disappeared. The stock draws up from the soil the fluid which the leaves of the graft require; these obtain carbon from the air, and elaborate the crude sap into proper juice, a portion of which is supplied by the graft to the stock for the extension of its own tissues, just as if the stem really belonged to it.

To effect this object, it is generally necessary to choose as the stock, a plant either of the same species as the graft, or one very closely allied to it; and the less the relationship, the more care and precaution must be taken to secure a union, by bringing the newest layers of bark and wood into contact. It is customary to select for the stock some less valuable form of the same species. Thus the cultivated varieties of Pears and Apples are often grafted upon the Wild Pear and Crab. Or a species nearly allied, will sometimes answer nearly as well, and from being readily procured, is commonly employed.—Thus, Peaches and Apricots are grafted on the common Plum. The operation does not always succeed between two species of different genera; and it fails entirely, if an attempt is made to unite individuals of different families. Thus, for example, Pears answer well upon Pears, nearly as well upon Quinces, less freely upon Apples or Thorns, and not at all upon Plums or Cherries, which are of a different family. The Lilac will take upon the Ash, notwithstanding their great apparent difference, because they are of the same natural family; but the Olive, which also belongs to the same family, cannot be profitably grafted upon the Ash, since the vegetation of these is too different to allow them to live long together.

The cause which thus restrains the gardener in the choice of his stock, is not merely the difference in the properties of the fluids of the two kinds, but also the difference in the general character of their growth. It is essential that the stock and graft should be naturally in sap at the same time; and this is more likely to be the case in nearly allied species than in others. However, in very succulent plants, such as the Cacti, of which the fleshy stems are always full of fluid, grafts of very different species succeed very well together; and this exception helps to prove the rule. It is necessary, also, that the rate of growth of the two should be nearly the same; for, if the graft be of more rapid growth than the stock, and more be sent down to the latter than it can convert into tissue, a swelling will be formed above the line of union, like that which takes place when a cord is bound round a stem; and this will increase so, as in time to cause the death of both parts, by altogether obstructing the passage of fluid.

Not only does the process of grafting enable the gardener to multiply with greater rapidity, and to preserve with more certainty, any valuable kind of flower or fruit, but by the judicious selection of a stock, a favorable influence may be produced upon them. Thus the more delicate kinds of vines produce larger and finer grapes when worked upon coarser and more robust kinds; and the Double Yellow Rose, which seldom opens its flowers, and will not grow at all in many situations, blossoms abundantly, and grows freely, when grafted on the common China Rose. Some statements, however, which impute to the stock a much greater influence, are without any foundation in truth. Thus, it has been asserted that Roses become black when grafted on Black Currants; and Oranges crimson, if grown upon the Pomegranate: but this is altogether erroneous, as these species will not unite at all.

Errors in regard to the success of the process have arisen from an occurrence that sometimes takes place,—the formation, by the graft, of independent roots, which supply it partly or wholly with nourishment, with little or no assistance from the stock. In this way has been explained the fact, that the Olive has been made to grow upon the Fig-tree, (as recorded by Columella, one of the earliest writers upon Agriculture;) for no proper union can take place between them, on account of the wide difference of their character. Mention is made by Pliny, of a tree in the garden of Lucullus, which was so grafted, as to bear pears, apples, figs, plums, olives, almonds, grapes, &c.; and at the present time, the gardeners of Italy, sell plants of Jasmines, Roses, Honeysuckles, &c., all growing together from a stock of Orange, or Myrtle, or Pomegranate, on which they say they are grafted. But this is a mere cheat. The fact is, that the stock has its centre bored out, so as to be made into a hollow cylinder, through which the stems of Jasmines, and other flexible plants, are easily made to pass, their roots intermingling with those of the stock. After growing for a time, the increase in the diameter of the stems thus enclosed forces them together, and they assume all the appearances of being united. Such plants are, of course, very short lived.

THE NATURAL SYSTEM OF BOTANY.

NUMBER NINE.

Order—ACERACEÆ. *The Maple Tribe.*

THIS order contains some of the finest forest trees of northern countries. Several species of Maple are among the most common and useful. Of these the wood is extensively used in the manufacture of furniture, and for other useful purposes, and the sap of the sugar maple affords a well known and very pleasant saccharine substance. The characters of the order are easily ascertained. The leaves are opposite, and without stipules; the flowers are small, regular, sometimes perfect, and often diœcious or polygamous. The calyx has five sepals, and the corolla, when present, the same number of petals. The fruit is always a *Samara*, or ovary expanding into wings. The shape and appearance of this is well observed in the common white or red maple.

Order—HIPPOCASTANEÆ. *The Horse-Chestnut Tribe.*

The species belonging to this order are ornamental trees. The common Horse-Chestnut, so generally admired for the richness of its foliage, the beauty of its flowers, and the elegance of its whole aspect, is a native of the north of Asia. The characteristics of the order are readily observed in this fine tree. The leaves are digitate, without stipules; the flowers are showy, in a large panicle; the calyx has five united sepals; the corolla is irregular, with five petals; the stamens are from six to eight, usually seven, unequal in length; the fruit is roundish, with a leathery envelope, enclosing one or two large, smooth, roundish seeds, which contain much bitter, starchy matter.

Order—CELASTRACEÆ. *The Staff-Tree Tribe.*

These are shrubs or small trees, and are possessed of a bitter or acid principle, which, however, does not appear to be of any use. One of the most peculiar of the American species, is the Bladder Nut, *Staphylea trifolia.* This is a shrub, of six or eight feet high; the flowers are white, in a drooping raceme; the capsules are remarkable, being large, and inflated, and the seeds are very hard. The Spindle-tree, *Enonymus*, and the Staff-tree, *Celastrus scandens*, a climbing shrub whose scarlet *aril*, or seed envelope, is so conspicuous through the winter, are other not uncommon members of this order. They all have four or five sepals, united at the base, and the same number of alternate petals, and perigynous stamens. The ovary is superior, composed of several adherent carpels, and immersed in a large fleshy disk. The fruit is either a capsule or a berry.

RHAMNACEÆ. *The Buck-Thorn Tribe.*

This order in some respects much resembles the last, but is readily distinguished by the position of the stamens, which alternate with the sepals, instead of with the petals. The calyx also is *valvate*, instead of imbricate. The ovary is partly enveloped in the disk, the fruit is a capsule, berry, or drupe, and the seeds have no aril. The species of this order are distributed over nearly all the temperate and warm regions of the earth. They are generally shrubs or small trees, and many of them possess spines, like the common Buck-thorn. The inner bark and fruit of most of the order are purgative, and some are also emetic and astringent. A well known medicine, (at present however fallen into disuse,) Syrup of Buck-thorn, is made from the fruit of one species, which also affords a valuable coloring matter. The fruit of an Asian species, *Zizyphus Jujuba*, affords a gummy matter, which is a favorite dessert in Italy and Spain, and under the name of Jujube paste is much used in this country, as a remedy for coughs. The leaves of *Ceanothus Americana*, (the genus is peculiar to this country,) were used as tea during a certain period of the war of the Revolution, whence the shrub is commonly called Jersey Tea.

Order—LEGUMINOSÆ. *The Pea Tribe.*

This is a very extensive and important order. It comprises some of the most interesting, and useful of all plants. Some

Leguminosæ furnish man with great quantities of excellent food, such as the Pea and the Bean, and others are equally valuable for cattle, as the various kinds of Clover and Lucern. Others afford some of the most important dyes, such as Indigo, and Log-wood, and others again the finest woods, Brazil-wood, Rose-wood, and Locust-wood. The medicinal products of some species are in the most common use, as Senna, Cassia, and Acacia. Others still are attractive on account of their great beauty, such as the Laburnums, and Robinias; and others are very interesting on account of their physiological peculiarities, as the Sensitive plant, the Gleditschias, and some of the Acacias.

The most important point in which all Leguminosæ agree, is in the structure of their fruit, which is a pod or *Legume.* This is a carpel which grows long and flat, and separates when ripe into two valves. The pod of a pea is a ready illustration. Leguminosæ are divided into two sub-orders, Papilionaceæ and Mimoseæ. The first of these divisions is distinguished by the singular arrangement of the petals, which have been thought to resemble a butterfly at rest. The flower of the pea is an example, and is constructed as follows. The calyx has five small nearly equal sepals united into a short tube. The corolla consists of five petals, one of which is much larger than the rest, and is wrapped over them before the flower expands. This is called the *vexillum.* In front of this are two smaller petals, called wings, or *alæ.* These are folded over a curved or boat-shaped part, which is placed in front of all the rest. It is formed of two petals, adherent at the lower edge, and is called the keel or *carina.* The stamens are ten in the pea diadelphous, but in some others monadelphous, or distinct.

In the Mimoseæ the flowers are more nearly regular, the stamens are definite in number, (from four or five to twenty,) or else very numerous, and are inserted separately on the receptacle. In this division are contained the Senna, Mimosa, and Acacia. Many of them have a very elegant appearance their clusters of flowers being very numerous and often splendidly colored. Besides the structure of the fruit, all Leguminosæ agree in that of the seed, the whole interior of which is occupied by the fleshy cotyledons, without any separate albumen; a character which is invariable, and which shows the order to be a natural one. These plants are very generally diffused over the whole world, Papilionaceæ being found in almost all countries from the tropics to high northern latitudes, and Mimoseæ flourishing principally near the equator. The number of known species amounts nearly to four thousand.

"A full account of the useful plants and products of this large order," says Dr. Gray, "would require a separate volume. Many, such as Clover, Lucerne, &c., are extensively cultivated for fodder; Peas and Beans for pulse. The roots of the Liquorice, (Glycirrhiza glabra of Southern Europe,) abound in a sweet mucilaginous juice, from which the pectoral extract of this name is prepared. The sweet pulp of the pods of Ceratonia Siliqua (Carob-tree of the South of Europe, &c.,) of the Honey-Locust (Gleditschia,) &c. is likewise eaten. The laxative pulp of Cathartocarpus Fistula, and of the Tamarind, is well known. A peculiar volatile principle (called *coumarin*) gives its fragrance to the well known *Tonka-bean*, and the Melilotus, or Sweet Clover; the flowers and seeds of which are employed to give the peculiar odor to *Gruyere* or *Scheipzeiger* cheese.

Astringents and tonics are also yielded by this order: such as the African Pterocarpus erinaceus, the hardened red juice of which is *Gum Kino;* that of P. Draco, of Carthagena, &c., is *Dragon's Blood.* The bark of most Acacias and Mimosas contains a very large quantity of *tannin*, and is likely to prove of great importance in tanning. The valuable astringent called *Catechu* is obtained by boiling and evaporating the heart-wood of the Indian Acacia Catechu. Leguminosæ yield the most important coloring matters; such as the *Brazil-wood*, the *Log-wood* of Campeachy, (the peculiar coloring matter of which is called *Hæmatin;*) and the Red Sandal-wood of Ceylon. Most important of all is *Indigo*, which is prepared from the fermented juice of the Indigofera tinctoria, a native of India, and also from I. cerulea, and other species of the genus. To the same order we are indebted for valuable resins and balsams; such as the Mexican *Copal*, *Balsam of Copaiva*, of the West Indies, the bitter and fragrant *Balsam of Peru*, and the sweet, fragrant, and stimulant *Balsam of Tolu.* This rich order also furnishes the most useful gums; of which we need only mention *Gum Tragacanth,* derived from Astragalus verus of Persia, &c.; and *Gum Arabic,* the produce of numerous African species of Acacia. The best is said to be obtained from A. vera, which extends from Senegal to Egypt; while *Gum Senegal* is yielded by Acacia Verek, and some other species of the river Gambia. The *Senna* of commerce consists of the leaves of several species of Cassia, of Egypt and Arabia. More acrid, or even poisonous qualities, are often met with in the order. The roots of Baptisia tinctoria, (called wild Indigo, because it is said to yield a little of that substance,) of the Broom, and of the Dyers' weed, (Genista tinctoria, used for dying yellow,) possess such qualities; while the seeds of Laburnum, &c., are even narcotico-acrid poisons. The branches and leaves of Tephrosia, and the bark of the root of Piscidia Erythrina, (Jamaica Dog-wood, which is also found in Southern Florida,) are commonly used in the West Indies for stupifying fish. Cow-itch is the stinging hairs of the pods of Mucuna (or Stizolobium) pruriens, of the West, and M. prurita of the East Indies. Among the numerous valuable timber-trees, our own Locust, (Robinia Pseudacacia,) must be mentioned; and also the Rose-wood of commerce, the produce of a Brazilian species of Mimosa. Few orders furnish so many plants cultivated for ornament."

Order—Rosaceæ. *The Rose Tribe.*

Whether considered in reference to the beauty and universal culture of some of its members, the usefulness of the medicinal properties of many, or the excellence of the fruit of others, this order is one of the most important of all. The species are very numerous, and are generally natives of the temperate regions of the Northern Hemisphere.

The structure of the flower is nearly the same in all the order, but from differences in the fructification, it has been divided into several families, or sub-orders. Taking the flower of the Strawberry for examination, we find that the calyx consists of five sepals, on the outside of which are five bracts.

The corolla has five equal petals; the stamens are very numerous, and instead of arising from the receptacle beneath the carpels, are inserted on the calyx. The pistil consists of a cluster of separate carpels, each having a style, and containing a single seed. The transformation of such a flower to the fruit of the Strawberry, appears singular. When the corolla has fallen off, the receptacle on which the carpels are situated, swells gradually, and separates the carpels from each other, bearing them on its outside, and becoming at length the soft, juicy fruit. In the Raspberry, the structure of the fruit is different. The receptacle does not enlarge, but remains as the white convex core of the fruit; and the fruit itself consists of the carpels, in which the seeds are imbedded, and which become pulpy and succulent. Now on examining a Rose, the structure of the flower will be found to be similar to that of the Strawberry; but the fruit, or Hip, as it is called, is formed of the tube of the calyx, in the interior of which are the carpels. The Apple, Pear, and their allied fruits, are constructed somewhat differently. In these the ovaries, and the tube of the calyx completely coalesce, and form one body, which becomes the fruit. The principal part of the flesh of the Apple consists of the tube of the calyx or the prolonged receptacle; but in its interior are found the five carpels, whose walls have become thin and horny. In the Almond, the Plum, the Peach, and such fruits, there is only a single carpel developed; and this in time becomes the fruit, which is termed a *drupe*, and consists of a fleshy outside, surrounding a hard shell, which contains the cotyledons.

The first sub-order, then, following what appears the most natural division, is AMYGDALEÆ, which have a single ovary, and single seed, a deciduous calyx, and bear a drupe. To this division belong some of the most delicious and esteemed fruits, as the Peach, the Cherry, the Apricot, the Plum, the Nectarine, the Almond, &c. All these agree in the peculiar properties which they derive from the presence of Prussic Acid, (which when of full strength is one of the most violent of known poisons,) in some of their parts. Generally the quantity is not sufficient to produce any deleterious effect, unless it is artificially concentrated, though the leaves of a species of

Cerasus which grows in the Southern States, are said sometimes to destroy cattle which eat them. But such preparations as Laurel-Water, which is distilled from the leaves of a European species of the same genus, and is used for flavoring some dishes and liquors, are eminently dangerous. Almonds are the product of an Eastern species of Amygdalus, and the two varieties differ greatly in the quantity of the acid which they contain; the oil of Sweet Almonds being harmless, while that of Bitter Almonds is most deadly.

The second sub-order is POMEÆ, which contains those important fruits, the Apple, the Pear, the Quince, the Medlar, &c. These need no further allusion. The characters which are peculiar to this division are: ovaries two to five, cohering with each other, and with the thickened or fleshy calyx tube. Fruit a pome.

The third sub-order is ROSACEÆ *proper*, in which the ovaries are several, distinct, rarely solitary; and the fruit becomes either follicles, or achenia. To this belong the Roses, the Blackberries, the Strawberry, the Raspberry, the Cinquefoil, &c.

Order—MYRTACEÆ. *The Myrtle Tribe.*

This order is chiefly remarkable for the aromatic and pungent oil, and the astringent principle which make some of its species so valuable as spices. It is well distinguished by these qualities, as well as the structure of its leaves. These, like those of the Orange tribe, are dotted with little receptacles, which contain the aromatic oil, and if bruised, they emit a fragrant odor. In the Myrtle, as in most of the order, the calyx has five adherent sepals, and the corolla five small petals. The stamens are inserted on the tube of the calyx, and they are sometimes united into bundles. The ovary is three-celled, and the fruit is a berry.

Cloves are the dried flower-buds of the Caryophyllus aromaticus, a small tree which is native in many of the Islands of the Indian Ocean, whence it has been introduced into some parts of Asia, and the West Indies. Eugenia Pimenta produces Pimento or Alspice. The pleasant fruits called the

Rose Apple, and the Guava, are the succulent berries of shrubs of this order, as is also the Pomegranate. Cajeput oil is made from the leaves of an Indian species. It is considered a good external application for the cure of Rheumatism, and was once thought a specific for Cholera. Few Myrtaceæ are found in other than warm climates. South America produces a great number of species, and many are natives of New Holland and the South Sea Islands.

VEGETABLE PHYSIOLOGY.

NUMBER SEVEN

ABSORPTION OF FLUID BY LEAVES.

Besides being the special organs of exhalation, the leaves of plants are capable of supplying in some degree the functions of the roots, when these are in any way prevented from performing their appropriate office. The fact that leaves as well as roots are capable of absorption is easily shown. Every one knows that when plants have suffered from lack of water, or are faded from excess of light and heat, they will rapidly revive, if their leaves are moistened, though no fluid has been supplied to the roots. From numerous experiments, it appears certain that the leaves of trees and shrubs absorb most when their lower side is placed in contact with the water, while those of herbaceous plants abstract most by their upper surface, or equally by both. Thus, leaves of the White Mulberry, placed with their upper side in water, faded on the fifth day; while those which absorbed by their lower surface remained fresh nearly six months. This effect was, however, no doubt due in part to the greater degree of obstruction to the loss of fluid by transpiration in the second case than the first, the stomata being principally situated on the lower surface. But in experiments on other plants in which they are similarly disposed, the contrary result has been observed. Thus, leaves of the

Nettle, whose inferior surface was only kept moist, faded at the end of three weeks, while others whose upper surface was in contact with the water, lived for two months. Lastly, the leaves of the Sunflower, Kidney-bean, Cabbage, and many other plants, were observed to remain fresh for the same length of time, by whichever of their surfaces they received their supply of fluid.

The absorbing power of leaves has been shown by other satisfactory experiments. Some plants of *Mercurialis* (Mercury) were placed in water, some of them being immersed by their roots, and others touching it by a part of their leaves alone, a small shoot of each being left out, for the purpose of comparison with the rest. After five or six weeks, the shoots of the plants which were nourished by the leaves, differed little in vigor from those which had been supplied by the roots. Experiments upon single leaves, which have already partially faded, are still more striking. Some leaves of *Potamogeton natans* (Pond-weed) after being wiped dry, were weighed; and after remaining out of the water for two hours, they were found to have lost from three and a half to five and a half grains each. They were then put in water, and after the lapse of two hours more, were again wiped dry and weighed. It was found that they had severally gained from three to five grains each; and this increase, which was also evident from the restoration of their natural freshness and plumpness, could only have taken place by absorption through the cuticle, as the cut ends of their footstalks were defended by soft cement. Many similar experiments might be mentioned, but these are sufficient to show that leaves whose tissue has been deprived of fluid, have the power of replacing it by absorption from water, or from a moist atmosphere. This absorption appears to take place chiefly through the membrane of the cuticle, but more particularly by the downy hairs, which seem to act like so many root-fibres. They are chiefly developed in plants which grow in situations much exposed to the light, and to a dry atmosphere, whilst the same species in damp, shady situations, will not form them. It has been noticed that they lift up their points and separate from one another at the approach of the evening dew, which collects in minute drops around them; and that they fall down again, as soon as the heat of the sun begins to be perceived. In comparing the increase in weight when exposed to dew, in plants thickly furnished with hairs, and possessing few or no stomata, with that manifested by plants having a smooth surface and no stomata, it is seen that the former is much the greatest; and that it also surpasses in about the same proportion the weight gained by immersing the footstalk in water. Thus two heads of common Horehound, the original weight of which was fifteen grains each, were placed, one with its stalk in water, and the other in a place exposed to dew, for a night; the first was found to have gained two grains, and the second five grains. Both were exposed to dew during the next night, and on the following morning they each weighed twenty-three grains, each having gained eight grains, of which the first had acquired six in that night. A withered stem of Alpine Chickweed, weighing five grains, gained six grains by exposure to dew for two nights.

DURABILITY OF THE FERNS.

The great preponderance of the ferns, and of the higher orders of the Cryptogamic plants, in the Flora of the ancient world, having excited, in a peculiar degree, the attention of naturalists, and it being conceived that the total absence of certain kinds of plants, and the constant presence of others, with other points of the like nature and interest, might be accounted for by a difference in the capability of one plant to resist the action of water beyond another, Dr. Lindley resolved to try the result by actual experiment.

He therefore, on the 21st of March, 1833, filled a large iron tank with water, and immersed in it 177 specimens of various plants belonging to the more remarkable natural orders, taking care, in particular, to include representatives of all those which are constantly present in the fossil state, or as universally absent. The vessel was placed in the open air, left uncovered, and was untouched, with the exception of filling up the water as it evaporated, till the 22d of April, 1835, that is, for rather more than two years. At the end of that time, what remained was examined, and the following highly curious results were obtained.

In the first place it was found that the dicotyledonous plants had in general wholly disappeared; whence it was inferred that they could not remain for two years in water without being wholly decomposed. On the contrary, the principal part of those found in an undecayed state, were the Coniferæ and Cycadeæ, which are the very individuals found best preserved in the fossil state.

Secondly, it seemed that monocotyledonous plants survived to a considerable degree; whence it was concluded, that they are more capable of resisting the action of water, (the palms in particular,) than the exogenous tribes, which agrees with their fossil relics; but the grasses and sedges had perished; whence it was concluded that although none of these may be found as fossils, still we have no right to infer that the earth, in the primeval state, was not clothed with the grasses, since there is reason to believe, that had this been the case, they might have entirely disappeared.

Thirdly, the fungi and mosses, and all the lower forms of vegetation, were not to be found, and even the equisetums, though of considerable size, left no traces behind

Fourthly, the ferns appeared to have the greatest power of all the plants tried, to resist the decomposing effects of water, especially if immersed in the green state, for not one of them had disappeared during the experiment; there being no decay, except that the spots of fructification had disappeared; a result often, if not constantly, met with in the fossil state.

From these experiments, Dr. Lindley assumes, as a general result, that the numerical proportion of different families of plants found in the fossil state, throws no light whatever upon the ancient climate of the earth; but that the species and numbers found, depend entirely upon the power which particular families may possess, by virtue of the organization of their cuticles, or otherwise, of resisting the action of the water in which they floated previously to their being fixed in the strata in which they are now found.

REVIVING PLANTS.

The following extract, describing a mode of reviving faded or dying plants, is taken from the *Journal of Science* for 1828. Experiments made by ourselves, have proved that this plan may be relied upon as effecting the object desired. We have found also, that a simple mixture of alcohol and water, will produce a similar effect, though in a less degree.

"This is called a proved method of reviving plants, when their leaves and buds are faded, and their bark and roots hard and nearly dry. The directions are to dissolve camphor to saturation in alcohol, adding the former until it remains solid at the bottom; a sufficient quantity of rain or river water is then to have the alcoholic solution added to it, in the proportion of four drops to one ounce of water. As the camphor comes in contact with the water, it will form a thin solid film, which is to be well beaten up with the water. For a short time the camphor will float in the water in small flocculi, but will ultimately combine with the fluid, and disappear. Plants which have been removed from the earth, and have suffered by a journey, or otherwise, should be plunged into this camphorated water, so that they may be entirely covered. In about two, or at most three hours, the contracted leaves will expand again, the young faded and drooping shoots will erect themselves, and the dried bark will become smooth and full. That being effected, the plant is to be placed in good earth, copiously watered with rain or river water, and protected from the too powerful action of the sun, until the roots have taken good hold of the ground. When large plants, as trees, are to be revived, their roots are to be plunged into the camphorated water for three hours, the trunk, and even the head of the tree, being frequently wetted with the same water, so as to retain them in a properly moistened state. But it is always best, if possible, to immerse the whole plant. Shoots, sprigs, slips, and roots, are to be treated in the same manner. If plants thus treated are not restored in four hours, their death may be considered as certain, for they cannot be recalled to life by any artificial means.

No plant should therefore be left more than four hours in the camphorated water, because the exciting action of the camphor, when it is continued for a longer period, may do injury instead of good. It is not necessary to say that the final prosperity of the plants, thus reanimated by the camphor-water, must depend upon their particular properties, the state of their roots, and the care bestowed upon them. The camphor produces no other effect than to restore to life plants nearly dead; after that, all proceeds according to the ordinary laws, and their ultimate state must be left to art and nature."

PHILOSOPHY OF BLANCHING.

Common Celery is a native of the meadows of many parts of England, where it forms a rank, weedy, strong-smelling herb, which is unfit for human food; how different it is in gardens every body knows. It is thought that its ceasing to be noxious when cultivated, is owing to the greater part of its stems and leaves being blanched. No doubt you must be curious to know why blanching a plant should destroy its unwholesomeness. In my last letter, I told you that the business of leaves is to expose to light and air the sap they suck out of the stem. The consequence of light and air acting upon the surface of leaves, is the forming in their substance, which is originally of the same yellowish white that you see in seeds, a green color, which is more or less deep in proportion to the degree in which the light is powerful; thus a plant which stands exposed to the sun all day long, has its leaves of a darker green than another which grows among other trees, or near a building which throws it into the shade for a part of the day; and the latter again is darker green than a plant which grows at the north side of a high wall, or in an enclosed court which the sun's rays never enter. In like manner, if you cause a plant, or any part of a plant, to grow in total darkness, it will be entirely destitute of greenness; or in other words, the substance of the plant will remain of its original yellowish white, because no green matter can be formed but by the action of light; and if a part already green is kept for a long time in darkness, it will become yellowish-white, in consequence of all its green being destroyed by the peculiar action of the atmosphere upon plants in darkness. This is the explanation of blanching. But mere loss of color is not the only consequence of plants being kept in the dark; poisons, when it is the nature of plants to yield poisons, are also formed in leaves by the action of light; the absence of this wonderful agent will therefore prevent the formation, as well as the formation of green color; and hence blanching renders poisonous plants harmless. Thus, in the Celery, but a small portion only of the leaves is exposed to light; the whole of the stem and of the lower part of the leaves is buried in the earth; the small quantity of noxious matter that might be formed by the few leaves which are allowed to bask in the sun, has to pass down the buried stalks of the leaves before it can reach the stem, where it would be laid up; but you know the leaf-stalk of the Celery is very long, and any thing which has to filter from the upper part of such a leaf to its bottom, has to take a long journey, in the course of which it is constantly under the destroying influence of darkness; so that before it can reach the stem, it will all have perished. A similar effect is produced by the Italians upon Fennel, which, although not a poisonous plant, has too powerful a taste to be a pleasant food, except as an ingredient for flavoring sauces. The Italians, in their warm climate, cause Fennel to grow rapidly in darkness, and thus obtain it in a state very like Celery in appearance; the darkness destroys the principal part of the flavor, no more of the Fennel taste being left than is sufficient to give the blanched stems a pleasant aromatic quality.—*Lindley.*

HYBRID FLOWERS.

It has been discovered, that if two plants are very near relations, the pollen of one will act upon the stigma of the other, just as well as if the pollen was produced by the anthers of the plant to which the stigma belongs; but when the seeds so obtained are sown, the plants which they produce are not exactly like either of those from the intermixture of which they sprang, but bear a strong resemblance to both. For instance, if the pollen of a plant with blue flowers, be placed upon the stigma of one with red flowers, the result will be a plant with purple flowers; or if a plant with a very vigorous growth is thus intermixed with another of a very dwarf habit, the plants which spring from seeds thus procured, will be neither very dwarf nor very tall. Flowers produced in this way are called *hybrids*. This intermixture will only take place between plants closely related to each other. As a general rule, two different species will not hybridize, but there seems, in many cases, to be no limit to the power of intermixing different varieties of the same species. To produce a hybrid, the anthers of the plant which is to afford the seed, must be cut off as soon as possible after the flower expands. and before they have burst to discharge their pollen. The anthers of the other plant must then be watched, and as soon as they burst, the pollen must be collected with the point of a camel's hair pencil, and preserved in a paper till wanted. As soon as the stigmas of the seed-plant are observed to become moist, the pollen must be applied to them by means of the pencil. A very little will be sufficient. The stigmas usually become moist a few days after the flower has expanded; and the pollen should be applied to them in the morning, as the moisture often dries with the heat of the sun, and when the stigma is dry, it cannot suck up the pollen. The pollen will keep a long time; in some cases two or three years. The plant that is to bear the seed should be planted in good soil, and frequently watered; and a bit of thread should be tied round the stalk, below the flower, to indicate which seed has been hybridized. The seed should be sown in pots as soon as it is ripe; and if the plant is at all tender, the pots should be kept under cover during winter. For those who wish to try the experiment for curiosity, perhaps the most convenient subjects would be any two varieties of Pelargonium, or Geranium, as they are usually called, or of any species of Phlox.

A DREAM OF WILD FLOWERS.

I dreamed, that, as I wandered by the way,
 Bare winter suddenly was changed to spring;
And gentle odors led my steps astray,
 Mixed with a sound of waters murmuring
Along a shelving bank of turf, which lay
 Under a copse, and hardly dared to fling
Its green arms round the bosom of the stream;
But kissed it, and then fled, as thou mightest in a dream.

There grew pied wind-flowers and violets,
 Daisies, those pearled Arcturi of the earth,
The constellated flower that never sets;
 Faint oxlips; tender blue-bells, at whose birth
The sod scarce heaved; and that tall flower that wets
 Its mother's face with heaven-collected tears,
 When the low wind, its playmate's voice, it hears.

And in the warm hedge grew lush eglantine,
 Green cowbind, and the moonlight colored may,
And cherry blossoms, and white cups, whose wine
 Was the bright dew yet drained not by the day;
And wild roses, and ivy serpentine,
 With its dark leaves and buds, wandering astray,
And flowers, azure, black, and streaked with gold;
 Fairer than any wakened eyes behold.

And nearer to the river's trembling edge,
 There grew broad flag-flowers, purple prankt with white,
And starry river buds among the sedge,
 And floating water lilies, broad and bright,

Which lit the oak that overhung the hedge,
  With moonlight beams of their own watery light;
And bulrushes and reeds of such deep green,
  As soothed the dazzled eye with sober sheen.

Methought that of these visionary flowers,
  I made a nosegay, bound in such a way,
That the same hues which in their natural bowers
  Were mingled or opposed, the like array
Kept these imprisoned children of the Hours
  Within my hand,—and then, elate and gay,
I hastened to the spot whence I had come,
  That I might there present it!—Oh! to whom?

Shelley.

LOBELIA—THE LOBELIA.

Natural Order, Lobeliaceæ; Linnæan System, Pentandria, Monogynia.
Generic Distinctions:—Tube of the calyx adhering to the ovary; limb free, five-cleft; corolla irregular, tubular, cleft on the upper side, thickened or ventricose at the base; limb, five-parted, bilabiate; the upper lip in two narrow segments; the lower lip in three roundish segments; anthers united above into a curved tube; stigma two-lobed; capsule opening at the apex; seeds small.

L. fulgens.—Simple, erect, somewhat pubescent. Leaves elongately lanceolate, attenuated, nearly entire. Raceme many-flowered. Style and stamens longer than the corolla.—*Pl.* 39.

This genus was named in honor of M. Lobel, a distinguished botanist. He was born at Lisle, in 1538, wrote several valuable works, particularly one entitled *Icones Plantarum*, became physician and botanist to James I., and died in London, in 1616. The irregular bilabiate flowers are not easily mistaken for those of any other genus. Several of the Lobelias are very highly prized, and much cultivated by florists, especially L. fulgens, L. splendens, and L. cardinalis. The two former species greatly resemble each other. The principal points of difference are, that L. fulgens is covered with a fine down, and its flowers are of a lighter and more brilliant scarlet than those of the other. Both species are natives of Mexico, and were introduced more than thirty years ago into England, where they are much cultivated. They both require a great abundance of water, and may be planted to advantage by the side of a pond where their roots can have access to plenty of moisture. L. cardinalis, called in New England, Eyebright, is one of our most elegant and showy native plants. It is not uncommon in wet soils, near brooks and ponds, and puts forth from July to the middle of September its superb flowers, of a hue so intense as almost to dazzle the eye. In favorable circumstances, the raceme of this plant will become nearly two feet long, and produce nearly a hundred flowers. It is a shame that the Cardinal-flower, so much esteemed and so carefully cultivated in England, is not oftener seen in American gardens. It costs the cultivator nothing, and the plant

39.

Lobelia fulgens (The Refulgent Lobelia) will amply repay the slight care and attention which it requires.

There are several other handsome species, worthy of culture. A common American species, L. inflata, is in great use among a certain class of quacks, as an emetic, and an unskilful use of it has more than once caused the death of the patient. According to Dr. Gray, less than a tea-spoonful of the seeds or powdered leaves would destroy life in a few hours. The juice of all the species, indeed, possesses an acid, narcotic, poisonous principle, in greater or less intensity. There are nearly fifty species of Lobelia, the greater part of which are natives of America, while some inhabit the Cape of Good Hope, Japan, and the South of Europe. In New England there are seven or eight species, and five more in the Southern States.

JASIONE—THE SHEEP SCABIOUS.

Natural Order, Campanulaceæ; Linnæan System, Pentandria, Monogynia. Generic Characters:—Flowers in heads; common involucre ten-leaved; calyx five-cleft; corolla deeply five-parted; segments linear lanceolate; anthers cohering at base; stigma bifid; capsule two-celled.

***J. perennis.*—Stems erect, simple. Leaves rather hairy; radical ones obovate; cauline ones oblong linear, flat. Peduncles naked.—*Pl.* 40. *Fig.* 1.**

This genus has somewhat puzzled botanists. It was at first placed among Compositæ, and it certainly bears a strong affinity to that order, in its headed flowers and united anthers. The seeds, however, are numerous, while the Compositæ have only one in each seed vessel, and the bracts are distinct instead of being grown together. The name of the genus was applied by Pliny to some unknown plant.

The perennial species is a native of the South of Europe, and is sometimes cultivated. It is a very showy plant, with flowers of a deep blue. It is grown in the open border, and flowers abundantly all summer.

1. *Jasione perennis.* (Perennial Sheep Scabious.
2. *Michauxia Campanuloides.* (Persian Bell-Flower.)

MICHAUXIA—THE PERSIAN BELL-FLOWER.

Natural Order, Campanulaceæ; Linnæan System, Octandria, Monogynia.

Generic Character:—Calyx eight or ten cleft, with appendages covering the recesses; corolla eight or ten parted, rotate; stamens eight or ten; filaments very broad, membranous, approximate at the base; anthers cuspidate; style hairy; stigmas eight, filiform; ovary eight-celled; seeds numerous; capsule eight or ten valved, opening at the base.

M. campanuloides. Stem pilose; leaves lanceolate, irregularly lobed; petioles marginate; appendages of the calyx shorter than the lobes.—*Pl.* 40. *Fig.* 2.

This genus was named in honor of Andrew Michaux, the distinguished botanist, who discovered its only two species. Both species are biennial plants, and natives of Asia. The flowers are very singular. Those of M. campanuloides, when in the bud, much resemble a Campanula, but when they are fully open, the eight petals curl back, and expose the broad filaments growing together at their bases. The stamens are eight, with yellow anthers; the limb of the calyx has eight divisions, and there are eight stigmas. The flowers are white, with a tinge of pink; the stems are reddish, the leaves are large, and irregularly lobed, with a very conspicuous midrib, and the root is fusiform. The plant grows about six feet high, and bears a profusion of its curious and showy flowers in July and August. It was discovered near Aleppo and on Mount Lebanon, and was introduced into England in 1787. It is found to be quite hardy, except that its seeds do not ripen well. The seeds should be sown in the autumn, and the young plants suffered to remain in the seed-bed till May, when they should be removed to where they are to flower.

ARCTOTIS—THE ARCTOTIS.

Natural Order, Compositæ; Linnæan System, Syngenesia, Necessaria. Generic Character: Flowers radiate; receptacle honey-combed, bristly, seeds doubly furrowed on the back; pappus chaffy; involucre imbricate; scales rough at the margin.

A. tricolor. Stemless; leaves lyrate, spreading, upper surface slightly hairy, lower tomentose; scales of the involucre linear, sometimes club-shaped, downy, mucronate.—*Pl.* 41.

The plants which compose this genus are all natives of the Cape of Good Hope. There are more than twenty species, several of which are in much estimation for their beauty. Nearly all the species, indeed, are remarkable for the size and beauty of their flowers, which are often tinged with a reddish orange color, which forms a fine contrast with green. The following directions apply to the cultivation of all the species: "In situations where it is not convenient to protect the plant during the winter, cuttings should be made in the summer, which will strike root easily if planted in a border of light earth, and which may be potted in autumn, in order that they may be protected in a frame during the winter, till they can be planted out in spring; or the cuttings may be struck at once in pots early in autumn, and protected in winter for planting out in spring. Plants of this genus do much better with this treatment in the open ground than they do in green-houses, as in the latter situation, old plants are very apt to become mouldy, and the leaves to decay. In the open ground, on the contrary, the plants grow freely, and produce abundance of handsome leaves and flowers of good size and brilliant color. They should all be grown in dry light soil, and supplied with abundance of water during the growing season."

The three-colored Arctotis is a dwarf species, and its flowers are among the largest and most beautiful of all. The upper side of the ray florets is white, and the lower dark purple, while the disk is of a shining deep brown. The flower stems are about a foot high. It is easily propagated by suckers

rctotis tricolor (Three-colored Arctotis planted in a mixture of peat and loam, and flowers from May to July.

The *Botanical Register* gives the following curious account of the remarkable method in which the ray florets of these flowers are fertilized:—"On a bright, warm day, under the shelter of a green-house, the stigmas of the various florets may be perceived to emerge from within the tube of the concealed anthers, carrying up the pollen parted with to them by these organs, and which is seen to adhere in a thick coat of yellow powder, to afford it from this new position the means of an access necessary to the otherwise unprovided stigmas of the surrounding ray, a task to which the proper organ is here evidently incompetent. By and by the stigmas are seen to retreat gradually within the cavity of the now empty anthers. When recently emerged and charged with pollen, they bend and incline themselves with a lively motion on the slightest touch, but always in the direction whence the impulse came; and, in so doing, necessarily part with a portion of the pollen which covers them. And as the honeyed liquid which attracts insects to the flower, is deposited in the ray which surrounds the disk, the impulse will be the more certainly given by that means, from the side towards which it is requisite that the pollen should be carried. The style, by the extension and contraction of which the stigma is made to advance and withdraw, seems to consist of a substance resembling elastic gum (caoutchouc), and like that substance may be repeatedly drawn out to a considerable extent, contracting to its former dimensions when left to itself, with the same elastic force."

PRIMULA—THE PRIMROSE.

Natural Order, Primulaceæ; Linnæan System, Pentandria, Monogynia.
Generic Character:—Corolla salver-shaped, with an open orifice; calyx five-cleft, tubular; stamens five, enclosed in the tube of the corolla; stigma globose; capsule ten-toothed at the apex.

P. Auricula.—Leaves obovate, smooth, serrated; scape many-flowered, about as long as the leaves.—*Pl.* 42.

The genus Primula derives its name from *Primus, the first*—on account of the early flowering of many of the species. Perhaps there is no genus which contains a greater number of well known and much admired flowers. Some of these, under the names of Cowslip, Oxlip, Primrose, Polyanthus, and Auricula, with their numerous varieties, have formed the most common ornaments of the garden for hundreds of years. No plants have received in a greater measure the attention of florists, whose treatises have given minute instructions for the cultivation and propagation of the different varieties. It is only, however, with the species which is known to every body as the Auricula, that we have here to do.

The Auricula is a native of the Alps of Switzerland and the neighboring mountainous countries, whence it was brought to England in 1596, and was originally called the French, or Mountain Cowslip. In a very short time it became a favorite, and Parkinson, in 1629, enumerates twenty varieties, which he considers the best, though, he says, "many other varieties are to be found with those who are curious concervers of these delights of nature." The most common colors of the Auricula in its wild state, are yellow and red, sometimes purple, and occasionally variegated or mealy. In cultivation the varieties are innumerable, and some are of exquisite beauty and fragrance. The leaves in different varieties differ nearly as much as the flowers. Near most of the manufacturing towns of England, and many in Scotland, the culture of this plant forms a favorite amusement of the weavers and mechanics. Lancashire has long been famous for its Auriculas. It is no uncommon thing there for a working man who earns three or four

Primula auricula. (The Auricula.)

dollars a week, to give two guineas for a new variety of Auricula, with a view of crossing it with some other, and raising seedlings of new properties. Much has been written as to the soil proper for cultivating the Auricula—and some highly artificial compounds of bullocks' blood, sugar-bakers' scum, night soil, fullers' earth, &c., have been recommended.* An experienced American florist gives the following directions, which can be put in practice without great trouble.

"To cultivate the Auriculas to advantage, they should be protected from heavy rains, (which injure them, by washing the powdery bloom off their leaves), and shaded from the sun in summer. Where any number of them is grown, it is a good plan to plunge the pots in a north border, and protect them by a garden frame, raising up the back of the sash to admit air, and watering them as they become dry. When the plants have done flowering, which will be about the month of May, they should be re-potted in a compost of loam, decayed manure, and sand, in doing which, pick off the dead leaves; and if it is desired to increase them, divide them with the fingers, and break off the old stump at the bottom, but do not cut them with a knife, as it injures them very much. When potted, give them a little water, and place them in the frame for summer. In the fall, previous to taking them in for winter, take a little of the old soil from the top of the pot, and replace it with fresh compost; and if they require a larger pot, shake them out and put them into a larger one with the same ball entire, filling up the pot with fresh soil, and giving them a little water; then place them in a cool, shady part of the house, and keep them rather dry, till they begin to grow, and when in flower they may be watered pretty freely."

The names which florists have given to different varieties are innumerable, and entirely arbitrary, as are their rules for judging of the beauty or merits of a variety. All the Auriculas are divided by them into three classes; those which have a green border and white centre; those with a gray border and white centre; and those of a single color. The variety represented in the plate is one of the finest of the first class.

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* Loudon. Enc. Pl.

THE NATURAL SYSTEM OF BOTANY.

NUMBER TEN.

Order, Onagraceæ—*The Evening Primrose Tribe.*

This Order contains many American plants, several of which are esteemed for their beauty. A specimen of the common Evening Primrose, *Œnothera biennis,* which is found in every sandy field, will present the student with the characters of the order. The number *four* will be found to prevail in all parts of the flower. The calyx has four sepals joined into a tube which envelopes the ovary. The petals are four, and from within them arise eight stamens, with long anthers slightly attached by the middle to the filaments. The pollen is peculiar, the masses being of a triangular shape, and held together by delicate threads. The ovary is four-sided, and four-celled, and the style separates into four stigmas. Besides Œnothera, this order contains the genus Epilobium, a species of which, *E. spicatum*, called Willow-herb, is not uncommon in low grounds, and is one of our most showy native plants. Its long racemes of light purple flowers, and its tall, erect figure, make it very conspicuous. Other northern genera are Gawra, Ludwigia, and Circæa. The beautiful and much cultivated Fuchsia also belongs here. It is a native of Chili. This differs from all other plants of the order, in bearing a berry, the fruit of the rest being a dry capsule, and the seeds of Epilobium being furnished with a tuft of down. In Circæa, the petals, sepals, stamens, and seeds are only two. No useful or medicinal properties are known to belong to these plants.

The sub-order Halorageæ contains a few insignificant plants of no importance, such as *Hippuris*, Horse-tail, and *Myriophyllum*, the Water Milfoil. In these the petals are often wanting, and the stamens sometimes reduced to two.

Order, CACTACEÆ—*The Cactus Tribe.*

These well known plants are among the most magnificent ornaments of the green-house. The splendor of their large flowers, and the grotesque shapes of their fleshy stems, render their appearance at once singular and beautiful. They are all natives of the New World, being principally found in the countries between the tropics, though some species have become naturalized in various parts of the eastern hemisphere. Nearly all of them are destitute of leaves, the stem being very succulent, and covered with an integument which is constructed like the pulpy part of a leaf, and performs the same office. The shape of the stems is singularly varied. "You will form a general idea of this highly curious natural order," says Lindley, "when you are told that the plants called *Indian Figs* (Opuntia), with their prickly, jointed, flattened stems, on which the Cochineal insect feeds; *Torch-thistles* (various species of Cereus), whose angular trunks rise erect and singly into the air, like fantastic vegetable columns; *creeping Cereuses*, with their long pendant branches, which might be taken for the tails of some animal, if it were not for the gay, rose-colored flowers they push out from time to time; and all the strange races of *Melon-thistles*, (Melocacti), *Porcupine-thistles* (Echinocacti) and *Hedgehog-thistles* (Mammillarias), whose names sufficiently attest their extraordinary appearance,—I say, you will form a clear general idea of this curious Cactus tribe, when you have collected in your mind all the remarkable plants that have now been named." A member of this order may be distinguished at a single glance; there is no mistaking the showy flower and the spiny stem. In the flower there is no distinction between the calyx and corolla, the sepals of the one, and the petals of the other being indefinite in number, and agreeing in color. The stamens are many, with long filaments, usually joined in a cylinder at the base. The style is single, dividing at the top into several spreading stigmas. The fruit is a pulpy berry, much resembling the Gooseberry in structure. The seeds are numerous, and nearly exalbuminous.

One of the most splendid species is the night-blooming

Cereus. The flower of this plant is nearly a foot in breadth, the outer leaflets being of a brown color, the inner yellow, gradually fading into a pure white in the centre. They begin to expand early in the evening, are in full bloom at midnight, and by daylight in the morning are quite decayed.

At page 219, is a notice of the peculiar structure of the Cactus-stem, and of its remarkable power of resisting heat and drought.

Order, Grossulaceæ—*The Gooseberry Tribe.*

By many botanists this order is considered to be nearly allied to the last. The structure of the fruit is similar, and the leaves are often converted into spines. The species are small shrubs, with alternate, lobed leaves. The most common and useful are the several varieties of Gooseberry and Currant, in a flower of either of which the characters of the order may be observed. The calyx is small, five-parted, and frequently colored. The petals are small, five in number, and the five stamens spring from between them. The style is single, with two small stigmas, and the ovary is imbedded in the calyx tube. It is one-celled, and contains a considerable number of ovules, attached to two parietal placentæ. This structure is easily observed by cutting a ripe gooseberry in two lengthwise.

All the plants of this order are natives of temperate regions. Their fruit is generally of a pleasant acid flavor, and always wholesome. Several species from Western America are cultivated for the beauty of their flowers, as the *Crimson Gooseberry* (Ribes speciosum), and the *Golden-flowered Currant* (R. aureum.)

Order, Passifloraceæ—*The Passion Flower Tribe.*

"When the Spaniards discovered America, they found, among other curious things, a flower, which they thought was an allegorical representation of the sufferings of our Saviour. In its anthers they saw his five wounds, in the three styles the nails by which he was fixed to the cross, and in a column which rises from the bottom of the flower the pillar to which he was bound; a number of little fleshy threads which spread from its cup, they compared to the crown of thorns. They called it, in allusion to its mystical attributes, ***Flos Passionis***, a Latin name signifying Passion-flower." The species which compose the order, are twining plants, which support themselves by tendrils, and bear a large, juicy fruit. The structure of the flower is unique. The calyx has five sepals, usually green on the outside, and colored inside. The petals are of the same number, and always of the same color with the inside of the sepals. Next within the petals "come several rings of beautiful fleshy threads, which spread from the cup like rays, and are splendidly mottled with azure, and crimson, and white. If there be one part of a plant more beautiful than all others, it is this ray (or crown of thorns, as the Spaniards called it) in the Passion Flower; the crimson blotches upon it do really look like stains of blood." Botanists themselves are hardly agreed upon the nature of these singular rays. Some consider them petals, and some stamens, in an imperfect state. In the centre of the flower, rises a column, having at its summit five stamens, each with a two-lobed anther, swinging from the point of a flat filament. The column itself consists of an outer sheath formed by the adhesion of the filaments, and an interior solid cylinder, on the top of which grows the ovary. This is egg-shaped, and has a single cavity, with three parietal placentæ, from which spring the ovules. Its summit bears three swollen stigmas. The fruit is a fleshy body, of the same shape with the ovary, and very variable in size and color in differennt species. In the common Passion-flower it is about as large as a hen's egg, and of an orange color; in others it is smaller, and quite round; and in some tropical species, the *Granadillas*, it is as large as a cocoa-nut, and of a greenish color. These are cultivated, and much esteemed for their refreshing pulp. The roots of some of the order are poisonous, containing a principle resembling Morphine; and this sometimes is found in the fruit and flower.

Nearly all the plants of the order are natives of tropical America, whence the cultivated species are brought. Two species are native as far north as Pennsylvania, and Virginia.

Order, Cucurbitaceæ—*The Gourd Tribe.*

This order is a small one, but it contains many plants of great use to man, such as the different varieties of Melon, Cucumber, Pumpkin, Squash, &c. With the Passion-flowers, this order is in near affinity. All its members have twining stems, with tendrils; their calyx is petaloid; their stamens are united into a column; the structure of the ovary is similar; the fruit is succulent. In these points they approach very near the last order, but in others they are essentially different. The Cucumber, for example, has no petals; its flowers are monœcious; the beautiful rays of the Passion-flower are entirely wanting. In some others of the Gourd tribe the flowers are dioæcious. The stamens are five, as are the other parts of the flower.

The whole tribe possesses a bitter, purgative principle, which, though not much apparent in the fruits commonly eaten, in several other species is powerful, and even deleterious. The drug called Colocynth is obtained from a kind of Gourd which grows in various parts of the East; and from the Squirting Cucumber (Momordica Elaterium) a preparation has been made, a few grains of which will destroy life. From some of the Gourds are formed very useful vessels for various purposes. The *Calabashes* of the East and West Indies, are often capable of holding a large quantity of water, being sometimes six feet in length, by nearly two feet in circumference. Some of the fruits of which they are made contain so large a portion of the bitter principle as to make great care necessary in eradicating it. The whole pulp is carefully scooped out, and the shell filled with water, which is often changed, before it is safe to use it.

Order, Crassulaceæ—*The House Leek Tribe.*

The plants of this order are remarkable for their succulent stems and leaves, and for their capability of existing in situations where few other plants can live. They are found in the thinnest and scantiest soil, even on the roofs of old houses, and the shingles of barren rocks. Several of the species of Sempervivum, House-leek, and Sedum, Stone-crop, are familiar to every one. The parts of the flower are subject to remarkable variations. The sepals vary in number from three to twenty; the petals equal the sepals in number, and they sometimes form a monopetalous corolla. The stamens are either equal in number to the petals, and alternate with them, or twice as many. The number of carpels is the same as that of the petals. Each contains several ovules, arranged in two lines.

The common House-leek, (Sempervivum tectarum) is a native of Britain, and is remarkable for often bearing ovules on its anthers, instead of pollen. So tenacious of life are some of these plants, that even when submitted to great pressure, and a high temperature, for the purpose of drying them for the Herbarium, they will continue to grow and send out long shoots.

Order, Saxifragaceæ—*The Saxifrage Tribe.*

Many of this order are alpine plants, inhabiting cold and mountainous countries, while others are among the most commonly cultivated garden flowers. Of the former are the low species of Saxifrage, which in New England expand their neat white flowers among the rocks in early spring, and of the latter are the Hydrangea, with its many varieties, and the Philadelphus, Syringa, or Mock Orange. The sepals of these plants are four or five, more or less adherent. Petals of an equal number, inserted between the lobes of the calyx. Stamens from five to ten. The ovary consists of from two to five carpels, united at the base, and distinct above. The fruit is generally one or two-celled, and many-seeded. The order is divided by some botanists into four sub-orders, Saxifrageæ; Escalloniæ; Hydrangeæ; Philadelphiæ.

Order, Umbelliferæ—*The Umbelliferous Tribe.*

This is an order of great extent and importance, and the plants which belong to it are very readily distinguished by a most obvious peculiarity. This consists in their manner of inflorescence, which may be observed in a specimen of any common species, such as Parsley, Fennel, or Parsnip. The flower-stalk divides at the top into a number of rays, proceeding like the sticks of an umbrella from a common centre. Each of these rays is again subdivided into others, on which the flowers are borne. The whole constitutes a compound umbel, and this is characteristic of the order. The stems are almost always hollow, and the leaves much divided. The flowers are usually small, and require a lens for the examination of their parts. The border of the minute calyx has five indentations, being composed of five adherent sepals, which also adhere to the ovary. The five petals are inserted on the tube of the calyx, and between them arise five stamens. The styles are two, and the ovary is two-celled, and two-seeded. These characters are nearly invariable, so that most of the order belong to Pentandria, Digynia of the Linnæan arrangement. In the ripe fruit the seeds adhere to the inside of the ovary, whose two divisions separate and form two grains, which are usually called seeds, though really consisting of the carpels enclosed in the tube of the calyx. In this envelope are secreted the essential oils which give their taste to the Caraway, Anise, Fennel, &c.

Few tribes of plants are better known to us than this, on account of the numerous useful species which it contains. The Carrot, Parsnip, Celery, Eryngo, Angelica, Lovage, Caraway, Coriander, Dill, Anise, are much esteemed species, some of which are extensively cultivated as food. It is not common that an order so well marked as this, contains plants of such opposite properties; but we have here, associated with those already mentioned, the Hemlock, one of the most deadly of plants, the Drop-wort, the Fool's-Parsley, and others of a similar nature. The poisonous properties of these are owing to an acrid and narcotic principle, which is found especially in the roots. This principle, in the wild Celery, is removed by the process of blanching; see page 284. Many Umbelliferæ of warm climates, afford valuable medicinal gums, distinguished by their powerful and fœtid odor. Of these, Assafœtida, and Galbanum are most in use, and are considered excellent remedies in hysteric and spasmodic complaints. The former is the inspissated juice of the roots of a Persian species of Ferula.

The number of species of Umbelliferæ is estimated at nine hundred, of which three-fourths are natives of the Northern Hemisphere.

Order, ARALIACEÆ—*The Aralia Tribe.*

This is a small order, whose botanical characters differs little from those of the Umbelliferæ. The principal points of distinction are in the ovary, whose carpels are more than two, which do not separate when ripe, but become a berry, having several one-seeded cells. The properties of the order are tonic and aromatic. Several American plants in common use belong here ; as the several species of Aralia, variously called Wild Sarsaparilla, Spikenard, and Pettymorrel, which are in demand for flavoring beer, and the Ginseng, which has been in some estimation as a medicine.

Order, CORNACEÆ—*The Cornus Tribe.*

These are small trees or shrubs, inhabiting temperate countries. The flowers are in cymes, or in small heads, surrounded with a white or colored involucre. The limb of the calyx is small, and four or five-toothed, adhering to the ovary. The petals and stamens are the same in number, and alternate with each other. The fruit is a two-celled drupe. The only North American genus is Cornus, the species of which, under the name of Dogwood, are common in all our northern forests, where in spring, they form very conspicuous objects, with their large, white, showy involucres. They contain a peculiar principle, called *Carnine,* which renders their bark bitter, tonic and astringent. That of Cornus Florida has been used successfully in place of Cinchona.

Order, LORANTHACEÆ—*The Misseltoe Tribe.*

These plants chiefly deserve notice on account of their singulai habits. They are nearly all parasitic, inserting their roots into the bark of trees, and drawing nourishment from their sap. The calyx is undivided, the petals and stamens are from four to eight. The ovary is one celled, the style single, or wanting, and the fruit a berry. Sometimes the flowers are imperfect, being destitute of calyx or corolla, or both. The fruit usually contains a viscid matter, which in some species is made into bird-lime.

The well known Mistletoe, (Viscum album,) once used in the superstitious rites of the old Druids, and still hung up at Christmas in every country-house in England, is the most noted plant of the order. Its roots insinuate their fibres into the wood of various kinds of trees, and from them springs a pendant evergreen bush, from two to five feet in diameter, covered in winter with small white glutinous berries. Several species of Loranthus are among the most beautiful of tropical flowers, hanging in splendid scarlet clusters from the trees, which are thus clothed with a beauty not their own.

VEGETABLE PHYSIOLOGY.

NUMBER EIGHT.

ÆRATION OF SAP.

A chemical change of great importance is effected on the sap when it is subjected by the leaves to the action of light. It consists in the decomposition of the carbonic acid gas, which is either brought to the leaves by the sap itself, or obtained directly from the surrounding atmosphere. In either case its oxygen is separated and disengaged in the form of gas; while its carbon is retained, and composes an essential ingredient of the altered sap, which, as it now possesses one of the principal elements of vegetable structures, may be considered as having made a near approach to its complete assimilation.

Two glass jars were inverted over the same water-bath; the one filled with carbonic acid gas, the other filled with water, containing a sprig of mint; the jars communicating below by means of the water-bath, on the surface of which some oil was poured, so as to intercept all communication between the water and the atmosphere. The sprig of mint was exposed to the light of the sun for twelve days consecutively: at the end of each day the carbonic acid was seen to diminish in quantity, the water rising in the jar to supply the place of what was lost; and at the same time the plant exhaled a quantity of oxygen exactly equal to that of the carbonic acid which had disappeared. A similar sprig of mint, placed in a jar of the same size filled with distilled water, but without access to carbonic acid, gave out no oxygen gas, and soon perished. When, in another experiment, conducted by means of the same apparatus as was used in the first, oxygen gas was substituted in the first jar instead of carbonic acid, no gas was disengaged in the other jar, which contained a sprig of mint. It is evident, therefore, that the oxygen gas obtained from the mint in the first experiment, was derived from the decomposition by the leaves of the mint, of the carbonic acid which the plant had absorbed from the water.

It is in the green substance of the leaves alone that this process is conducted; a process, which, from the strong analogy it bears to a similar function in animals, may be considered as the *respiration* of vegetables. It is a process which takes place only in a living plant; for if a leaf be bruised so as to destroy its organization, and consequently, its vitality, its substance is no longer capable either of decomposing carbonic acid gas under the influence of solar light, or of absorbing oxygen in the dark. Neither the roots nor the flowers, nor any other parts of the plant which have not this green substance at their surface, are capable of decomposing carbonic acid gas. They produce, indeed, an effect in some respects the opposite of this; for they have a tendency to absorb oxygen, and to convert it into carbonic acid, by uniting it with the carbon they themselves contain. This is also the case with the leaves themselves, whenever they are not under the influence of light. Thus, during the whole of the night, the same leaves which had been exhaling oxygen all day, absorb a portion of that element. The oxygen thus absorbed enters immediately into combination with the carbonaceous matter in the plant, forming with it carbonic acid: this carbonic acid is in part exhaled; but the greater portion either remains attached to the substance of the leaf, or combines with the fluids which constitute the sap. In the latter case, it is again ready to be presented to the leaf when daylight returns, and a fresh decomposition is then effected. This reversal at night of what was done during the day, may at first sight appear to be at variance with the unity of plan which we should expect to find preserved in the vegetable economy; but a more attentive examination of the process will show that the whole is in perfect harmony, and that these contrary processes are both necessary, in order to produce the result intended.

Thus the great object to be attained by this vegetable æration is just the converse of that which is effected by the respiration of animals. In the former it is that of adding carbon, in an assimilated state, to the vegetable organization; in the latter it is that of discharging the superfluous quantity of carbon from the animal system. The absorption of oxygen, and the partial disengagement of carbonic acid, which constitute the nocturnal changes effected by plants, must have a tendency to lessen the capability of the atmosphere to support animal life; but this effect is much more than compensated by the greater quantity of oxygen given out by the same plants during the day. On the whole, therefore, the atmosphere is continually receiving from the vegetable kingdom a large accession of oxygen, and is, at the same time, freen from an equal portion of carbonic acid gas; both which effects tend to its purification and to its remaining adapted to the respiration of animals. Nearly the whole of the carbon accumulated by vegetables is so much taken from the atmosphere, which is the primary source whence they derive that element. At the season of the year when vegetation is most active, the days are longer than the nights; so that the diurnal process of purification goes on for a greater number of hours than the nocturnal process by which the air is vitiated.

The oxygen given out by plants, and the carbonic acid resulting from animal respiration, and from the various processes of combustion, which are going on in every part of the world, are quickly spread through the atmosphere, not only from the tendency of all gases to uniform diffusion, but also from the action of the winds, which are continually agitating the whole mass, and promoting the thorough mixture of its different portions, so as to render it perfectly homogeneous in every region of the globe, and at every elevation above its surface.

Thus are the two great organized kingdoms of the creation made to co-operate in the execution of the same design; each ministering to the other, and preserving that due balance in the constitution of the atmosphere, which adapts it to the welfare and activity of every order of beings, and which would soon be destroyed, were the operations of either of them to be suspended. It is impossible to contemplate so special an adjustment of opposite effects, without admiring this beautiful dispensation of Providence, extending over so vast a scale of being, and demonstrating the unity of plan on which the whole system of organized creation has been devised.

MOVEMENTS OF PLANTS.

Some of the most interesting among the vegetable movements are concerned in the deposition of the seed. The Balsam, (*Impatiens*) has a capsule formed of two valves, which, when the seed is ripe, suddenly separate from one another and curl inwards, scattering the seed to some distance. Now an examination of the tissue of these valves shows that their outer part consists of cells much larger than the inner, and that the fluid contained in it is the most dense. By the laws of Endosmose, (page 121,) therefore, the fluids contained in the tissue of the interior, will have a tendency to pass towards the outside, and will still more distend the cells of that part. This distention of the outside layer will manifestly give the valves a tendency to curl inwards; just as when two thin plates of metal, which expand unequally by heat, are soldered together, and, heat being applied, the compound plate bends towards the side which expands least. This tendency continues to increase up to the time when the seed is ripe; and it is then so powerful as to cause the separation of the valves from each other, and to occasion the rolling inwards of each. Now it has been found that if the valves be placed in a fluid more dense than that which the valves contain, such as syrup or gum-water, the fluid will be drawn off from their cells according to the same law of Endosmose; and the cells of the exterior will be emptied soonest, on account of their being larger and fuller than the others; so that the valves become straight, and even curl outwards. But if they be placed in water, the Endosmose, still taking place towards the side on which the fluid is most dense—viz. the interior cells—will distend them still more, and cause the valves to curl inwards more powerfully than at first.

Another instance of movement which may be explained in a similar manner, is that of the seed-vessel of the Squirting Cucumber, (*Momordica Elaterium.*) This, when ripe, very readily separates from its stalk; and its pulpy contents are violently forced out from the aperture thus left. The pulpy matter surrounding the seeds occupies the centre of the fruit, and by its own increase in amount, distends the cavity; when, therefore, an aperture is formed in any way, the distention is relieved by the violent contraction of the elastic walls.

Such explanations, however, will by no means account for all the evident movements of plants; and it is necessary to suppose their living tissues endowed with a property by which they are enabled to contract upon the application of a stimulus, just as do the muscular fibres of animals. The vegetable kingdom affords many examples of this kind of contractility. Thus, if the leaves of the common Wild Lettuce be touched when the plant is in flower, the part will be covered with a milky juice, which is forced out through the stomata by the contraction of the cells or vessels beneath. Again in the flower of the Barberry, if the base of the stamen be touched with the point of a pin, the filament will bend over so as to strike its anther against the style. This movement is undoubtedly connected with the process of fetilization; and it must be frequently caused by the touch of insects. There is a curious New Holland plant (*Stylidium*), sometimes cultivated in green-houses, which has a tall column arising from the centre of its flower, and consisting of the stamens and style united. This usually hangs down over one side of the flower, but if it be touched ever so lightly, it starts up with a jerk, and rapidly swings over to the opposite side.

One of the most interesting and best known of all vegetable movements, is that displayed by the Sensitive plant (*Mimosa pudica.*) When spread out in sunshine, the leaflets present no peculiarity of appearance; but at night they fold together as in sleep. If, when expanded, one of the leaflets be slightly touched, it will close towards its fellow; the neighboring leaflets will presently do the same; the vein upon which these are set will bend downwards, and meet the one on the opposite side of the mid-rib; the mid-rib will itself bend down upon the stem; and if the plant be in a very irritable state, the other leaves are sometimes affected in a similar manner. The explanation of this very curious phenomenon requires a knowledge of the structure of the parts concerned in it. It is evident that the movement must be in some way propagated from the parts touched, to those where the change actually takes place—that is, the points where the leaflets join the veins, the veins come from the mid-rib, and the mid-rib from the stem. At every one of these points there is a small swelling or intumescence, formed of very spongy cellular tissue, and containing a great deal of fluid in its cells. If the *under* side of the intumescence at the foot of the leaf-stalk be touched, its vesicles, being very irritable, contract and force out the fluid which they contain, and this necessarily pulls down or depresses the leaf-stalk and all that it carries. If, on the other hand, any thing distend the cells on the *upper* side of the intumescence, the leaf-stalk is pushed down, as it were, in a similar manner. The intumescence at the origin of each vein, and at the base of each leaflet, seems to possess the same properties in a degree proportioned to its size, and they are all connected together by the vessels and woody tubes of the mid-rib and veins. Now, when the tissue of any of the leaflets is touched, it appears to contract in the same manner as that of the Wild Lettuce; but instead of squeezing out its fluid upon the surface, it forces it through the vessels into the upper side of the intumescences at the base of itself and its fellow, and these leaflets are thus caused to fold down and meet each other. The fluid forced out from the under side of their intumescences is probably carried to the upper side of those at a little distance, and thus the neighboring leaflets are also depressed. The depression of the veins upon the mid-rib, and of the mid-rib or foot-stalk itself upon the stem, will follow in like manner; the extent to which the movement is propagated, being dependent on the amount of fluid expelled from the lower side of the intumescence, in the parts where it has already taken place.

Various other stimulants besides the touch of a hard substance, will produce similar effects. Thus, if electric sparks be communicated to the lower side of the intermescence, or the rays of the sun be concentrated on it with a burning-glass, a similar contraction of its vesicles, and depression of the leaf, will follow. In all these cases, the leaves return after a time to their usual condition. Several species of the Acacia tribe, growing in warm climates, exhibit corresponding changes in a less degree. The closure of the fly-trap of the Dionæa, may be probably explained on similar principles. The part here irritated is the tissue at the base of the three thorns on each side of the leaf, one of which must be touched in order to excite the movement.

THE FERN TRIBE.

FROM LINDLEY.

Ferns are the most completely organized of Flowerless plants, and approach nearer than any others to the Flowering tribes. In the northern parts of the world, they are green, leafy productions, which die down to the ground every year; and they are seldom more than two or three feet high. But in tropical countries many of them far surpass these pigmy dimensions; they acquire real trunks, resembling those of palms, and often rise to the height of forty or fifty feet without a leaf. Even a more considerable stature is spoken of by travellers. At all times they are graceful objects, from the slender stems on which they bear their leaves, which wave in the breeze like plumes of feathers, and from the multitude of leaflets into which they are cut with the most exquisite regularity. But the Tree-Ferns of the tropics are said to be most superb objects, combining the grace and agreeable color of their European kindred, with the majestic aspect of the Palms.

It is usual to call the leaves of Ferns by the name of *frond*, as if their leaves were not analogous to those of other plants. But I see no use in continuing this old fashioned word, which was coined at a time when the leaf of a fern was thought to be a sort of compound between a branch and a leaf. It is much better, on every account, to call it by the name that the same part bears in other plants.

For the purpose of studying the organization of Ferns, I recommend you to take a leaf of *Hart's-tongue*, (Scolopendrium officinarum,) a plant which is common on most damp and shaded banks, and within old open wells, the mouths of which are almost choked up by it.* All that you will find of the plant, is a brown scaly rootstock, from which grow a number of handsome lance-shaped leaves of a deep green color, placed upon a shining ebony-black stalk. If the leaves are newly formed, you will, by holding them up against the light, readily see their veins, which are dissimilar to those of all other plants. They neither resemble Monocotyledons, nor Dicotyledons; are neither netted nor parallel, but have simply a forked structure. You will remark that although now and then, one vein may be found running straight from the mid-rib nearly up to the margin, without dividing, yet that the principal part fork very soon after the vein has left the mid-rib, and that sometimes one of the branches forks again. This kind of vein is peculiar to Ferns, and will enable you at all times to recognise them, whether their reproductive parts are present or not.

After the leaf has been growing some little time, you may

* This plant, though a native of some parts of the northern States, and known as *caterpillar fern*, may not be familiar to the American student. In that case, one of the genus Asplenium, often called *Spleen-wort or walking leaf*, may be substituted for examination. The only important difference between the structure of these ferns and the Hart's-tongue is, that in the former the sori lie across the veins of the leaf, while in the latter they are parallel, and often attached to them.

remark a number of narrow pale bands appearing at pretty equal intervals upon some of the veins and following their direction. Presently afterwards the whole of the skin of the leaf, where these bands are, separates from the green part below it: in course of time, something swells and raises up the skin, till at last it bursts through it, separating the skin into two equal parts, one edge of which remains adhering to the leaf. At this period the cause of this swelling is discovered; it consists in a multitude of brown seed-like grains that are crowded together very closely, and form a brown ridge. Botanists call the skin which separates from the leaf, the *Indusium*, the ridge *Sorus*, and the seed-like grains *Thecæ*. In order to gain a distinct view of all these parts, you should cut through the leaf across the sorus, just after the indusium has burst; and the edges of the indusium will be distinctly visible, with the ridge-like receptacle of the thecæ rising up between them.

The only means of propagating itself which the Heart's-tongue possesses, resides in the thecæ. It has no calyx, corolla, stamens, or pistil, and consequently neither fruit nor seed; nevertheless it can perpetuate its kind with the same certainty as the most perfect plant. The theca is not a seed, nor is it a body whose functions are of a nature similar to those of a seed. You require a pretty good microscope to examine it correctly; but with such an instrument you will make it out to be a roundish compressed body, seated on a jointed stalk, which runs up one side of the theca. Upon examining a good many of the thecæ, you will no doubt remark some of them burst open; and then you will find that they are hollow bodies, containing a quantity of extremely minute oval grains, called *Spores* by botanists. It is in the spores that the power of increase resides; every one of them will form a new plant, and consequently they are analogous to seeds; but as they do not result from the action of pollen upon a stigma, they are not real seeds, but only the representatives of those organs amongst Flowerless plants.

How simple is all this; how different from everything we have seen in other plants—and yet no doubt as perfectly adapted to the multiplication of Ferns as any more complete contrivance. How prodigious too is the power that these plants possess of disseminating themselves. Hart's-tongue, owing to its small size, is one of those in which the power resides in only a small degree; and yet a little computation will show even its means to be prodigious. Each of its sori consists of from three thousand to six thousand thecæ; let us take four thousand and five hundred as the average number. Then each leaf bears about eighty sori; which makes three hundred and sixty thousand thecæ per leaf; the thecæ themselves contain about fifty spores each; so that a single leaf of Hart's-tongue may give birth to no fewer than eighteen millions of young plants.

The form and situation of the sori is not, in other genera, the same as in the Heart's-tongue; on the contrary, it is upon differences in those respects that the genera have been established. For example, in the *Shield-ferns* (Aspidium,) the sori are round, and covered with a kidney-shaped indusium; in *Polypody* (Polypodium,) they are round, and have no indusium; and in the graceful *Maiden-hair ferns* (Adiantum) they are oblong bodies arising from the edge of the leaf. The most curious arrangement of their parts is in the *Brake*, (Pteris;) no matter at what time of the year you examine the leaves of that plant, you will probably discover no trace of sori, and yet it would be difficult to find a brake-leaf in autumn, which does not abound with them. The truth is that in this plant they occupy so singular a position, that one could almost be tempted to believe them designedly hidden where none but the curious botanist should find them. Look attentively at the under side of the leaves; you will remark the margin to be turned in and thickened, like the hem of a lady's gown in which a cord is run; there lurk the thecæ you are in search of. With the point of a knife lift up gently the edge of the leaf, and you will at once discover a ridge of thecæ running all around it. In this instance the margin of the leaf acts the part of the indusium.

Another singular form of Ferns is that in which the whole of the segments of a leaf are contracted and curled up round the thecæ, so as to lose entirely their natural appearance, and to resemble a sort of inflorescence. A striking instance of this is not uncommon in bogs, in form of a plant called the *Osmund-royal*, or *Flowering-fern*, (Osmunda regalis;) a minute species found in woods, and called *Adder's-tongue,* (Ophioglossum) because of its narrow inflorescence, is another example.

Such is the first and highest degree in the scale of organization among flowerless plants. Possessing a system of vessels, frequently attaining a considerable size, having leaves intersected by veins, and having their surface provided with breathing pores; Ferns may be considered to differ from Flowering plants in little except in the manner in which they are propagated, and in the organs assigned them by nature for that purpose.

GROWTH OF THE MISSELTOE.

As the Misseltoe has been incidentally alluded to in a previous article, the reader may not be unwilling to know some curious facts which have been ascertained in regard to the growth of that singular plant. They are extracted from a late English work, of good authority.

There are some plants which have not the power of forming true roots for themselves, and which obtain their supply of sap from the stems of trees to which they attach themselves. Such is the common Misseltoe. The seeds of this plant are deposited by birds on the exterior of the stems and branches of trees; and the root-fibres which they put out, insinuate themselves through the crevices of the bark, and become incorporated with the wood. Now the Misseltoe imbibes the ascending sap from the wood of the tree or stock on which it grows; and this it converts into a proper juice, adapted to nourish its own structure, by means of its own leaves. The ascending sap of most trees being nearly alike, the Misseltoe seems to grow with almost equal facility on a great variety. It is remarkable, however, that it is very rare on the Oak; and it is perhaps this circumstance, which caused the plant, when found in connexion with that tree, to be regarded by the ancient Druids in a religious light.

It is a very curious fact, that the law of growth of the root-fibres of the Misseltoe, is different from that which governs other roots. While the latter grow downwards towards the centre of the earth, these grow toward the centre of the bough or stem which they may be penetrating. This tendency was ascertained by the experiments of the French physiologist, Dutrochet, who caused a seed of Misseltoe to germinate when hung by a thread near a large ball of metal; and he found that the radicle always directed itself towards the centre of this ball, near whatever part of the surface it might be placed. By this curious adaptation, the Misseltoe, which, from the want of power to form perfect roots, would otherwise be unable to exist, is endowed with a compensating power; it being as much a part of its natural habits to grow upon the stem and branches of trees, as it is for other plants to send their roots into the ground.

The fibres of the Misseltoe seem to incorporate themselves completely with those of the stock; and so intimate is the connexion between them, that colored fluids will pass from the stem into this natural graft, as it may be termed. It does not appear, however, that any communication exists between the parasite, and the bark beneath it, which is always found to be in a dead state around its insertion. But if the part of the branch at which it penetrates, be divided with a saw, it will be seen that the two woods are so thoroughly united that the line of separation between them can scarcely be traced. That the Misseltoe is itself quite deficient in the power of absorbing fluid, has been clearly proved by experience. If the stem of this plant be cut off and immersed in water, it will absorb little or none of the fluid; whilst if a portion of the branch with which it is connected be cut off with it, and immersed in the same way, it will absorb nearly as much as if furnished with leaves of its own.

CULTURE OF THE DAHLIA.

October is the month for taking up the tubers of the Dahlia. The following directions for their preservation, and for the cultivation and propagation of the plant, are concise and simple, and may be acceptable to the many admirers of this handsome flower.

The soil should be composed of equal parts of sand and loam, enriched with part of an old hot-bed, some very rotten cow-dung, or decayed leaves. Fresh stable-dung is unsuitable, as it will produce strong stems and large leaves rather than fine flowers. The ground should be well drained, as, though Dahlias require plenty of moisture, they are soon killed if their roots have access to stagnant water. Many cultivators put a deep layer of stones and brick-bats at the bottom of the bed, so as to prevent the possibility of water accumulating about the roots. The tubers, having been kept in a dry and moderately cool place during the winter, are generally planted in pots in February or March, and plunged into a slight hot-bed, to start them, as the florists term it. They are afterwards removed to the open ground, when they have begun to grow. Or the tubers may be planted at once in the open ground without starting; the tall kinds in May or June, and the dwarf early flowerers in April. The tubers should be planted in rows, about two or three feet apart every way; or in quincunx, about five feet apart in the row, and the rows three feet apart. The situation of the bed should be open and exposed to the sun; and if the weather prove dry, the young plants should be frequently and regularly watered. In planting, care should be taken to arrange the tubers so that the colors may harmonize agreeably. Thus the purples and crimsons, and the crimsons and scarlets, may be separated by yellow, white, or buff, and the salmon-colored and buff may be separated by white. Dahlias will degenerate if grown more than one year in the same bed without fresh soil or manure. When those which have been started in pots are planted, all the earth in the pot should be turned into the hole made to receive it, without breaking the ball; and the empty flower-pot should be turned over the young plant, to prevent too much evaporation from the leaves. As the plants grow, they should be carefully trained, so as to admit the sun and air to the centre of the plant. This is done by tying the stems to stakes fixed in the ground. Sometimes only a single stake is used, to which is tied the main stem. In whatever way stakes may be used, they should be driven a foot and a half or two feet into the ground before the Dahlias are planted; as if this be not done, there is danger of wounding the tubers in driving the stakes into the ground. The stems are tied rather loosely at first to the stakes with bast matting, which is frequently taken off and replaced, as the stems increase, till they have attained their full size. Sometimes, particularly with dwarf Dahlias, the stems are pegged down to the beds, and this plan, when the soil is dry, produces a brilliant effect. Where the object is to produce fine flowers, either for exhibition or seeds, part of the buds, and the tips of the shoots are occasionally removed. Where numerous small but early flowers are wanted, the soil should be sandy or gravelly, mixed with a very little loam. Many cultivators shade their flowers, as both sun and rain will injure the delicacy of the colors.

The plants will generally continue to produce flowers till their leaves and stems become blackened by frost; and as soon as this is the case, they should be cut down nearly to the surface of the ground; and the first dry weather that occurs, the tubers should be taken up in the morning and left exposed to the sun during the day. In the evening, they must be taken to a dry airy place, where they will be safe from frost, and kept there till they are dry enough to have all the soil removed from them, which may be done with a soft brush. They must be then buried in sand, saw-dust, or some similar material, and deposited in a dry cellar, or garret, or some other place where they can be kept dry; the great objects to be considered being dryness, security from frost, and a moderately cool temperature, which should never rise above forty-five degrees, nor sink below thirty-six degrees. Labels with the name of each Dahlia should be affixed to each fascicle of tubers when it is removed from the ground; and these labels are generally of zinc attached by wire.

Dahlias are propagated either by dividing the fascicles of tubers, by cuttings, or by seeds. By the first mode, the roots are planted either in the ground, or in pots plunged in a hot-bed, until they are started—that is, till they begin to grow; they are then taken up, and the tubers cut or pulled asunder, taking care that there is a bud or eye to each. Those which have no buds are termed blind tubers, and they may have buds inserted from other plants, by either cleft or peg grafting. The cuttings are either slipped off from started tubers with a portion of the tuber attached, or made like cuttings of other plants, by taking off part of a shoot in summer. In both cases, they require what is called bottom heat, that is, plunging the pot into a hot-bed, to make them strike. Summer cuttings are rarely made, unless it be of some new or choice sort, as the stems are too succulent to strike easily. The seeds should be sown on a slight hot-bed in February or March, or in a warm border in the open garden. The seedlings must be transplanted into beds, as soon as they have four or six leaves, or they will be drawn up and become weak.

THE DEATH AND FALL OF LEAVES.

BY DR. GRAY.

Leaves usually exist but for a single year. Most evergreens are scarcely exceptions, as their old leaves commonly fall, or at least become inactive, soon after those of the ensuing season are developed. Yet in some cases (as in Firs, &c.) they do survive for a series of years. On the other hand, it is seldom that all the leaves of an herb endure through the whole growing season; but the earlier foliage near the base of the stem perishes and falls, while fresh leaves are still appearing at the summit. In our deciduous trees and shrubs, however, the leaves are all developed within a short period, and they all perish nearly at the same time. They are not destroyed by frost, as is commonly supposed; for they begin to languish and often assume their autumnal tints (as happens with the Red Maple especially), or even fall, some weeks anterior to the earliest frosts; and when vernal vegetation is destroyed by frost, the leaves blacken and wither, but do not fall off entire, as in autumn. Some leaves fall, perhaps, before they have entirely lost their vitality. Others die and decay on the stem without falling, as in Palms and most Endogens; or else the dead leaves mostly hang on the branches through the winter, as in the Beach and some kinds of Oak, and fall when the new buds expand, the following spring. We must therefore distinguish between the death and the fall of the leaf.

The fall of the leaf is owing to the formation of an *articulation*, or joint, between the base of the petiole and the stem on which it rests. The leaf rapidly acquires its full growth,—in a few weeks at farthest,—and since its base cannot long keep pace with the continually increasing circumference of the stem, especially as the leaf is more and more enfeebled as the season advances, a separation therefore takes place by the formation of a joint, which in our trees is well marked long before frost occurs. When it falls, a well defined scar is left. But in most Endogenous plants, where the leaves are scarcely, if at all, articulated with the stem, which increases little in diameter subsequently to its early growth, they are not thrown off, but simply wither and decay; their dead bases or petioles being often persistent for a long time.

But why do leaves die? Why, in all ordinary cases, do they only last for a single year, or a single summer? The answer to this question is to be found in the anatomical structure of the leaf, and the nature and amount of the fluid which it receives and exhales. The water which the roots absorb, dissolves, as it percolates the soil, a small portion of earthy matter. In limestone districts especially, it takes up a sensible quantity of carbonate and sulphate of lime, and becomes *hard*. It likewise dissolves a small proportion of silex, alumen, magnesia, potassa, &c. A part of this mineral matter is deposited in the woody tissue of the stem. But a large portion is

Bignonia Radicans.

carried into the leaves, where, as the water is exhaled or distilled perfectly pure, all this earthy matter must be left behind to incrust the delicate cells of the parenchyma, much as the vessels in which water is boiled for culinary purposes are in time incrusted with an earthy deposit. This earthy accumulation gradually chokes the tissue of the leaf, obstructs the exhalation, and finally unfits it for the performance of its offices. Hence the fresh leaves most actively fulfil their functions in spring and early summer; but languish towards autumn, and ere long inevitably perish. Hence, although the roots and branches may be permanent, the necessity that the leaves should be annually renewed.

The general correctness of this view may be tested by direct microscopical observation. That this deposit consists in great part of earthy matter is shown by carefully burning away the organic matter of an autumnal leaf over a lamp, and examining the ashes by the microscope; which will be found very perfectly to exhibit the form of the cells. The ashes which remain when a leaf or other vegetable substance is burned in the open air, represent the earthy material which it has accumulated. A vernal leaf leaves but the minutest quantity of ashes; an autumnal leaf yields a very large proportion, from ten to thirty times as much as the wood of the same species; although the leaves contain the deposit of a single season only, while the heart-wood is loaded with the accumulations of successive years.

ANEMONE—THE ANEMONE, OR WIND-FLOWER.

Natural Order, Ranunculaceæ; Linnæan System, Polyandria, Polygynia. Generic Character:—Involucre of three leaves, more or less distant from the flower; petals wanting; calyx of from five to fifteen colored, petal-like sepals; caryopsides without feathery tails; roots tuberous.

***A. coronaria.*—Leaves ternate, deeply cut, with numerous linear segments; involucre sessile, deeply cut; sepals six, oval, rounded.—*Pl.* 43.**

Most species of Anemone grow in elevated situations, much exposed to the wind, whence the generic name, from a Greek word, signifying wind. The species are numerous; and among them are not only some of the most esteemed florist's flowers, but also some of the most common of our northern wild flowers. The little Wood-Anemone, or Wind-flower, *A. nemorosa*, is the earliest harbinger of spring, often opening its delicate blossoms on the hill-side, before the snow has fairly melted away. Several foreign species are much cultivated, and produce very large and beautiful flowers. The plate represents one of the finest double-flowered varieties of the Poppy-Anemone. This species is a native of the south of Europe, and the Levant, and has been a favorite garden flower in England and America for many years. It is valued for its hardy nature, and because it will flower at almost any season, according to the time the roots are kept out of the ground, and when they are replanted. The prevailing colors are red, white and blue. The roots are solid, tuberous masses, and the plant is propagated by their division.

The tubers, says Mrs. Loudon, should be planted either in October or February; in the first case they will flower in April, and in the latter in June. According to the usual method of growing these flowers, a bed should be dug, eighteen inches or two feet in depth, and at the bottom of this bed should be laid a stratum, six or eight inches deep, of old cow-dung; if two years old, so much the better. The bed should then be filled in with fresh loam from a field, if it can be procured, and if not, with good sandy loam. The bed should be raised about four inches above the level of the surrounding

Anemone coronaria. (Poppy Anemone.)

garden, and drills about two inches deep should be drawn from one end of the bed to the other. White sand should then be sprinkled along the drills, and the tubers should be planted three or four inches apart, according to their size, the largest kinds being of course planted farthest apart. The drills should then be covered level, and the beds raked quite smooth and even. When the plants begin to appear above ground, if the season be dry, they should be occasionally watered with rain water; and then watering may be continued regularly, as the plants approach flowering. In England, little or no protection is required for the roots during the winter; but in our colder climate the roots will be destroyed by the frost, unless they are well covered with tanner's bark, or straw. The roots may also be planted in spring, in April, May, and June, in succession, when they will flower during the successive summer months. The Anemone may also be grown in flower-pots. The roots should be planted in October, five or six to a pot of nine inches in diameter. The pots should be placed in the green-house, and watered whenever the soil becomes dry, and the plants will flower in March. By planting the roots in November, they will flower a month later, so that some may be in blossom every month in the year.

After flowering, they should be kept quite dry, by covering the beds with mats, until the stem and leaves become withered. The roots should then be taken up, the stem cut off, and when the roots are quite dry they should be placed in paper bags, and kept till it is time to plant them in the following season. They may be planted every year for fifteen or twenty years in succession; but they flower best from the fifth to the twelfth year.

It is proper to mention here, that the old genus Anemone has been divided, and that all those species whose carpels have feathery tails, are arranged in the genus Pulsatilla.

1. Aquilegia Mexicana (Mexican Columbine.)
2. Aquilegia fragrans. (Fragrant Columbine.)

AQUILEGIA—THE COLUMBINE.

Natural Order, Ranunculaceæ; Linnæan System, Polyandria, Polygynia. Generic Character:—Calyx of five, colored, petal-like, deciduous sepals; petals five, gaping above, two-lipped, outer lip large, flat, inner lip small; each petal drawn out into a hollow spur, which protrudes between the sepals: capsules five, erect, many-seeded, pointed with the styles.

A Mexicana.—Spurs straight, spreading, five times longer than the limb; sepals lanceolate, twice as long as the limb of the petals; stamens very long, exserted; styles three, rarely five.—*Pl.* 44. *Fig.* 1.

A. fragrans.—Stem leafy; segments of the lower leaves trifid; flowers numerous, somewhat downy; sepals ovate-lanceolate, acute; spur of the petals incurved, much shorter than the limb.—*Pl.* 44. *Fig.* 2.

Perhaps no flower is more universally cultivated than the common Columbine; and yet few persons observe its singular construction. The sepals and petals are of nearly the same color, and yet their forms are so different as to be readily distinguishable. The sepals are oval, generally pointed, and are attached by a short stalk to the disk. The petals are alternate with the sepals, and their formation is very curious. They form a hollow horn, or spur, having an expanded lip, or mouth, by one side of which they adhere to the disk, while the horns pass upwards between the stalks of the sepals, and curve inwards, so as nearly to meet at their extremities. When a petal is pulled off, with a sepal adhering to it on each side, it bears some resemblance, in shape, to a bird; and from this circumstance are taken both the common and the botanical names of the genus; the first being derived from the Latin, *columba*, a dove; and the other from *aquila*, an eagle. Of the numerous stamens of the Columbine, the inner ones are abortive, having no anthers, and forming a kind of membranous envelope to the carpels. The seed vessels, when ripe, open at the top, to discharge the seeds. The common Columbine is a native of most parts of Europe, and nearly all the species inhabit temperate climates. The very handsome species, *A. Mexicana*, however, as its specific name indicates, is found in

Mexico and Guatemala, being farther south than any other species yet discovered. It is readily known by the great length of its spurs, which are nearly two inches long; and by its numerous and projecting stamens. The styles are generally only three, and the flowers are drooping. This species was introduced into England in 1840, and is there considered the finest of the genus.

A. fragrans is another very fine Columbine, with large and delightfully fragrant flowers. It is a native of the north of India.

There are several other handsome and curious species, which are in cultivation; but none of them are more worthy of admiration than the delicate species, *A. Canadensis*, which grows wild in nearly all the United States. It is generally found in rocky places, on the sides of hills; and its beautiful flowers, scarlet without, and yellow within, with their numerous stamens, appearing as they do in early spring, form one of the chief ornaments of a season when few other plants are in bloom. All the Columbines are easily cultivated, requiring generally a light soil, and not too much water. They are propagated by seed, or by division of the roots.

RAFNIA—THE RAFNIA.

Natural Order, Leguminosæ; Linnæan System, Monadelphia, Decandria.
Generic Character:—Calyx five-lobed, lower lobe narrowest, setaceous, and very acute; keel of the corolla obtuse; vexillum, roundish; legume lanceolate, compressed, many-seeded; leaves simple, entire, alternate, the floral ones sometimes opposite; flowers yellow; stamens monadelphous.

***R. triflora.*—Leaves ovate, sessile, glabrous; branches angular; peduncles lateral, one-flowered, but growing in threes.—*Pl.* 45.**

The plants belonging to this genus have been separated from Crotalaria by De Candolle, and formed by him into a new genus, named in honor of Professor Rafn, a German botanist. *R. triflora* is a native of the Cape of Good Hope, and

Pl. 45.

Rafnia triflora. (Three-flowered Rafnia).

Dracocephalum Altaiense. (Large flowered Dragons-head.)

was introduced into England in 1786. It requires, says Mrs. Loudon, a slight degree of protection during the winter; but if the seeds be sown on a hot-bed in February, and the plants afterwards removed to single pots, they may be set in the open air all summer, and if kept in a frame or green-house during winter, they may be planted in the open ground in May, when they will flower in July or August. The Rafnia is a very showy biennial.

DRACOCEPHALUM—THE DRAGON'S HEAD.

Natural Order, Labiatæ; Linnæan System, Didynamia, Gymnospermia.

Generic Character:—Calyx tubular, straight, with an equally five-toothed mouth; tube of the corolla slender at base, generally exserted; throat wide; limb two-lipped; upper lip concave, erect; lower spreading, three-cleft; style bifid at top; achenia dry, smooth, naked.

D. Altaiense.—Flowers in whorls; bracts oblong; segments of calyx equal; radical leaves petiolate, cordate-oblong, obtusely dentate; stem-leaves sessile, nearly round, deeply toothed, with large, bluntish teeth.—*Pl.* 46.

The generic name Dracocephalum means Dragon's-head, and refers to the shape of the corolla. All the species are perennial plants, with the flowers in whorls, and hairy, large, leafy bracts. The species figured is a native of the Altaian mountains, and has been in cultivation for many years. Its flowers are very beautiful and showy. It grows best in a light, dry soil, where it can have plenty of sun and air; and in such a situation it is raised with very little trouble.

The American plants which were formerly included in Dracocephalum, have been arranged under the new genus, *Physostegia.* One of these, the common Dragon's-head, grows wild as far north as Pennsylvania, and is often seen in our gardens. The flowers are numerous, pale purple, spotted inside. One or two other species deserve cultivation, particularly *Physostegia speciosa,* a native of the South, with pink flowers.

Perhaps the best known foreign species is *D. Canariense,* from the Canary Islands. This is very commonly cultivated, under the name of Balm of Gilead, for its powerful and agreeable fragrance.

THE NATURAL SYSTEM OF BOTANY.

NUMBER ELEVEN.

In the previous articles we have given an account of nearly all the orders of polypetalous exogenous plants; that is, of such exogenous plants as possess both calyx and corolla, with distinct petals. These, it will be recollected, form the first division of the sub-class Angiospermæ. The second division of the same sub-class consists of those exogenous plants which have both calyx and corolla, but whose petals are united. In this division there are thirty-five orders. It is impossible, within our limits, to give more than a brief summary of them, since we must, in our next and final article, conclude our explanations of the Natural Orders for the present.

Division II.—Monopetalous Exogenous Plants.

Order—Caprifoliaceæ. *The Honeysuckle Tribe.*

To this order belong the Honeysuckles (Lonicera), the Elder (Sambucus), Viburnum, Symphoricarpus, or Snow-berry. Nearly all are shrubs; some, like the common Honeysuckle, being climbers. They have opposite leaves, without stipules; a tubular or rotate corolla, either regular or irregular; stamens usually as many as the lobes of the corolla; fruit generally a drupe; seeds pendulous. They inhabit temperate regions, and their properties are nauseous and bitter. The order is sub-divided into Loniceræ and Sambuceæ; the former having a tubular corolla, and filiform style; and the latter a rotate or urn-shaped corolla.

Order—Rubiaceæ. *The Madder Tribe.*

This is a very extensive order, mostly confined to tropical countries. It includes many plants of the most opposite aspects and qualities. The leaves are opposite, or in whorls, and are furnished with stipules. The calyx is often partly united to the ovary, and four or five-toothed. The stamens are as many as the lobes of the corolla, and alternate with them. The fruit is usually a berry, but sometimes a hard capsule, or a drupe. The order is divided into the sub-orders STELLATÆ, which are all herbs, with whorled leaves, as Galium, and Rubia, or Madder; and CINCHONEÆ, which are trees, shrubs, and herbs, having opposite leaves, with stipules. To the latter division belong some important plants.

Peruvian Bark, or Cinchona, and Ipecac, are furnished by southern species. Coffee is the horny seed of another species, Coffæa Arabica. The Button Bush (Cephalanthus), Mitchella, and Hedyotis, are the principal northern genera.

Order—VALERIANACEÆ. *The Valerian Tribe.*

A small order of herbs, having the flowers usually in cymes or panicles; a two or four-toothed calyx; a tubular or funnel-form corolla; an ovary with two abortive cells, and one perfect one. The principal productions of the order are Valerian, furnished by Valeriana officinalis; and the Spikenard of the ancients, which is the root of Nardostachys Jatamansi.

Order—DIPSACEÆ. *The Teasel Tribe.*

The leaves of these have no stipules. The flowers are in dense heads, surrounded with an involucre. The corolla is tubular, the calyx cup-shaped, or forming a pappus. Stamens four; ovary one-celled. Teasels are the dried heads of Dipsacus Fullonum. Several species of Scabiosa are often cultivated. None of the order are natives of America.

Order—COMPOSITÆ. *The Composite Tribe.*

This is the largest and most natural of all the orders. It comprises nearly one-tenth of all flowering plants. To give anything like an idea of its species, their uses, products, and peculiarities, would require a volume. The characters of the order are so marked, that little more than a single glance is required to distinguish its members. The flowers are in heads, forming what is usually called a composite flower. Take the Dandelion or the Sun-flower for an example. The involucre is formed of a set of bracts or scales; and each separate flower has often a bract of its own. The calyx is a pappus, consisting of bristles or hairs. The corolla is superior, and ligulate or tubular. The stamens are five, and the anthers are united into a tube. The style is two-cleft; the fruit an achenium, one-seeded, crowned with the pappus. There are three sub-orders in this immense family. TUBULIFLORÆ, contains all those whose corollas are tubular, regular, and four or five-lobed. The flowers of these are arranged either in a discoid head, without rays; as in Lappa (the Burdock), Cnicus (the Thistle), &c., in which the flowers are all tubular and perfect; or in a disk with rays, the disk flowers being tubular and perfect, while those of the ray are ligulate and imperfect, that is, lacking stamens, or both stamens and pistils, as in the Sun-flower and Aster. The second sub-order is LABIATIFLORÆ, in which the corolla of the disk flowers is bilabiate. These are tropical species. The third sub-order is LIGULIFLORÆ: in which the corolla, in both disk and ray flowers, is ligulate (flat or strap-shaped), as in the Dandelion, the Lettuce, &c.

Order—LOBELIACEÆ. *The Lobelia Tribe.*

The plants of this order are readily known by their irregularly five-lobed corollas, their coherent stamens, fringed stigmas, and capsular fruit. They are generally herbs, and their juice is acrid and narcotic. The species of Lobelia, one of which is used medicinally, are the Northern representatives of the Order.

Order—CAMPANULACEÆ. *The Bell-Flower Tribe.*

The ornamental Campanulas are much cultivated. None of the order possess any useful qualities. The regular, campanulate corolla, five distinct stamens, and hairy styles are characteristics.

Order—Ericaceæ. *The Heath Tribe.*

These are mostly shrubs. The flowers are nearly regular, the stamens distinct, the anthers are two-celled, the styles and stigmas united into one. The order is divided into four tribes or sub-orders. Vaccinieæ, which are shrubs with scattered, often ever-green, leaves, with an adherent ovary and a berry, or drupe-like fruit; Ericineæ, shrubs, in which the ovary is free from the calyx, and the fruit usually capsular; Pyroleæ, herbs, which have nearly distinct petals and capsular fruit; Monotropeæ, which are parasitic herbs, having brown or white scales instead of leaves. To the first division belong the Whortleberry (Vaccinium), the Cranberry (Oxycoccus), &c. To the second belong the true Heaths (Erica), and those beautiful shrubs, Kalmia, Rhododendron, Andromeda, Clethra, &c. The third contains those neat, low plants of the genera Pyrola and Gaultheria (Wintergreen); and the fourth, those curious and odd looking parasites, Monotropa or Hypopithys (Indian pipe, Bird's nest, or Beech-drops.)

Order—Aquifoliaceæ. *The Holly Tribe.*

These are shrubs or small trees, with coriaceous leaves and axillary flowers. The fruit is a drupe, with from two to six stones. The common Holly (Ilex) and the Winter-berry or Black Alder (Prinos) are examples.

Order—Ebenaceæ. *The Ebony Tribe.*

One species of Diospyros produces the valuable wood called Ebony, and another is the Persimmon of the Southern States.

Order—Primulaceæ. *The Primrose Tribe.*

This is a small family of herbs, with a four or five toothed calyx, a rotate, salver-shaped, or bell-form corolla, a single style and stigma, capsular fruit and numerous seeds. Familiar examples are the highly prized species of Primula and Cyclamen, the pretty little Anagallis (Pimpernel), and Lysimachia (Loosestrife).

Our limits will not permit an extended notice of the succeeding Orders. It will only be possible to give a list of them, with their chief properties, and the names of some of their members.

PLANTAGINACEÆ. The Rib-grass Tribe. Ex.: Plantago. Properties: Slightly bitter, and cooling.

PLUMBAGINACEÆ. The Lead-wort Tribe. Ex.: Statice. Armeria. Sea-side plants. Some are astringent, others acrid.

LENTIBULACEÆ. The Bladder-wort Tribe. Contains but two genera, Pinguicula and Utricularia. Of no importance.

OROBANCHACEÆ. The Broom-rape Tribe. Parasitic plants. Ex.: Orobanche, Epiphegus. (Broom-rape, Beech-drops.) Astringent, and bitter.

BIGNONIACEÆ. The Trumpet-flower Tribe. Mostly trees or climbing plants, with large showy flowers. Ex.: Bignonia (Trumpet-flower). Catalpa.

PEDALIACEÆ. The Oil-seed Tribe. Viscid herbs. Ex.: Martynia (Unicorn-plant).

ACANTHACEÆ. The Acanthus Tribe. Herbs or shrubby plants, mostly tropical. Thunbergia, Acanthus.

SCROPHULARIACEÆ. The Figwort Tribe. A large order of herbs or shrubby plants. Ex.: Scrophularia, Verbascum (Mullein), Chelone, Gerardia, Digitalis (Fox-glove). Generally bitter, acrid and deleterious. Fox-glove is important as a medicine, producing a remarkable effect on the action of the heart.

VERBENACEÆ. The Vervain Tribe. Ex.: Verbena, Tectona (Teak-wood). Some bitter and aromatic.

LABIATÆ. The Labiate or Mint Tribe. A very large, very natural, and very important order. All plants of this order possess an aromatic oil and a bitter principle. Ex.: Mint, Rosemary, Sage, Lavender, Catnip, Pennyroyal, &c.

BORAGINACEÆ. The Borage Tribe. Ex.: Borago (Borage), Cynoglossum (Hound's-tongue), Echium (Viper's Bugloss). Mucilaginous, demulcent, never poisonous.

HYDROPHYLLACEÆ. The Water-leaf Tribe. Ex.: Hydrophyllum, Nemophila. Of no known use.

POLEMONIACEÆ. The Greek-Valerian Tribe. Ex.: Phlox, Polemonium. Mostly North American herbs. Cultivated as ornamental plants.

Diapensiaceæ. The Diapensia Tribe. Ex: Diapensia, Pyxidanthera. Low, shrubby, evergreen trailing plants.

Convolvulaceæ. The Morning-glory Tribe. An important order of twining or trailing plants, mostly natives of hot countries. *Jalap* is furnished by a Mexican Convolvulus. The Sweet Potato is the tuber of C. Batatus. The Morning-glory and the Bind-weed are other examples. Cuscuta, (Dodder) and Dichondra, also belong here.

Solanaceæ. The Potato Tribe. A large and very important order. Ex.: Solanum, (Potato, Tomato, Egg-plant, &c.) Capsicum (Red Pepper), Atropa (Nightshade), Belladonna, Datura, Nicotiana (Tobacco), Hyoscyamus, &c. Properties very discordant; generally stimulant and narcotic, often violently poisonous. In the eatable species, the deleterious principle is expelled by cooking or ripening in the sun.

Gentianaceæ. The Gentian Tribe. A large Order of herbs, some very ornamental. Ex.: Gentiana, Menyanthes (Buck-bean), Sabbatia, Frasera. A tonic and intensely bitter principle, called *Gentianine*, is found in all the order.

Apocynaceæ. The Dog's-bane Tribe. Trees, shrubs, and herbs. Ex.: Apocynum (Dog's-bane), Vinca (Periwinkle), Nerium (Oleander). The juice and seeds usually possess poisonous properties. *Nux vomica* is the seed of a species of Strychnos; *Caoutchouc* or India-rubber is produced by some.

Asclepiadaceæ. The Milk-weed Tribe. Ex.: Asclepias (Milk-weed, Butterfly-weed). Properties similar to those of the last, though not so active.

Jasminaceæ. The Jessamine Tribe. Ex.: Jasminum (Jessamine). Asiatic shrubs, with showy and fragrant flowers.

Oleaceæ. Trees or shrubs. Ex.: Olea (The Olive), Fraxinus (The Ash), Syringa (The Lilac). In the bark generally resides a bitter, astringent principle. The sweet cathartic, *Manna*, is the gum of a species of Fraxinus; and Olive oil is pressed from the fruit of Olea Europæa.

Division III.—APETALOUS EXOGENOUS PLANTS.

In this Division the corolla is wanting; the floral envelope being simply a calyx. Sometimes both calyx and corolla are wanting.

ARISTOLOCHIACEÆ. The Snake-root Tribe. Generally herbs, but sometimes shrubby vines. Ex.: Aristolochia (Virginia Snake-root), Asarum (Wild Ginger). Used in medicine as tonics, being stimulant, pungent and aromatic.

CHENOPODIACEÆ. The Goose-foot Tribe. Weeds or herbs with fleshy leaves. Ex.: Beta (The Beet), Spinacia (Spinach), Salicornia (Samphire). From some Soda is obtained, and others are used as food.

AMARANTHACEÆ. The Amaranth Tribe. Mostly weeds; some of the Amaranths are cultivated for their showy flowers. Ex.: Amaranthus, Celosia (Cock's-comb).

NYCTAGINACEÆ. The Four-o'clock Tribe. Ex.: Mirabilis (Marvel of Peru, Four o'clock). Roots of some are purgative.

POLYGONACEÆ. The Buckwheat Tribe. Ex.: Polygonum (Knot-grass), Rheum (Rhubarb), Rumex (Dock). The roots are purgative. The leaves of some are agreeably acid, and one species produces Buckwheat.

PHYTOLACCACEÆ. The only American member is Phytolacca decandra (Poke, or Julap). The root is emetic, but little is known as to its properties.

LAURACEÆ. The Cinnamon Tribe. Trees or shrubs. Ex.: Laurus, Sassafras. All the species possess pungent, stimulant and aromatic properties. Camphor is the gum of an Asian species. Cinnamon, Cassia, and Sassafras are obtained from others.

SANTALACEÆ. The Sandal-wood Tribe. Ex.: Nyssa (Pepperidge, Sour-gum, &c.), Santalum, which produces the fragrant Sandal-wood.

THYMELACEÆ. In this order the only North American genus is Dirca (Leather-wood). The bark is acrid and very tough.

ELEAGINACEÆ. Shepherdia Canadensis is sometimes cultivated. The foliage is silvery, and covered with a kind of scurf.

ULMACEÆ. The Elm Tribe. A small order, of which Ulmus (The Elm) is the principal genus. The mucilaginous bark of the Slippery Elm is the only medicinal product.

SAURURACEÆ. Aquatic herbs. Ex.: Saururus (Lizard's-tail). No important properties.

CERATOPHYLLACEÆ. Consists of the single genus, Ceratophyllum, a floating plant sometimes called Hornwort.

CALLITRICHACEÆ. Also contains a single genus, common to both Europe and America, Callitriche, a little aquatic herb.

PODOSTEMACEÆ. Insignificant aquatics. Ex.: Podostemum (Thread-foot.)

EUPHORBIACEÆ. The Spurge Tribe. A small order, but containing some important plants. Their properties are generally acrid and poisonous, contained in their milky juice. The root-stock of one species furnishes *Tapioca;* the seeds of another afford Castor-oil, and those of another Croton-oil. Box-wood, the dye called Turnsole, and Caoutchouc are the products of other species. Some of the order are violently poisonous, and their juice will immediately blister the skin.

EMPETRACEÆ. The Crow-berry Tribe. Small evergreen shrubs. Ex.: Empetrum (The Crow-berry).

JUGLANDACEÆ. The Walnut Tribe. In this order are found some of the most valuable timber trees, as Black Walnut, and Hickory. Some of them also afford edible nuts.

CUPULIFERÆ. The Oak Tribe. Important trees. Ex.: Quercus (The Oak), Castanea (The Chestnut), Corylus (The Hazel), Carpinus (The Hornbeam). The bark is mostly astringent.

MYRICACEÆ. The Gale Tribe. Aromatic shrubs. Ex.: Myrica (Sweet Gale, Bayberry, Candle-berry or Wax Myrtle), Comptonia (Sweet Fern).

BETULACEÆ. The Birch Tribe. Trees and shrubs. Ex.: Betula (The Birch), Alnus (The Alder).

SALICACEÆ. The Willow Tribe. Ex.: Salix (The Willow), Populus (The Poplar). The bark is astringent and tonic.

BALSAMIFLUÆ. Contains the single genus Liquidambar, called Sweet Gum, from the aromatic balsam which is derived from it.

Platanaceæ. This order contains only the genus Platanus (Plane-tree, Button-ball or Sycamore), a very large and noble tree.

Urticaceæ. The Nettle Tribe. This is a large order of trees, shrubs and herbs. It is divided into four sub-orders:

1. Artocarpeæ. Tropical plants. Ex.: Artocarpus (The Bread-fruit).

2. Moreæ. Ex.: Morus (The Mulberry), Ficus (The Fig).

3. Urticeæ. Ex.: Urtica (The Nettle).

4. Cannabineæ. Ex.: Cannabis (The Hemp), Humulus (The Hop.)

The juice of nearly all the order is deleterious, while the fruit is generally harmless. That terrible poison, the *Bohon Upas*, is the inspissated juice of a species of Antiaris. Ficus religiosa is the renowned *Banyan tree;* F. Indica produces *Gum lac;* F. Carica affords the *Fig. Bread-fruit* is the product of Artocarpus, and *Mulberries* of Morus nigra. Every one knows the uses of Hops and of Hemp, and the unpleasant properties of the Nettle.

Class II.—Gymnospermous Exogenous Plants.

The Gymnosperms are distinguished by their truly naked seeds. The ovules are not enclosed in a pericarp, and are fertilized without a pistil.

Coniferæ. The Fir Tribe. Perhaps there is not a more important order than this. It contains some of the noblest of all trees, which furnish the timber and the resinous matters so universally used. Differences in the structure of the flowers and fruit have caused the following sub-divisions to be adopted;

1. Abietineæ. Ex.: Pinus (The Pine), Abies (The Fir or Spruce).

2. Cupressineæ. Ex.: Cupressus (The Cypress), Juniperus, (Juniper and Red Cedar).

3. Taxineæ. Ex.: Taxus (The Yew-tree.)

Cycadaceæ. These are singular tropical plants, with unbranched, cylindrical trunks. Their fruit, like that of the pines, is a strobilus or cone. Ex: Zamia, a species of which is called *Coontie* in Florida, and from the thickened stems of which is made a kind of *Arrow root.* From the trunk of Cycas, is obtained a kind of *Sago.*

VEGETABLE PHYSIOLOGY.

NUMBER NINE.

DEVELOPEMENT OF LEAVES.

When leaves are first produced, they are small, delicate in texture, pale in color, and packed closely together, forming what is called a leaf-bud. Some of the outer ones are generally more firm in texture and darker in color, and fold over each other so as to protect the more tender ones within. These are often quite different from the other leaves in aspect, and are usually called *scales;* but the distinction is not real, since on opening the bud, it will be seen that they pass gradually into true leaves. The young leaves are beautifully folded together, in such a manner as to occupy the least possible space, and the mode in which this is done differs in different families of plants. Any one may examine this, with the certainty of being greatly interested, by cutting through the leaf-buds with a sharp knife, when they are swelling, but before they begin to expand.* The outer scales are sometimes covered with a thick down, as a protection against cold, and sometimes, as in the Horse-chestnut, they are coated with a gummy substance. In most buds, the young leaves may be easily observed to be arranged around a common centre or

* An excellent subject for this purpose is the leaf-bud of the Tulip-Tree. The buds are large, and the vernation very curious, being of the kind termed *appressed.*

axis. As the branch grows, the insertions of the leaves, which were at first close together, become separated by the lengthening of the branch; and they then usually assume something of a spiral arrangement around it. This may be regarded as the regular mode in which leaves are arranged. Starting from any one leaf, we shall generally find the next leaf not exactly above or below it, but a little on one side of the perpendicular; the next a little to one side of the last, and so on. The number of leaves taken to complete the spiral varies in different plants. Sometimes it amounts to twenty or more. Sometimes we find only two, in which case they are nearly on opposite sides of the stem, but one is higher up than the other. Such leaves are said to be *alternate.* The point of the stem at which the leaf originates, is termed a *node*, and the space between two nodes is an *internode.*

Now although it is considered the regular mode of growth for a branch or stem to lengthen equally throughout, yet many varieties in the arrangement of leaves are met with, occasioned by the cessation of growth at particular points. Thus, if the internode between any two alternate leaves is not developed, they will be opposite to each other. Again, where each spiral turn contains several leaves, if all the internodes between the highest and the lowest be undeveloped, these leaves will arise from the same point of the stem, still growing, however, in their proper directions; so that a complete circle of leaves, resembling that of the leafy parts of a regular flower, will be produced. This is called a *whorl* or *verticil.* There are some plants which exhibit the true spiral arrangement, as their regular mode of growth; others in which the leaves are constantly opposite; and in some they are always verticillate.

But there are many species which present differences in arrangement in the same individual, according to the circumstances under which each part has been developed; and by such examples the connexion between the several modes of growth is perceived. Thus, in the Rhododendron, the leaves are sometimes opposite, and sometimes alternate. In the Honeysuckle, they are naturally verticillate; but the whorls are broken up, and the leaves carried to a distance from one another, by anything which causes an increased developement of the stem, just as when any leaf-bud (whose young leaves are arranged in a series of whorls, one above or within another) is elongated into a branch. On the other hand, in the Strawberry, the leaves, which are usually alternate, become opposite, or whorled at intervals. It is to be remarked that, when leaves are opposite, the several pairs are not in a line with one another above and below, but each pair is at right angles to the next; so that, if the internode between two pairs were undeveloped, a whorl of four leaves would be produced. Again, when one whorl is developed near another, their leaves do not issue from corresponding points in the stem, but are arranged in such a manner that the leaves of one arise from what seem to be the *intervals* of those of the other, so that the whorls are *alternate* to each other. It is clearly shown that the several parts of the flower are arranged exactly on the same principles.

It is by the developement of leaf-buds into branches bearing leaves, and capable of producing flowers and fruit, that the tree or plant is increased in size. The leaf-bud has also the power of developing roots, if removed from the parent, and may thus form a completely independent structure. It is by separating the buds, and by placing these in circumstances favorable to their growth, that any particular variety of plant may be propagated with more certainty than by seeds. As every bud is thus capable of maintaining an independent existence, it may be regarded as in some degree a distinct individual; and thus a tree would not be one being, but a collection of many. This is in part true; still it must be considered, that while they all remain upon one stem, they depend upon it for nourishment, and are liable to be influenced by the same circumstances which affect it. Still it is quite possible for some buds to live while others die. Thus if arsenic be introduced into any portion of the sap-wood, it will give such a poisonous character to the fluid, that all the buds and branches above it will be killed, while those below remain uninjured. It has even occurred that a single bud at the summit of a stem has preserved its life, while the vitality of all the others, and of the stem, has been in some manner destroyed; and that from this bud have been sent down bundles of root-fibres between the bark and wood of the dead stem. These fibres have reached the ground, supplied nutriment to the expanding bud, which has at length formed a perfect tree, enclosing the original dead stem.

Leaf-buds are always formed from the cellular portion of the stem or branches, on which the function of extending the growth of the individual seems especially imposed. They may be distinctly traced in young branches to the pith; and where this has dried up, they may be seen to arise from the medullary rays. Sometimes they are stunted in their growth, and instead of being developed into branches, they remain as thorns, or rather spines. That spines are really produced from the leaf-buds may be easily ascertained by examining a growing shoot of the common Barberry, when their different states of developement will be observed.

The influence of light in producing the green color of leaves, is remarkably shown when the buds are unfolding. The stronger the sunshine, the sooner will they assume their characteristic hue; and on the other hand, in dark dull weather, they will remain for days together almost of the same color as before they expanded. If during a continuance of rainy weather, the buds of a forest expand, their hue remains pale until the sun appears, when within a few hours they assume their full green color. One writer mentions a forest in this country, on which the sun had not shone for twenty days. "The leaves during this period were expanded to their full size, but were almost white. One forenoon the sun began to shine in full brightness; the color of the forest absolutely changed so fast that we could perceive its progress. By the middle of the afternoon, the whole of this extensive forest, many miles in length, presented its usual summer dress."

MOSSES.

FROM LINDLEY.

Still lower in the scale of creation than Ferns, are Mosses. Up to the present moment, a microscope has rarely been necessary in our studies; whenever I have recommended you to employ it, the subject would usually have admitted of your dispensing with its aid, if you pleased. But from henceforth it must be constantly in your hand, and every observation must be made with it. You will, however, find abundance of most curious and interesting results, to indemnify you for the trouble it will give you.

Mosses are among the smallest of plants with true leaves; they are often so minute that the whole specimen, leaves, stem, fruit and all, would escape the eye, if they did not grow in patches; and they never, in the largest kinds, exceed the height of a few inches. Nevertheless, they are organized in a manner far more complete than Ferns, although they are destitute of air vessels and breathing pores. Mosses are usually the first plants that show themselves on rocks, or walls, or barren places, where no other vegetation can establish itself; provided the air is damp, they will flourish there, and in time, lay the foundation of a bed of vegetable mould, in which the roots of grasses, and other stronger plants, may find support, till they in their turn have decayed and prepared the way for shrubs and trees. This is the usual order observed by nature in converting the face of rocks into vegetable mould; and thus you see Mosses have to perform the office of pioneers to larger plants, an office for which one would have thought their Lilliputian size would hardly have qualified them.

Mosses are formed upon precisely the same plan as flowering plants, as far as the arrangement of their organs of vegetation. They have in all cases a stem, or axis, however minute, round which the leaves are disposed with the greatest symmetry: they have the parts which answer to seeds, enclosed in a case; and this case is elevated on a stalk, which arises from among the leaves. But beyond this, analogy ceases: in all other points of structure, the Moss tribe is of a most singular nature. Mosses are said to be in fruit, when the stems are furnished with brown hollow cases, seated on a long stalk. It is chiefly of this fruit, or theca, or sporangium, and its modifications, that we make use in distinguishing the genera. Let it therefore engage our attention first. No species can be more common than *Wall Tortula* (Tortula muralis), dark tufts of which are found everywhere, upon the north side of walls, growing out of the mortar. The theca of this plant wears a little cap, not unlike that of the Norman peasant women, with its high peak, and long lappets : this part is called a *calyptra :* when young, it was rolled round the theca, so as completely to cover it over, like an extinguisher; but when the stalk of the theca lengthened, the calyptra was torn away from its support, and carried up upon the tip. After a certain time, the calyptra drops off; and at that time the theca is in the best state for examination. You will find it terminated by a conical lid, or *operculum*, which is thrown off when the spores, or reproductive parts, are fit to be dispersed. When the lid has been thus spontaneously thrown off, a new and peculiar set of parts come in view—you will find that the lid covered a kind of tuft of twisted hairs, which at first look as if they stopped up the mouth of the theca. But if you cut a theca perpendicularly from the bottom to the top, you will learn from the sectional view that you will obtain of the parts, that, in reality, the hairs arise from within the rim of the theca, in a single row. These hairs are named, in Botany, the *teeth* of the fringe, or *peristome;* the latter term designating the ring of hairs. The nature of the fringe varies in different genera; sometimes it consists of two rows of teeth, differing from each other in size or number, or arrangement : some have only four teeth, others eight, or sixteen, or thirty-two, or sixty-four; in all cases, their number is some multiple of four; a curious circumstance, which shows the great simplicity of design that is observed in the construction of these minute objects. The fringe is not, however, always present: there is a small section of the Moss Tribe, all the genera of which are destitute of this singular organ. What office it may have to perform, we can only guess. It seems to be connected with the dispersion of the spores; and often acts in the most beautiful hygrometrical manner. If you take the theca of this Tortula, for example, when dry, and put it in a damp place, or in water, its teeth will uncoil, and disentangle themselves with a graceful and steady motion, which is beautiful to look upon.

It is in the inside of the theca that the spores are confined. They lie there in a thin bag, which is open at the upper end, and which surrounds a central column, called the *columella*. They are exceedingly minute, and not unlike the spores of Ferns. The study of the distinctions of Mosses, requires great care and attention, and much skill in the use of the microscope. It has sometimes occupied the undivided attention of botanists, and cannot be prosecuted without much leisure and patience.

When we quit Mosses and other plants of a similar nature, we find ourselves among beings in which all traces of stem and leaves have disappeared, and which consist of nothing but thin horizontal expansions of vegetable matter, in which a few harder, and differently formed kernels or shields are imbedded. In some of these the color is yellow, brown, or green; the texture of the expansion leafy; and the margin cut up into many lobes—these are most nearly related to leafy and more perfect plants. In others, the expansion is merely a thin crust, which readily crumbles in pieces, the species having scarcely vital energy enough to keep the cells of which they are composed in a state of cohesion. Such plants as these are called *Lichens*. They are found chiefly in the temperate or colder regions of the earth. Some of them crawl upon the surface of the earth, spreading their dingy, cold, and damp bodies over whole plains in the desolate regions of the north: others spring up on the branches of trees, and hang down from them like gray and netted beards, giving the unfortunate plants of which they take possession a hoary, wintry aspect, even in summer: some overrun old walls, stones, and rocks, to which they communicate those wild and agreeable tints, which render ancient ruins so pleasing to the eye; and, finally, a fourth description of Lichens establish themselves upon the bark of living trees, occasionally burying themselves beneath the skin through which their shields alone peep forth in the strange form of the letters of some eastern tongue.

Plants of this tribe have no parts in the smallest degree resembling flowers; they have no certain mode of multiplying themselves, except by the dispersion of little spores, which are nothing but exceedingly minute cells, that are lodged in the centre of the shields. These are very difficult to find; you may, however, make them out, if you observe the following directions. Take the full grown shield of any Lichen; with a sharp knife divide it perpendicularly; then shave off the thinnest possible slice of one of the faces, and drop it into water; place it on the glass stage of a microscope, and illuminate it from below. You will thus be able to perceive that the kernel consists of a crowd of minute compact fibres, planted perpendicularly upon a bed of cellular substance; and that in the midst of the fibres there is a great number of little oblong bags, filled with transparent cells; the bags are thecæ, the cells are spores; and it is to the latter that the Lichen has to trust for its perpetuation.

Notwithstanding their minuteness and uninviting appearance, several of them are of considerable importance to man and animals. The Arctic *Gyrophoras*, called, by the Canadians, *Tripe de Roche*, were the only food that the daring travellers, Franklin, Richardson and Back, were for a long time able to procure, in the horrible countries they so fearlessly visited in the cause of science; *Reindeer Moss* (Cladonia rangiferina) is the winter food of the reindeer of the Laplanders; *Iceland Moss* (Cetraria Islandica) furnishes a nutritious food for the invalid; and, finally, the production of *Orchil*, by Rocella tinctoria, is an indication of the value of some species to the manufacturer, as dyes.

PAULOWNIA IMPERIALIS.

This fine tree, although so lately introduced into this country, is fast becoming a favorite. Its heavy, rich foliage, and handsome flowers, make it a conspicuous object in shrubberies, and it is found to be quite hardy. The following account of the Paulownia is taken from a good English authority, and from information afforded by an extensive nurseryman in New-York.

The Paulownia is a native of Japan, and grows, in that country, to the height of thirty or forty feet, with a trunk two or three feet in diameter. The branches are few, but strong; and they proceed from the trunk at right angles. The leaves are very large and broad; and the flowers, which singly resemble those of the Fox-glove, are produced in large terminal panicles, like those of the Horse-chestnut, or the Catalpa. At a little distance, indeed, the Paulownia strongly resembles the latter tree, except in the color of its flowers; but the seed-vessels are very different; that of the Catalpa being a long, horn-like pod; and that of the Paulownia an oval-shaped nut. The Paulownia is in the Natural Order, Scrophularinæ, and the Linnæan Class and Order, Didynamia, Angiospermia. According to our authority, the method of its introduction into Europe, was the following.

In 1834, M. Neumann, the chief gardener in the Jardin des Plantes, at Paris, received some seeds, in a little China pot, from Japan. He sowed them in a flower-pot, which he placed in the hot-house; but only one seed vegetated. This plant he nourished with great care; but it grew slowly, and appeared sickly. As he observed that after it lost its leaves in Autumn, the heat of the stove made it bud again immediately, he felt convinced that the stove was too hot for it; and he removed it to the green-house, which evidently suited it better, though still it grew slowly. He now took some cuttings from his plant, which struck readily; and he then ventured to remove the parent plant into the open air. It immediately began to grow vigorously; and though only six inches high when planted in spring, it became three feet high before autumn, growing with a strong, erect stem, and forming a large, bushy head. As soon as winter approached, it lost all its leaves at once, like the Catalpa, without their becoming withered; but it regained them early in the following spring, and grew so rapidly, that in July, 1840, it was nearly twelve feet high. It was then growing vigorously, and had a profusion of fine large leaves, which cast a refreshing shade. M. Neumann protected it for several winters with mats, but he afterwards found it quite hardy; and in the winter of 1838–9, when the thermometer was below zero, it did not lose even the tips of its branches. Some of its leaves measured fifteen inches in breadth, by eighteen in length.

This plant is called Kiri by the Japanese, and Too, or Háktoo, by the Chinese; and it was named *Paulownia imperialis* by Dr. Sieboldt, in honor of the hereditary Princess of the Netherlands, who was one of the daughters of the Emperor of Russia. It will grow in any common garden soil that is tolerably dry, and somewhat loamy: but in moist, peaty soil, the leaves turn yellow, and fall off. It strikes readily from cuttings, and it may also be propagated by division of the roots.

Our American authority states that "the Paulownia was introduced into this country about five years ago. It is perfectly hardy in this latitude (that of New-York); the height to which it will attain here, is, of course, not known to me; but I presume it will be a similar tree, in that respect, to the Catalpa, which it much resembles. It flowers at the end of May, and beginning of June. The flowers are of a bluish lilac color, sweet scented, and in form and size like Fox-glove. My tree was four years old, and was covered with flowers this spring (1847) for the first time. Trees now sell for from fifty cents to two dollars each, from four to twelve feet high.

AYLMER BOURKE LAMBERT, F. R. S., &c.

The gentleman whose name heads this article, is one of the most munificent patrons of botanical science in England. He has published a magnificent work on the Pines and Firs; and he possesses probably the finest library of botanical works in Europe. He has also a most splendid and extensive herbarium, containing, among other rarities, the botanical specimens collected by Ruis and Pavou for the Flora Peruviana; the dried plants of Pursh, used for his North American Sylva; the dried specimens of Pallas, and those of many other celebrated botanists. Besides these collections, which possess a high degree of historical interest, in addition to their intrinsic value, Mr. Lambert's herbarium is continually being increased by additions from every part of the world. He possesses a splendid collection of the Banksias and Proteas, those extraordinary plants of Australia, the novelty and beautiful appearance of which procured for the coast where they were first seen, the name of Botany Bay. From the tropical regions of the western hemisphere, Mr. Lambert has some extraordinary specimens of Cactus, some of which are the only ones of the kind in Europe. A volume would be required to describe all the rarities of Mr. Lambert's collections.

In the early days of the establishment of the Linnæan Society, Sir Joseph Banks was in the habit of assembling around him, on stated days, all the most celebrated persons connected with botany and the other branches of natural history. All newly discovered plants, all important discoveries, and in short, all that was interesting in these most interesting sciences, was there discussed, before it was given to the public; and, as every one must have observed that new ideas are frequently elicited by persons skilled in similar pursuits, which would not have occurred to the closest student when alone, there can be no doubt that these meetings were of the greatest service in promulgating and elucidating the natural sciences.

What Sir Joseph Banks's meetings were in his day, Mr. Lambert's are at the present time. Every Saturday during the London season, his reception rooms are crowded with persons eminent for their learning and talents, not only Englishmen, but foreigners. It is impossible for any person to be more kind and liberal than is Mr. Lambert, with all this power to oblige. His books and his herbarium are always open to the use of all literary persons, and many important works have owed their origin and progress to him. "Without the herbarium of Mr. Lambert," says Loudon, in the preface to his great *Encyclopedia of Plants*, "this work could not have been completed." A large number of the excellent wood-cuts with which that useful book is illustrated, were engraved from specimens in Mr. Lambert's collection. His librarian is, or was, David Don, Esq., whose botanical publications are well known.

PLANTS IN SLEEPING ROOMS.

It is not many months since a case was reported of the death of a lady, supposed to be caused by her sleeping in a close room which contained a number of plants. This was probably the true cause of the catastrophe, and its explanation on chemical principles, is not difficult. It has been stated in one of our articles on Vegetable Physiology, that carbonic acid gas, a very deleterious substance, is absorbed from the atmosphere, and decomposed by the leaves of plants, when under the influence of a strong light—oxygen being at the same time evolved. Now the process of human respiration produces an effect exactly the reverse. The lungs decompose the atmospheric air, but retain its oxygen, which acts upon the blood, while the carbonic acid is evolved. Thus plants in rooms are rather beneficial than otherwise by day, since they then absorb the carbonic acid produced by breathing the air, and leave the oxygen. But in the darkness of night, the process is reversed. Their leaves then give out carbonic acid gas, and retain oxygen. A superabundance of the former gas always produces stupor, head-ache, and a sense of suffocation in those who breathe it, and in an unventilated room, where no fresh air can come in, it is very likely to be productive of the most pernicious effects. A sleeping room, therefore, where plants are kept, ought always to be so arranged as to receive plenty of air from without, unless, which is better still, the plants should not be allowed to remain in it at night.

THE PALMS.

THE Palms exceed most other plants in size, and surpass them all in grandeur, and majesty of aspect. They naturally, therefore, commanded the earliest attention of mankind; and the innumerable purposes to which their fruit, their leaves, and their stems have been applied, as food, clothing and shelter, have worthily retained for them that regard which their beauty at first excited. They all bear a strong general resemblance to each other, and hence were early distinguished by a peculiar name. They are mostly remarkable for the size and strength of their stems, which usually shoot up to a great height from the ground, tapering gracefully from the base to the summit, and surmounted with a magnificent crown of gigantic leaves. These towering stems, which, when growing in sheltered situations, are often perfectly straight, sometimes attain the height of two hundred feet, or even more. Other species, however, have stems which trail along the ground, sometimes to the length of five hundred feet. The Palms are remarkable for the prodigious developement of their organs of fructification. A single bunch of the staminiferous flowers of the Date contains about twelve thousand; whilst another species has been estimated to bear above two hundred thousand in one cluster, and three times that number on each tree. Although the flowers are frequently complete, each containing both stamens and pistils, they are more frequently polygamous; that is, both complete and incomplete flowers are borne on the same individual. They are crowded together in large clusters, upon a stalk, which is termed a spadix, having an enormous bract developed from its base, called a spathe, which enwraps them all. The perianth consists of a calyx and corolla, each in three pieces. The stamens are commonly six in number; sometimes, however, only three; and occasionally indefinite. The ovary is superior, generally divided into three cells, of which each contains a seed. The styles and stigmas of the three carpels are more or less adherent. In the ripe fruit, however, it is commonly found that the seed of only one cell has been developed, and that the other cells are therefore obliterated. In the common Cocoa-nut we have an example of this: the fruit when covered with the husk is evidently three-lobed; and when the husk is detached, the shell exhibits three spots upon its rounded end, of which two are hard, while the other is soft, and easily perforated. The fibrous husk is the outer wall of the ovarium; the shell is the inner wall, with which the seed is in close contact. If the cocoa-nut be cut through lengthwise, by a section passing through the middle of the soft spot, it will be found that the small embryo is just beneath it, lying in the midst of the firm, fleshy albumen; and we understand, therefore, that the two hard spots indicate the positions of the two embryos which have not been developed. In the Date-Palms, the staminiferous and pistilliferous flowers grow on separate trees; and the fertilization of the latter is dependent upon the conveyance of the pollen from the former, which is usually accomplished by the agency of the wind, of insects, &c. But if unseasonable weather, or any accident, should prevent this, the Date crops entirely fail, or the fruit is degenerate, and unfit for food. In order to prevent such an occurrence, the Arabs, many tribes of whom rely almost entirely on this tree for their supplies of food, have long been accustomed to gather the stamineous clusters, and to hang them over the pistilline flowers; and they even lay up stores of pollen from year to year. When they make inroads into districts inhabited by hostile tribes, they cut down the stamen-bearing Palms, as one of the most severe injuries they can inflict.

The stems of Palms are the best of all examples of Endogenous structure. They are frequently so dense externally, as to bear the stroke of a sharp hatchet, without injury. This is caused by the very close interweaving of the woody bundles that descend from the leaves, with those previously forming the exterior. In most of the species with long, slender, trailing stems, the outside is additionally hardened by a copious deposition of silex, as in the grasses. This is especially the case with the Rattan, which will readily strike fire with steel.

Palms are exclusively confined to the regions bordering on the tropics in both hemispheres. Their chief habitation is in South America, where they mostly abound in the low and humid parts of the country, though some species rise upon the sides of mountains, almost to the limits of perpetual snow. In general, each species is confined within very narrow bounds. It is related by Humboldt, that in travelling through the central part of South America, he found a new species at almost every fifty miles. Although nearly two-thirds of the Palms at present known are natives of South America, none have yet been found in South Africa, where the distance from the Equator is the same. Some species, however, appear to be very easily spread by the agency of man, or by natural causes; and this is especially the case in regard to those which are most capable of being made useful to man. The Cocoa-nut, for example, is found in almost all the islands of the Polynesian Archipelago, even in those as yet untenanted by man. This is easily accounted for, when it is considered that the Cocoa-nut may float a long time in the sea, without any injury to the seed, which is protected by the fibrous husk, and dense shell: but when cast up by currents of the ocean on the low shores of these islands, the husk gradually separates, under the combined influences of the sun, air, and moisture, by which the seed is then excited to germination.

It would be impossible here to enumerate all the uses to which the various parts of these important trees, and their products, are applied by the inhabitants of the countries where they abound; since these include almost every one for which all other tribes of the Vegetable Kingdom are employed by those who respectively possess them. Wine, oil, wax, flour, sugar, salt, says the celebrated traveller, Humboldt, are the produce of this tribe; whilst their fabric affords the materials of the habitations, weapons, and clothing of many nations. The exterior of the stems, of most species, affords a wood which is extremely valuable for its hardness, sometimes even taking a very high polish. In some countries this is the only kind of timber the inhabitants possess; and it therefore serves all the purposes for which wood is required. Of the hardest parts, weapons are usually manufactured, and these possess such density as to be no unfit match for those of iron. Sections of the stem, the soft interior being removed, are converted into drums; and the stems, split lengthwise, and channelled out, are employed as conduits for water. The soft interior, in most of the large-stemmed species, consists entirely of cellular tissue, and usually contains a large quantity of starch, which renders it very nutritious. This is obtained as food from many species, but especially from the Sago Palm, in which it is particularly abundant. The unexpanded buds of many species also furnish a wholesome article of food. Those of the Cabbage Palm of the West Indies are very commonly boiled and eaten, when they have a flavor very similar to that of the ordinary Cabbage. This Palm is one of the stateliest and most elegant of the whole tribe. The leaves of many species are used entire to form thatch, fences, and fuel; the midribs furnish oars; and the fibres of the leaves are spun into thread, of which cords, ropes, and various woven fabrics are made. The ropes manufactered from the fibres of the Cocoa-nut husk are equal in strength to hemp; and for cables are said to be superior, on account of their great elasticity. The sap of some Palms is a very pleasant, sweet beverage; and by fermentation it makes a sort of wine, or affords the material for distilling the spirit called Arrack. The Date and the Cocoa Palms furnish well-known and valuable fruits. Upon the Date subsist almost entirely a great part of the inhabitants of Egypt, Arabia, and Persia. A single tree will bear upwards of a hundred weight of dates in a season, and sometimes more than twice that amount. They come into bearing at from six to ten years of age, and are fruitful for more than two hundred years. About two hundred species of Palm are known; and it has been estimated that the total number of species may probably amount to a thousand, many hundreds yet remaining to be discovered.

ENGLISH TREES.

The parks abound with trees of extraordinary age and size. They are not like trees of our original forests, growing up to a great height, and on account of the crowded state of the neighborhood throwing out but few lateral branches ; but what they want in height they gain in breadth ; and if I may be excused for a hard word, in umbrageousness. I measured one in Lord Bagot's celebrated park in Staffordshire, and, going round the outside of the branches, keeping within droopings of the circuit, was a hundred yards. The circumference of some of the celebrated oaks in the park of the Duke of Portland, which we measured together, when he did me the kindness to accompany me through his grounds, seemed worthy of record. The little Porter Oak measured twenty-seven feet in circumference ; the Porter Oak is twenty-nine feet in circumference ; the Seven Sisters, thirty-three feet in circumference. The great Porter Oak was of very large diameter, fifty feet above the ground ; and an opening in the trunk of Green Dale Oak, was at one time large enough to admit the passage of a small carriage through it : by advancing years the open space has become somewhat contracted. These indeed are noble trees, though it must be confessed that they were thrown quite into the shade by the magnificent Buttonwood or Sycamore, of whose trunk I saw a complete section exhibited at Derby, measuring twenty-five feet in diameter, and seventy-five feet in circumference. This was brought from the United States ; and indeed might well be denominated the mammoth of the forest.

In these ancient parks, oaks and beeches are the predominant trees, with occasional chestnuts and ashes. These trees are looked on with great veneration ; in many cases they are numbered ; in some a label is affixed to them, giving their age ; sometimes a stone monument is erected, saying when or by whom this forest or this clump was planted, and commonly some family record is kept of them, as a part of the family history. I respect this trait in the character of the English, and I sympathize with them in their veneration for old trees. They are the growth often of centuries, and the monument of years gone by.

I cannot quite enter into the enthusiasm of an excellent friend who used to say that the cutting down of an old tree ought to be made a capital offence at law: yet I deem it most sacrilegious to destroy them, excepting where necessity demands it; and I would always advise that an old tree, standing in a conspicuous station, either for use or ornament, should be at least once more wintered and summered, before the sentence of death which may be passed upon it is carried into execution.

The trees in the park of the palace of Hampton Court, are many of them the horse-chestnut and the lime, of great size, and eminent beauty, several straight lines of them forming for a long distance the approach to the palace. On a clear, bright day, at the season of their flowering, I passed through this magnificent avenue, with inexpressible delight. I passed through them again late in the autumn, when the frost had marred their beauty, and the autumnal gales had stripped off their leaves; but they were still venerable in the simple majesty of their gigantic and spreading forms. I could not help reflecting with grateful emotion on that beneficent power which shall presently breathe upon the apparently lifeless statues, and clothe them with the glittering foliage of spring, and the rich and splendid glories of summer. So be it with those who have gone far into the autumn, or stand shivering in the winter of life.—*Coleman's European Agriculture.*

DAHLIA—THE DAHLIA.

Natural Order, Compositæ; Linnæan System, Syngenesia, Superflua.
Generic Characters: Involucre, double; exterior, many-leaved; interior, eight-parted; receptacle, flat, chaffy; flowers of the disk, tubular, hermaphrodite; those of the ray, ligulate, female or neuter; achenium, naked.

D. crocata. Stem erect, fleshy, hollow, branched in the upper part; lower leaves bipinnate, or tripinnate; leaflets ovate, acuminate, obtusely serrate; achenia linear.—*Pl.* 47.

Few flowers are now better known, or more generally cultivated, than the Dahlia; but notwithstanding its present popularity, its early history is not generally known. The first printed account of the Dahlia is said to be in Hernandez's *History of Mexico*, published in Madrid, in 1651; in which two species are figured, under the name of *Acocotli*. Both of these are single flowers, and one appears to be *D. crocata*, and the other *D. variabilis* or *superflua*. There was, however, an Italian work on the Natural History of Mexico, published at Rome about the same time, which had not only a single but a double Dahlia figured in it. In both these works the plants are described as having tuberous roots, of a strong and bitter taste; and Hernandez says that the Mexicans used these roots medicinally as a tonic. It is not a little singular, that a plant so showy as the Dahlia, should have remained from this time unnoticed for a period of more than one hundred and thirty years. Yet such was the case; for the next mention of it is made by M. Menonville, who was sent to Mexico by the French Government, in 1787, to endeavor to steal the cochineal insect and plant from the Spaniards. This botanist only saw some Dahlias growing in a garden near Guaxaca, and he describes them as having large aster-like flowers, stems as tall as a man, and leaves like those of the elder. In 1789, *D. variabilis* was discovered in a wild state in Mexico by Baron Humboldt, and sent by him to the Abbe Cavanilles, then Professor of Botany at Madrid. The Marchioness of Bute was at that time a great patroness of floriculture in England, and

Pl. 47.

Dahlia crocata. (Saffron-coloured Dahlia.)

Ackermann's lith.

being in correspondence with the Professors at the different botanic gardens in Europe, Cavanilles sent her some of the seeds the same year that he received them. One of the seedlings raised by Cavanilles produced semi-double flowers in October, 1790, and a figure of it was published in the following January, in Cavanilles' *Icones Plantarum*, in which the genus was named *Dahlia*, in honor of Andrew Dahl, a Sweedish botanist; and the plant figured, which is the same as that now called *D. variabilis*, was christened *D. pinnata*. Cavanilles afterwards figured in the same work two other Dahlias, which he called *D. rosea*, and *D. coccinea*. Tubers and seeds of these three kinds were sent to Paris in 1802, under the idea that the tubers would be eatable; but they were found so bitter and pungent, that they "disgusted both man and beast." In the mean time, Lady Bute had raised, from the seeds sent her by Cavanilles, some young plants, which she kept in pots in a green-house; but in the course of two or three years afterwards, they all died without ripening seeds. In 1802, an English nurseryman named Fraser, obtained in Paris some of the seeds of *D. coccinea*, sent from Madrid, but the flowers produced by his seedlings were bright orange instead of scarlet. Mr. Fraser's plants were kept in a green-house, and died without ripening seed. In 1804, M. Thonin published a paper on the Dahlia, in which he suggested propagating the plant by dividing its fascicles of tuberous roots; keeping the roots in a state of rest during the winter, and allowing the plants to have large pots full of rich earth. In the spring of the same year, Lady Holland sent to England, from Madrid, some seeds, which were sown by Mr. Buonaiuti, librarian to Lord Holland, on a hot-bed at Holland House, when some of the seedlings flowered in the autumn of the same year. In 1807, Mr. Salisbury tried some Dahlias for the first time in the open ground in his garden. About this time, Professor Willdenow attempted to change the name of Dahlia into *Georgina*, in honor of a Russian botanist named Georgi, under pretence of a similar name to Dahlia having been previously given to another plant by Thunberg. Thunberg's plant, however, was named in honor of an English botanist, Mr. Dale, and was called Dalea. In 1808, Count Lelieur began to pay some attention to the culture of the Dahlia in the neighborhood of Paris, and he introduced into the garden at St. Cloud, from Malmaison, three varieties, from which he raised numerous others. About the same time, M. Otto, curator of the Botanic Garden at Berlin, obtained numerous varieties by hybridization, some of which were very beautiful. When the continent was thrown open, by the approach of the Allies to Paris, in 1814, the British amateurs and florists who visited it, were astonished at the beauty of the Dahlias in the French gardens; and since that period, the cultivation of Dahlias has been common, and many varieties have been raised, of great beauty of form and brilliancy of color.

The Dahlia, in its native state, is one of the radiate-flowered Compositæ, having eight ligulate florets in the ray, and numerous tubular ones in the disk. The ray florets are vulgarly called the petals, and the flower becomes double when these are greatly increased in number, and those of the disk disappear. When this is not the case, the flower is considered imperfect. Sometimes the ray florets become tubular, when they are said to be quilled. Each floret has a membranous, half-transparent bract, and when the florets are carefully picked out so as to leave all the bracts remaining, the Dahlia appears changed into a kind of everlasting flower of considerable delicacy and beauty. In judging of a Dahlia, the attention is directed to its form, color and size. The form of a fine flower should be as nearly round as possible, with the largest florets at the edge, and decreasing gradually towards the centre, where they are frequently raised into what is called a crown. The outer florets should be broader and flatter than the inner ones, which are always more or less tubular, preserving the character of disk florets, though of the same color as those of the ray. When there is a crown, the florets composing it should be placed close together, so as entirely to hide the disk; as, if either green or yellow be seen in the centre of any Dahlia, it is disqualified from becoming a prize flower. The color is of no consequence, provided it be clear and bright; and the size is also of little importance, unless the Dahlia be naturally one with large-sized flowers.

The greater number of Dahlias now grown in gardens, have been raised from *D. variabilis*, which varies so much from seed, that dark and light crimson, dark and light scarlet, salmon-colored, lilac, dark purple, and striped flowers, have been raised from the seeds taken from a single head of flowers.

D. coccinea or *frustranea* only varies from scarlet, to orange or yellow, and rarely produces double flowers. It is said not to hybridize with *D. variabilis*. The most common colors among Dahlias are purple and crimson in various shades. A pure scarlet was at first rare, but it is now tolerably frequent. There are also many shades of yellow and orange, but a perfectly pure white, or bright light rose-color, is rarely met with. No blue Dahlia has yet been seen, and even the dark purples have always a reddish tinge. The outer florets are sometimes so much recurved as to make the flowers look ball-shaped, and these are called Globe Dahlias. Sometimes there is only a single row of broad flat ray florets, while the inner ones are erect and tubular; and these are called Anemone-flowered. Within the last few years, several new species have been introduced, and it is probable that more will be discovered as the Flora of Central America becomes better known.

The species of which a drawing is given, is easily distinguished from the more common single-flowered species, by its hollow stems, (which are very tall and strong, and only branch at the top), and its bipinnate leaves. The flowers are of a most brilliant scarlet, with a yellow disk; and there are twelve or more florets in a single series in the ray. A sandy soil suits it best, and it must be tied to a tall stake. At page 316, directions are given for the cultivation of the Dahlia.

PL. 48.

1. *Catananche cærulea.* (Blue Catananche.)
2. *Chaetanthera serrata* (Serrate-leaved Chaetanthera.)

Ackerman's Lith.

CATANANCHE—THE CATANANCHE.

Natural Order, Compositæ; Linnæan System, Syngenesia, Æqualis. Generic Character: Receptacle, chaffy; involucre, imbricated, scarious; pappus, bristly, each calyx having five bristles.

C. cerulea. Scales of the involucre, inferior, ovate; flowers, blue.—*Plate* 48. *Fig.* 1.

The derivation of the word Catananche appears to be very uncertain. It was employed by Dioscorides to designate a plant used by the women of Thessaly in philters and love potions. The genus at present contains only two species, one with yellow, and the other with blue flowers. The latter species, *C. cerulea*, is a native of the South of France, and has been in cultivation in England for many years. In its native country it grows among stones and rocks, on hills where it would hardly seem able to obtain sufficient nourishment. In cultivation a dry soil is best for it, as it is easily killed by wet. Its showy blue flowers blossom from July to October. The seeds should be sown in spring, and the plants removed in the following autumn to the border where they are to flower. This is said to be the best mode of culture; as, though the plants raised from seeds sown in autumn, will flower sooner, they are so much injured by passing the winter in a comparatively feeble state, as rarely to make good plants. After the first transplanting, the plants should not be taken up, as they are always injured by removal. Indeed, some florists consider it best to sow the seeds in the place where they intend the plant to remain. It must be observed, that though the Catananche should always be planted in a dry soil, and should be kept as dry as possible during winter, it yet requires abundance of water when about to flower.

CHÆTANTHERA—THE CHÆTANTHERA.

Natural Order, Compositæ; Linnæan System, Syngenesia, Superflua. Generic Characters: Involucre, imbricate; receptacle, flat, smooth; flowers of the ray, numerous, pistilliferous; exterior lip, ligulate, tridentate; inner lip, slender, bidentate; disk flowers, hermaphrodite tubular, bilabiate; lips nearly equal; pappus, hairy, persistent.

C. serrata.—Leaves, linear, somewhat wedge-shaped; serrated at the apex; scales of the involucre, lanceolate, mucronate; pappus, somewhat bristly. —*Plate* 48, *Fig*. 2.

The anthers of this genus appear like bristles; whence the generic name, which signifies a bristly anther. The flowers are peculiar, each having two distinct, differently-shaped lips, in consequence of which, the genus is placed in that division of Compositæ called *Labiatifloræ*. All the species are natives of Chili. C. serrata is a very pretty evergreen plant, growing in low tufts, with large bright yellow flowers. It is easily cultivated in a sandy soil.

PRIMULA PRÆNITENS—THE CHINESE PRIMROSE.

Specific Character: Pubescent, umbel duplicate; calyx, membranaceous, ovate, ventricose, many-cleft; capsule inflated; segments of the corolla sharply dentate.—*Plate* 49.

The generic characters of the genus Primula are given at page 294, where the Auricula—another species—is mentioned. The Chinese Primrose has become a great favorite with florists, although it was introduced into England from China as late as 1820. When first introduced, it was called Primula Sinensis; but it having been afterwards ascertained that a Portuguese botanist had called another species by that name, the present specific name was given to it. *Prænitens* signifies glossy, or shining, and it is certainly difficult to understand why it should be applied to a plant covered nearly all over with down. For some time after its introduction, only two varieties of this species were known, but many have been since produced, some of which are double or semi-double.

"The Chinese Primrose," says Mr. Eley, "from its free blooming habits, and pretty appearance in the winter months, is a desirable plant for a room window. It is usually raised from seed, which should be sown early in Spring, in a pot of rich sandy soil, placed on a shelf near a window, and the soil kept a little moist. When the plants are of sufficient size, they should be potted in separate pots, in any light rich soil, and in summer may be plunged in the flower-beds in a shady place, or they may be planted out in any moist ground, and they will often flower throughout the season. They must be taken in before frost, and potted, and kept in the shade till they have recovered. Those kept in pots should be shifted into larger ones before autumn, and be kept in a cool room window till they show their flower-buds; then placed in a warm room, and watered freely, when they will soon come into bloom."

VERBASCUM—THE MULLEIN.

Natural Order: Scrophulariaceæ. Linnæan System: Pentandria, Monogynia. Generic Character: calyx, five parted. Corolla rotate, five-lobed, unequal. Stamens, five, all bearing anthers; declinate, usually bearded. Anthers, lunate. Capsule, globose, two-valved.

***V. formosum*.—Stem, branching; leaves, woolly and white below, but green and naked above; usually cordate, acuminate. Spike, lax, tomentose. The two lower stamens bent down, and widely apart.—*Plate* 50.**

The name Verbascum is said to have originally been *Barbascum*, from *barba*, a beard, in allusion to the hairy filaments. All the species are strong, vigorous plants, with broad, thick, woolly leaves. The flowers, which are often very showy, are disposed in long terminal racemes. The whole plant, except the flowers, is generally covered with a kind of wool, which makes the leaves feel soft and thick, much like flannel, to the touch. The common American Mullein, V. Thapsus, is well known, growing in every stubble-field, and by every wood-side, where its dry, tall, prim-looking stalks, often remain the whole winter through. Our other species, V. blattaria, or Moth Mullein, is much prettier, and more graceful. The leaves are more smooth, and the brown and yellow corolla contrasts very handsomely with the purple hairy stamens. The Moth Mullein is well deserving of cultivation. Several species are often seen in gardens. The Purple Mullein, V. phœniceum, is well known. It is a handsome plant, and continues in flower a long time. V. formosum is the most beautiful of the genus, from the large size and brilliant colors of the flowers. It grows from two to four feet high, and is in flower in July and August. It came from the Caucasian mountains. The Mulleins require little care in cultivation, being raised from the seed in any common garden soil.

THE NATURAL SYSTEM OF BOTANY.

NUMBER TWELVE.

Class II.—Endogens, or Monocotyledonous Plants.

Stem, having no distinction of wood, pith, and bark. Leaves, usually with simple, parallel veins, often sheathing at base, and falling off without an articulation. Parts of the flower generally in threes. Embryo with one cotyledon; or, if with two, they are alternate, and very unequal in size.

Division I.—Petaloideæ.

In this division the flowers have a calyx or corolla, or both; or, if these are wanting, the stamens and pistils have no covering.

Palmæ. The Palm Tribe. These are mostly trees with unbranched trunks, large leaves, small, perfect flowers, and usually bearing a drupe or berry. The plants of this order are among the most beautiful and majestic of all vegetables. They are usually found in the tropics. Ex.: Cocos (The

Cocoa-nut Tree), Chamærops (The Palmetto), Phœnix (The Date Tree).

ARACEÆ. The Arum Tribe. The flowers are on a spathe, generally surrounded with a spadix, and destitute of calyx and corolla. Ex.: Symplocarpus (Skunk-Cabbage), Arum (Indian Turnip), Acorus (Sweet Flag). Some species acrid, others pungent and aromatic.

LEMNACEÆ. Ex.: Lemna (Duck-weed). Small floating plants.

TYPHACEÆ. The Reed-mace Tribe. Ex.: Typha (Cat-tail), Sparganium (Burr-reed). Herbs, growing in ditches and ponds.

NAIADACEÆ. The Pond-weed Tribe. Ex.: Zostera (Eel-grass), Potamogeton (Floating Pond-weed). Growing in water, with obscure flowers and cellular leaves.

ALISMACEÆ. The Water-Plantain Tribe. Ex.: Sagittaria (Arrow-head), Alisma (Water-plantain). Aquatic herbs, with regular flowers.

HYDROCHARIDACEÆ. The Frog-bit Tribe. Ex.: Vallisneria (Tape-grass), Udora (Ditch-moss). Small floating plants.

ORCHIDACEÆ. The Orchis Tribe. A large order, embracing nearly 1500 species. No order is more interesting or curious, whether for the singular construction of the flowers, or their fragrance and beauty, or for the remarkable shapes of the roots and stems. Many of them are epiphytes, growing upon the roots or trunks of decayed trees. Ex.: Orchis, Arethusa, Cypripedium (Lady's Slipper), Pogonia, Spiranthes, &c.

ZINZIBERACEÆ. The Ginger Tribe. Ex.: Zinziber (Ginger), Amomum (Cardamon). Tropical aromatic herbs.

CANNACEÆ. Ex.: Canna (Indian Shot), Maranta (Arrow-root).

MUSACEÆ. The Banana Tribe. Noble tropical plants, whose fruit and huge leaves are of the greatest importance for food and shelter. Ex.: Musa (The Plantain-tree.)

BROMELIACEÆ. The Pine-apple Tribe. Chiefly tropical American plants. The delicious fruit of the Pine-apple is formed by the "consolidation of the imperfect flowers, bracts, and receptacle, into a fleshy, succulent mass." Ex.: Ananassa (The Pine-apple), Tillandsia.

Amaryllidaceæ. Ex.: Amaryllis, Narcissus (Jonquil, Daffodil), Galanthus (Snow-drop), Agave (Mexican Aloe). Bulbous-rooted plants, with showy flowers; very ornamental, and many species much cultivated.

Iridaceæ. The Iris Tribe. These are perennial herbs, having bulbous roots, or rhizomas, and showy flowers, with spathaceous bracts. Ex.: Iris (Blue Flag, Fleur-de-lis, &c.), Crocus (Saffron, &c.), Tigridia (Tiger Lily). The bulbs contain starch, with some acrid and aromatic properties.

Dioscoreaceæ. The Yam Tribe. A small order of twining plants, with diœcious flowers. Yams are the tubers of Dioscorea sativa, and form an important article of food in tropical countries.

Smilaceæ. The Smilax Tribe. This order consists of a few herbs or shrubby plants, some of which are climbing. The veins of the leaves are reticulated. Sarsaparilla is made of the roots of several species of Smilax.

Liliaceæ. The Lily Tribe. A large and widely-dispersed order. They spring from bulbs or tubers; the flowers are usually ornamental, finely colored, regular and perfect. Many possess a bitter principle, and the bulbs of some yield a very nutritious food. This extensive order is separated into several sub-orders or tribes. In one are comprised such bulbous plants as the Lily and the Tulip; in a second, the Tuberose and Hemerocallis; in a third, the Onion, Squill, and Hyacinth; in a fourth, the Asphodel and Asparagus; and in a fifth, the Convallaria (Solomon's Seal), and Uvularia (Bellwort, &c.)

Pontederiaceæ. The Pickerel-Weed Tribe. These are aquatic plants, with sheathing leaves, and often spathaceous inflorescence. Ex.: Pontederia, (Pickerel-weed), Schollera, &c.

Melanthaceæ. The Colchicum Tribe. Herbs, with bulbs, corms, or fascicles, and regular flowers. Qualities, generally acrid and poisonous. Ex.: Colchicum, Veratrum, (White Hellebore), Trillium, Medeola.

Juncaceæ. The Rush Tribe. Herbs, generally grass-like, frequently leafless, with small, dry flowers. Ex.: Juncus (Rush, &c.)

Commelynaceæ. The Spider-wort Tribe. Leaves, usually sheathing. Flowers, distinguished from most other Endogens by their herbaceous green sepals. Ex.: Tradescantia (Spider-wort), Commelyna.

XYRIDACEÆ. The Xyris Tribe. Resembling the rushes in aspect. Flowers, capitate. Ex.: Xyris (Yellow-eyed grass.)

ERIOCAULONACEÆ. The Pipe-wort Tribe. Aquatic herbs, with cellular leaves, and heads of minute flowers. Ex.: Eriocaulon (Pipe-wort.)

Division II.—GLUMACEÆ.

Flowers, destitute of a true calyx and corolla, but enveloped in scales or chaffy bracts. This division comprehends the grasses and sedges.

CYPERACEÆ. The Sedge Tribe. This is a large order of coarse, grass-like plants, with fibrous roots, stems without joints, and solid. They are natives of nearly all countries, but in general possess few useful properties. The ancient *papyrus* was made of the pith of Cyperus Papyrus. Ex.: Scirpus (Club-rush, &c.), Carex, Eriophorum.

GRAMINEÆ. The Grass Tribe. One of the largest, most common, and most important orders. The stems are hollow, and jointed; the leaves entire, parallel veined, sheathed at base; flowers in spikelets, racemes, or panicles. The grasses undoubtedly contribute more sustenance for both men and animals than all the rest of the vegetable kingdom. With a single exception, no poisonous plant is known to be contained in the order. The stems often contain sugar, and the fruits are the common grains, as wheat, rye, oats, barley, &c. Ex.: Poa, Alopecurus, Festuca Panicum, Phleum, Agrostis, &c., which are among the most common pasture grasses; Triticum (Wheat), Zea (Maize), Avena (Oat), Hordeum (Barley), Secale (Rye), &c., which afford the staple food of men; Saccharum (Sugar-cane), Sorghum (Broom-corn), &c.

FLOWERLESS, OR CRYPTOGAMOUS PLANTS.

Plants chiefly composed of cellular tissue, destitute of spiral vessels, having no flowers, and instead of seeds, producing spores.

The flowerless plants are divided into the following orders, which are merely named here, as it is not within the scope of this work to give any particular account of them.

EQUISETACEÆ. The Scouring Rush Tribe. Ex. Equisetum.

LYCOPODIACEÆ. The Club Moss Tribe Ex. Lycopodium.

FILICES. The Ferns. Ex. Polypodium, Aspidium, Pteris, Adiantum.

MARSILEACEÆ. The Pepperwort Tribe.

MUSCI. The Mosses.

HEPATICÆ. The Liverworts.

LICHENES. The Lichens.

FUNGI. The Mushrooms.

CHARACEÆ. The Chara Tribe.

ALGÆ. The Sea-weeds.

VEGETABLE PHYSIOLOGY.

NUMBER TEN.

REPRODUCTION IN FLOWERING PLANTS.

The parts of a flower essentially concerned in the reproductive process, are the stamens and pistil. Within the stamens are produced a number of minute yellow bodies, usually of a globular form, which together constitute the fine dust known as the *pollen* or *farina*. Each grain of pollen, when examined with the microscope, is seen to consist of a cell exactly analogous to the spore of a flowerless plant. It has two or more coats, enclosing a fluid, in which a large number of extremely minute granules may be seen with a good microscope. These granules are probably the germs of new cells. They may be seen to move within the parent cell, or pollen grain, previously to the time when its walls become too thick to allow the granules to be observed through them; and when the contents of the pollen grain are mixed with water, they are seen to be constantly performing a kind of vibratory motion. The anthers, or receptacles of pollen, which evidently correspond with the capsules or spore-cases of the Cryptogamia, burst when their contents are mature, and scatter the grains. They have various ways of opening; sometimes they split along their length, as in the Lily; sometimes transversely, as in the Duckweed; sometimes by little pores at their extremity, as in the Potato; and sometimes by valves, as in the Barberry. These different methods of opening are characteristic of different tribes of plants.

The *ovarium*, or seed vessel, is the part in which are formed the young seeds or *ovules*, and occupies the centre of the flower. Sometimes this part consists of several evident divisions, and in other cases these are united together more or less closely. If the ovarium be cut into previously to the opening of the flower, it will usually be found to contain a great number of the ovules. They are at this period quite soft; and their interior is filled up with a kind of pulp, which is enclosed in two or more envelopes. These envelopes or seed-coats do not entirely cover the central part of the ovule, but leave a small opening, which is called the foramen. This opening may be easily detected in the perfect seed, (although it has then nearly closed up,) by soaking it in water, and then pressing out the fluid that has been absorbed, which will be seen to issue from this little orifice. The foramen has a very important purpose in the fertilization of the seed, which, at the period now described, contains no trace of the germ of the new plant.

This germ appears to be conveyed into it from the pollen in the following curious manner. The little pollen-grains, or cells, when set free from the anthers, fall upon the stigma of the pistil. In general the anthers are situated above the stigma; the stamens being longer than the pistil in erect or upright flowers, and shorter in those which hang down; but sometimes a special provision is necessary for the conveyance of the pollen to the stigma, especially in monœcious and diœcious plants. This operation is often accomplished by insects, which in going from flower to flower in search of honey, cover their bodies with pollen-dust, and rub it against the pistils of other flowers. When the pollen falls on the stigma, it is retained by a glutinous secretion from the surface of the stigma. After a short time the outer coat of the pollen-cell appears to burst at one or two points, and to allow the inner coat to pass out through it, in the form of a tube. This tube insinuates itself between the cells of the stigma, and passes down between the long and loosely arranged cells of the style. It gradually extends until it reaches the ovarium itself, even when the style is several inches long. The pollen-grains are not always globular, but are sometimes triangular, and emit a pollen-tube at each corner. The tubes, when they arrive at the ovarium, direct themselves towards its different chambers, and have been seen to enter the apertures in the several ovules, which are at that time directed towards the part of the base of the style from which the pollen-tubes project themselves. Sometimes a considerable change in the position of the ovule is necessary, in order that the foramen should be applied to the right portion of the wall of the ovary; but this change always takes place just as the pollen-tubes are passing down the style. The granules which the pollen-grain originally contained, are seen to pass down the tube, and by it some of them are conveyed into each ovule. Whilst yet within the tube, they are seen to develope themselves into new cells, and these cells are the rudiment of the future plant.

The germs are thus conveyed into a sort of receptacle, where they are supplied with nourishment that has been previously prepared and stored up for their use by the parent structure; and they are thus greatly assisted in their early developement. The pulpy matter contained in the ovules, consists of starch and sugar; and these nutritious substances are absorbed by the cells of the embryo, which increase at their expense. The first increase of these cells does not so much tend, however, to form those parts which are afterwards to be developed into the stem, root, and leaves, as to produce those temporary structures, termed *cotyledons* or seed-leaves, which are destined to assist for a time in the developement of the permanent structure, and then to wither and decay. Hence, at the time of the ripening of the seed, the cotyledon forms the greatest part of the embryo or young plant. The starch contained in the seed is sometimes absorded into the tissue of the cotyledons, rendering them thick and fleshy, as in the Pea and Bean. In this case the cotyledons, with the small germ to which they belong, form the entire contents of the seed. In other instances, however, they are thin leafy organs, and occupy, with the germ, but a small part of the seed. The remainder then consists of a separate store, which is termed the *albumen*. This is the case in all monocotyledonous seeds, and in some dicotyledons, as the Ash and Horse-Chestnut.

Between the cotyledons, (taking a bean as the subject of examination,) is the real germ; the upper extremity of which, called the *plumula*, subsequently developes itself into the stem, and puts forth leaves; whilst the lower part, or *radicle*, which is always directed towards the foramen, becomes the root. The plumula sometimes presents the appearance of the plant in miniature; its leaves and buds being quite discernible, though on a very small scale. The subsequent develópement of the germ into the perfect plant, is that which in its early stage, is called *germination*. When a seed like that of the bean begins to germinate, it first swells and bursts its seed-coats; the plumula then extends upwards, bringing the cotyledons just above the surface of the ground; whilst the radicle penetrates downwards. In some plants, however, the cotyledons remain underground, as in the Oak; and there are a few in which they appear entirely absent. The cotyledons when exposed to the light, become green; and perform for a time (though imperfectly) the functions of leaves, at the same time yielding to the young plant, the nourishment they contain. By the time this is exhausted, the true leaves and roots are sufficiently developed for the support of the structure; and the cotyledons, being then no longer required, decay away. In the seeds of monocotyledons, the albumen is always separate, and the embryo, which occupies but a small proportion of the whole mass, cannot always be readily distinguished in the midst of it, until germination commences. The cotyledon at first completely sheaths the plumula, which afterwards pierces it, and unrols its first leaf.

The conditions requisite for the germination of the seed, are warmth, moisture, and the presence of oxygen. The process is also favored by darkness. The influence of each of these agents will be readily understood. No vital action can go on without a certain amount of heat; and where this is not produced within the being, it must be derived from without. The germination of a seed is therefore as much dependent upon warmth, as the hatching of an egg, though the amount required is not nearly as great. Moisture is also required, for the conversion into a fluid state, of the dry nutriment which has been previously stored up in the seed; and no change can commence until that is supplied. The presence of oxygen is necessary, because the conversion of starch into sugar requires that some of the carbon of the former should be set free. For this purpose the carbon must be combined with oxygen so as to form carbonic acid. This process is favored by darkness, because light has a tendency to produce the contrary effect—the *fixation* of the carbon.

It is interesting to observe how all these conditions are supplied, in the ordinary course of nature, by the soil in which the seed is dropped. If it be sown during the spring or summer, it speedily begins to germinate; but if in the autumn, it remains almost unchanged, until the winter has passed, and the returning warmth of the earth and air arouses it into activity. It is seldom that the soil is so completely destitute of moisture, for any long time together, as not to be able to excite seeds to germinate; but their sprouting is well known to be favored by damp weather; and if seeds remain undeveloped on account of having been placed in the ground during a drought, they are very rapidly brought forward by a shower. A porous soil is favorable to germination, on account of the free admission of air as well as moisture, which it affords to the seed.

PL. 50.

Verbascum formosum: (Handsome Verbascum)

Ackerman's Lith.

JOHN C. LOUDON, ESQ.

The works of Mr. Loudon are so well known in this country—his name is so closely connected with the sciences of horticulture and botany—and there is so much of interest and profit in a knowledge of the man himself, and of his career,—that a short account of his life may most properly fill a few of our pages. We believe, too, that familiar as are his books to the American public, not many are aware of the trying circumstances under which they were written.

Mr. Loudon was born on the 8th of April, 1783, at Cambuslang, in Lanarkshire, Scotland. His father was a respectable farmer, who died early, leaving to his widow the care of a numerous family of children, of whom the subject of this sketch was the eldest. Mr. Loudon was educated as a landscape gardener, and in 1803 went to England, with numerous letters of introduction to some of the first landed proprietors in the kingdom. He afterwards took a large farm at Tew, in Oxfordshire, where he resided in 1809. Whilst there, he printed anonymously one of his earliest works, "A Treatise on the Culture of Wheat." In the years 1813–14–15, he made the tour of northern Europe, traversing Sweden, Russia, Poland, and Austria; in 1819, he travelled through Italy; and in 1828, through France and Germany.

Mr. Loudon's career as an author began in 1803, when he was only twenty years old, and continued, with very little interruption, during the space of forty years. His first works were, "Observations on laying out Public Squares," published in 1803, and on "Plantations," in 1804; "A Treatise on Hot-houses," in 1805, and on "Country Residences," in 1806, both quarto; "Hints on the Formation of Gardens," in 1812, and three works on Hot-houses, in 1817 and 1818. In 1822, appeared the first edition of the "Encyclopædia of Gardening," a work remarkable for the immense mass of useful matter which it contained, and for the then unusual circumstance of a great number of wood-cuts being mingled with the text. This book obtained an extraordinary sale, and fully established

PL. 49.

Primula praenitens. (Chinese primrose)

Ackerman's Lith

his fame as an author. Shortly afterwards was published "Observations on laying out Farms." In 1824, a second edition of the "Encyclopædia of Gardening" was published, with very great alterations and improvements; and the following year appeared the first edition of the "Encyclopædia of Agriculture." In 1826, the "Gardener's Magazine" was commenced, being the first periodical ever devoted exclusively to horticultural subjects. The "Magazine of Natural History," also the first of its kind, was begun in 1828. Mr. Loudon was now occupied in the preparation of the "Encyclopædia of Plants," which was published early in 1829, and was speedily followed by the "Hortus Britannicus." In 1830, a second, and nearly re-written edition of the "Encyclopædia of Agriculture," was published; and this was followed by an entirely re-written edition of the "Encyclopædia of Gardening," in 1831; and the "Encyclopædia of Cottage, Farm, and Villa Architecture," in 1832. This last work was one of the most successful, because it was one of the most useful, he ever wrote, and it is likely to continue a standard book on the subjects of which it treats. Mr. Loudon now began to prepare his great and ruinous work, the "Arboretum Britannicum," the anxieties attendant on which were, undoubtedly, the primary cause of that decay of constitution which terminated in his death. This work was not, however, completed till 1838; and, in the meantime, he began the "Architectural Magazine," the first periodical devoted exclusively to architecture. The labor which he underwent at this time was almost incredible. He had four periodicals, viz: the Gardener's, the Natural History, and the Architectural Magazines, and the Arboretum Britannicum, which was published in monthly numbers, going on at the same time; and to produce these at the proper times, he literally worked night and day. Immediately on the conclusion of the "Arboretum Britannicum," he began the "Suburban Gardener," which was also published in 1838, as was the "Hortus Lignosus Londiniensis;" and in 1839, appeared his edition of "Repton's Landscape Gardening." In 1840, he accepted the editorship of the "Gardener's Gazette," which he retained till November, 1841; and in 1842, he published his "Encyclopædia of

Trees and Shrubs." In the same year, he completed his "Suburban Horticulturist;" and finally, in 1843, he published his work on "Cemeteries," the last separate work he ever wrote. In this list, many minor productions of Mr. Loudon's pen have necessarily been omitted; but it may be mentioned, that he contributed to the "Encyclopædia Britannica," and Brande's "Dictionary of Science," and that he published numerous supplements from time to time, to his various works.

No man, perhaps, has ever written so much, under such adverse circumstances, as Mr. Loudon. Many years ago, when he first came to England, he had a severe attack of rheumatism; and the following year, (1804,) his right arm was broken near the shoulder, and it never properly united. Notwithstanding this, he continued to write with his right hand till 1825, when the same arm was broken again, and he was then obliged to have it amputated; but not before a general breaking up of the frame had commenced, and the thumb and two of the fingers of the left hand had been rendered useless. He afterwards suffered frequently from ill health, till his constitution was finally undermined by the anxiety attending on that most costly and most laborious of his works, the "Arboretum Britannicum." He died at last, on December 14, 1843, of disease of the lungs, after suffering severely about three months; and he retained all the energy and clearness of his mind to the last.

Never, perhaps, did any man possess more energy and determination than Mr. Loudon. Whatever he began, he pursued with enthusiasm, and carried out, notwithstanding obstacles that would have discouraged any ordinary person. He was a warm friend, and most kind and affectionate in all his relations of son, husband, father, and brother; and he never hesitated to sacrifice pecuniary considerations to what he considered his duty.

Though supporting himself and his family (writes one of his friends) by arduous and indefatigable application, it was to something far beyond a mercenary motive that he looked for the just and honorable reward of his labors. The acquirement of money he seemed to consider only valuable as a necessary means of support; and, had he been placed in happier and more affluent circumstances, he would have been equally ardent in his pursuit of knowledge for its own sake. He possessed, it is a consolation to know, in his own home, all the comfort and happiness that can be rationally expected. His great infirmities were vigilantly attended to, and affectionately assisted. The pursuits of his family were congenial to his own; whatever were subjects of interest to him, were also felt and partaken by all. Whoever was his guest, was sure to be gratified by the company of persons of superior intelligence and information. Among his friends he numbered many whose names are highest in the number of those distinguished for botanical knowledge; and these he considered not in the light of rivals, contending for public favor against himself, but rather as fellow-laborers in the great and general field of science, which equally required the exertions of all.

Mr. Loudon was happy and fortunate in possessing a wife whose talents and virtues were as great as her affection for him was sincere. She is the authoress of several well-known and valuable works on horticulture and gardening. Since her husband's death, she has received a most worthily-bestowed pension from Queen Victoria.

PRESERVATION OF SEEDS.

BY MRS. LOUDON.

The gathering and preservation of seeds is an occupation peculiarly agreeable to persons fond of gardening. All seeds may be known to be ripe, or nearly so, by the firmness of their texture, and by their changing from a white or greenish color to a color more or less brown. There are, indeed, some seeds which are whitish when ripe, such as those of the White Lupine, and several of the Sweet Peas; and others which are quite black; but in general, a brown color is characteristic of ripeness. Seeds should be gathered on a dry day, after the sun has had sufficient time to exhale all the moisture which dews or rains may have left on the seed-vessels. In general, the pods, or capsules, should be cut off, with a small portion of the stalks attached, and the whole should be spread out, each kind by itself, on papers, in an airy room, from which rain, and the direct influence of the sun, are both excluded. When the seed vessels are thoroughly dried, they may be put up in papers, without separating the seeds from them, and kept in a dry place, rather airy than close, till wanted for sowing. Seeds preserved in the seed-vessel, no doubt, make packages clumsy in comparison with those of seeds from which every covering has been separated; but in this clumsy state, they are found to keep better than when cleaned. Nevertheless, when they are to be sown the following year, or sent anywhere in a letter, it is better to take them out of their covering, and render them as clean as possible, by the use of sieves with holes large enough to admit the passage of dust, but not of the seeds. Such sieves on a small scale every lady may make for herself, by turning up the edges of a thin circular piece of pasteboard, and piercing the bottom with holes with a large pin or needle. When it is determined to separate the seeds from the vessels, instead of putting the whole up together, the vessels may be dried in the sun—when many of the seeds will fall out by the expansion of the vessels, and the remainder can be easily rubbed out. For keeping seeds, a lady should have a small cabinet, which she might make of pasteboard, with the draws lettered properly, and the packets of seeds of each genus placed in their appropriate drawer. If so much trouble is considered unnecessary, a large paper bag may be substituted.

The period during which seeds will retain their vegetative powers differs in different families, genera, and even species. Seeds of Ranunculaceæ and Cruciferæ, will, in general, preserve their vitality for several years, in whatever manner they may be kept, provided the situation be not such as will cause them to germinate. On the other hand, seeds of Capsicum will keep for several years, if retained in the berry, but will seldom grow the second year after being removed from it. The rule may in general be safely adopted, that all seeds will keep three years, and grow, provided they are retained in their unopened seed-vessel; that most seeds, if maturely ripened, and kept in a dry place in close paper packets, will grow the second year; and that all seeds whatever, whether kept in the seed-vessel or exposed in open drawers, will grow the first year after being gathered. Mignonette seed will keep seven years; but that of Stocks and Wall Flowers will not remain good more than two years, unless kept in the pod. The seeds of Sweet Peas and Lupines will with difficulty keep two years; while those of Prince's Feather, and of Poppies, will keep several years. Larkspur seed will seldom grow after the second or third year. Notwithstanding the length of time for which some seeds will keep, it is generally advisable to sow them as soon after they are ripe as practicable, since fresh seeds always vegetate much sooner than old ones.

CHINESE CHRYSANTHEMUM.

The varieties of Chrysanthemum are well known, but not as much appreciated as they should be. This is surprising, when it is considered that they are not only easy of cultivation, but that they form a great addition to the beauties of the flower-garden in the latest months of autumn, when every thing else is dull and withered. The following account of the history of the Chinese Chrysanthemum, and directions for its cultivation, are compiled from excellent authorities, both English and American—and the mode of culture is one especially adapted to our own climate.

The first known account of these beautiful flowers is given by Rheede, in 1678. He describes, however, only one species, which had flowers of a greenish ash-color, and grew in its native country in sandy places. A curious Latin work by Kæmpfer, published in 1712, and called *Amœnitates Exoticæ*, gives a long description of the plants of Japan. Among these are mentioned thirteen varieties of this plant, ten of which have since been obtained, and are now cultivated.

Rumphius, in his *Herbarium Amboiense*, gives a long and interesting account of the Chrysanthemum. He says, that the Chinese value it highly, and bestow great pains on its culture;

and that they place pots and jars in which it is growing, on their tables, when they give entertainments. He adds, that it is esteemed a mark of respect to present the finest flower to the most honored guest; and, as the extent and value of the compliment are estimated by the size of the flower, he tells us, that in order to produce these large flowers, the Chinese gardeners are obliged to check the growth of the plant, as, if it is left to itself, it becomes tall and rude, and produces little else than leaves; but that when it is made dwarfish, the flowers are abundant. He also tells us, that each branch usually produces three blossoms, but that the Chinese pinch off two of these in the bud, which occasions the remaining flower to increase so much, that it is often broader than a man's hand; and that if the same plant be suffered to remain more than two years in the ground, it degenerates: for which reason, he continues, the Chinese raise new plants every year.

This history is curious on account of the details respecting culture, which agree so well with the practices and experience of modern days, as to afford another proof of what has so often been observed, that many of what we consider modern improvements, are in fact only the revival of ancient knowledge.

The Chrysanthemum is next mentioned by Thunberg, in his *Flora Japonica;* and he not only describes it in its wild state, but says that the extreme beauty of its flowers had caused it to be cultivated in gardens and houses throughout the whole empire of Japan. The first of these plants introduced into England, was brought from China in 1764, and from that period until within fifteen years past, all the kinds grown in British gardens were from the same country.

The botanical name of the Chinese Chrysanthemum has been changed several times. The old botanists who first described it, called it Matricaria, supposing it to be a kind of wild Chamomile. Linnæus named it Chrysanthemum Indicum; which was changed by Sabine to C. sinense. Willdenow gave it the name of Anthemis Artemisiæfolia; and De Candolle has removed it to the genus Pirethrum.

The culture of the Chrysanthemum, even at the present day, strongly resembles what Rumphius tells us of the practice of the Chinese; as it is found that it is apt to degenerate, if not frequently renewed from cuttings, or transplanted. The soil most suitable for them is a light rich loam, and decayed manure, in the proportion of two parts of the former to one of the latter. The cuttings should be made in spring, generally in April, and they will flower the same year. They may be either grown in pots through the summer, or planted in the ground, and taken up and potted in September. When grown in pots, they will require to be shifted two or three times during their growth; and by the end of August, they should be finally shifted into the pots in which they are to flower. They require at all times during their growth, a good supply of water; and in the dry weather of summer, when the foliage droops, they are much benefited by being sprinkled all over with water, sometimes as often as three times a day in the hottest weather. In August, those in pots should be watered with soap-suds or manure-water once a week, and this should be continued until they come into flower, which will be in November. If planted in the ground, they should have an open situation, and be allowed sufficient room, so as not to interfere with each other while growing, and be tied up to sticks as they advance. In September they should be taken up, with balls of earth at their roots, and placed in proper sized pots. They should then be placed for a time in a shady situation; and removed into the house before frost. When in flower, give them plenty of water; and when they have done flowering, cut off the stems to within a few inches of the root, and place them where the frost will not injure them. An occasional watering will be all the care they require, till the next season.

MR. WARD'S PLANT-CASES.

A very useful and ingenious plan of growing plants in close boxes, or glass tubes, was invented some years ago by Mr. Ward, of England. We are not aware that this plan has been put in operation to any extent in this country. It is certainly calculated to be of great importance, especially as a means of conveying living plants from one country to another, or from one place to another in the same country. Without explaining the chemical principles on which the plan is founded, it will be enough to give the following ideas concerning it, and the method in which it may be most easily practiced. We quote from *Newman's Ferns*, and from *The Gardener's Magazine*.

"The plan depends," says Mr. Newman, "primarily and fundamentally, on protecting the plants from too free communication with the outer air. This end is obtained by the use of glass; the light so essential to vegetation being thus freely admitted. The most ready way to try the experiment, is, to procure a glass vessel—for instance, one of those jars used by druggists and confectioners; introduce some soft sandstone or some light soil, filling one-sixth of the jar with it, and taking care that the earth is very moist, yet allowing no water to settle at the bottom of the jar; plant a fern in the earth, and then cover the jar with its glass lid, first supplying a slip of wash-leather round the rim of the jar, which will pretty nearly cut off the communication between the internal and external air. No farther attention will be required. The fern will live, thrive, and probably seed, the seed also vegetating, and at last the jar will become too small for its contents. No watering is needed; the moisture in the earth will exhale, condense on the glass, trickle down its sides, and return to the earth whence it arose.

"There is no limit to the application of this principle. Instead of a jar, it is easy to construct, in the window-sill, a box extending through its entire length, the bottom and sides being lined with zinc, to prevent the moisture from damaging the adjoining wood-work; then let the window be a double one, leaving a space of six or twelve inches between the inner and outer glass. The ferns so planted in the box—which should contain a depth of five or six inches of light sandy earth—will soon fill up the space between the two windows, supplying the most beautiful curtain or blind that could be invented. The plants need not be ferns exclusively. Roses, Fuchsias, &c. would also thrive; but it must be always borne in mind, that plants requiring a humid atmosphere, should not be enclosed with those which prefer aridity. Of course, the upper sash alone must be made moveable."

"It is a great advantage of this method," says the Gardener's Magazine, "that it may be put in practice by others, as it was first by Mr. Ward himself, simply by confining a single plant in a bottle, as well as by enclosing a greater number in a more costly apparatus. It may therefore be practiced to any extent, or adapted to any scale of expense. When once fitted up, the apparatus, be it either small or large, requires scarcely any further care or attendance. No fresh watering or airing is at any time required; nor is any inconvenience experienced from dust or litter, which often render the ordinary mode of keeping plants in well-furnished rooms objectionable and troublesome. Further, as the plants in this apparatus are shut off from all communication with the external air, no apprehension of their injuring the atmosphere, even of close rooms, can be reasonably entertained. The only condition that claims observance, is an occasional exposure to light, perhaps for a short period only, on days of sunshine, and for a longer one, when the light is more feeble.

"By means of this plan, the rarest and most delicate plants have been transported to and from the most distant countries, with little or no trouble in regard to attendance, and scarcely any risk of suffering from the inclemency of the weather at sea. It has thereby conferred on the botanist and horticulturist benefits which no researches of travellers, however successful, nor expenditure of money, however great, could have enabled them otherwise to procure. Instead of simple descriptions or dried specimens, or fine pictures of foreign plants, they can now fix their eyes on living specimens retaining their freshness and beauty, and possessing all their natural and characteristic properties. Already have exchanges of plants between distant countries been carried on to a great extent; and the public conservatories, as well as those of private individuals, been enriched with specimens of many rare plants, which could scarcely have reached them by any other means."

LOVE OF PLANTS.

The following is an extract from a celebrated work, (*Ray's Flora,*) published in 1665. The truth and excellence of its sentiments make this extract worth remembering.

"Fair houses are more frequent than fine gardens; the first effected by artificers only, the latter requiring more skill in the owner—few gardens being found well furnished out of the hands of an affectionate florist. The love of such a master will keep each tender plant alive his care and skill have collected; for never was any art or excellence liked or loved by the ignorant; it is knowledge that begets affection, and affection increaseth knowledge. Love was the inventor, and is still the maintainer of every noble science. It is chiefly that which hath made my flowers and trees to flourish, though planted in a barren desert, and hath brought me to the knowledge I now have in plants and planting; for indeed it is impossible for any man to have any considerable collection of noble plants to prosper, unless he love them; for neither the goodness of the soil, nor the advantage of the situation, will do it without the master's affection: it is that which animates and renders them strong and vigorous; without which they will languish and decay through neglect, and soon cease to do him service.

"I have seen many gardens of the new model, in the hands of unskilful persons, with good walls, walks, and grass plots; but in the most essential adornment so deficient, that a green meadow is a more delightful object: there nature alone, without the aid of art, spreads her verdure carpets, spontaneously embroidered with many pretty plants and pleasing flowers, far more inviting than such an immured nothing. And as noble fountains, grottoes, statues, &c. are excellent ornaments and marks of magnificence, so all such dead works in gardens, ill done, are little better than blocks in the way to interrupt sight, but not at all to satisfy the understanding. A choice collection of living beauties—rare plants, flowers, and fruits—is indeed the wealth, glory, and delight of a garden, and the most absolute indication of the owner's ingenuity, whose skill and care is chiefly required in their choice, culture, and position."

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thers, or receptacles of pollen, which evidently correspond with the capsules or spore-cases of the Cryptogamia, burst when their contents are mature, and scatter the grains. They have various ways of opening; sometimes they split along their length, as in the Lily; sometimes transversely, as in the Duckweed; sometimes by little pores at their extremity, as in the Potato; and sometimes by valves, as in the Barberry. These different methods of opening are characteristic of different tribes of plants.

The *ovarium*, or seed vessel, is the part in which are formed the young seeds or *ovules*, and occupies the centre of the flower. Sometimes this part consists of several evident divisions, and in other cases these are united together more or less closely. If the ovarium be cut into previously to the opening of the flower, it will usually be found to contain a great number of the ovules. They are at this period quite soft; and their interior is filled up with a kind of pulp, which is enclosed in two or more envelopes. These envelopes or seed-coats do not entirely cover the central part of the ovule, but leave a small opening, which is called the foramen. This opening may be easily detected in the perfect seed, (although it has then nearly closed up,) by soaking it in water, and then pressing out the fluid that has been absorbed, which will be seen to issue from this little orifice. The foramen has a very important purpose in the fertilization of the seed, which, at the period now described, contains no trace of the germ of the new plant.

This germ appears to be conveyed into it from the pollen in the following curious manner. The little pollen-grains, or cells, when set free from the anthers, fall upon the stigma of the pistil. In general the anthers are situated above the stigma; the stamens being longer than the pistil in erect or upright flowers, and shorter in those which hang down; but sometimes a special provision is necessary for the conveyance of the pollen to the stigma, especially in monœcious and diœcious plants. This operation is often accomplished by insects, which in going from flower to flower in search of honey, cover their bodies with pollen-dust, and rub it against the pistils of other flowers. When the pollen falls on the stigma, it is retained by a glu-