

THE PRINCIPLES
OF
DESCRIPTIVE AND PHYSIOLOGICAL
BOTANY.

INTRODUCTION.

OBJECTS OF BOTANICAL INVESTIGATION (2.). — DESCRIPTIVE AND PHYSIOLOGICAL BOTANY — SUB-DIVISIONS (3.). — ADVANTAGES OF OUR PURSUIT (4.). — UNORGANISED AND ORGANISED BODIES (5.). — DISTINCTION BETWEEN ANIMALS AND VEGETABLES (7.).

(1.) OF the advantages which accrue from the cultivation of the natural sciences, sufficient has been said in the treatise of Sir J. Herschel, forming our fourteenth volume; and Mr. Swainson, in his discourse, which forms our fifty-ninth volume, has further exposed the importance of the study of Natural History in general, and more particularly of that department which he so successfully cultivates. In introducing the science of Botany to the general reader, for whom more especially this volume is designed, rather than for the scientific adept, it will be right that we should follow the example which has thus been set us, and say a few words by way of introduction to our present subject. Whenever we are about to enter upon any science which is new to us, it

Cambridge University Press

978-1-108-00186-1 - The Principles of Descriptive and Physiological Botany

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is always advantageous to take a general survey of the limits within which it is restricted, and to obtain some notions of the objects of which it professes to treat. We shall, therefore, offer a few remarks upon the position which Botany holds with respect to other kindred branches of Natural History ; and point out the separate and subordinate departments into which it may be advantageously divided.

(2.) *Botany*. — In the most extended sense of the term, Botany may be considered as embracing every inquiry which can be made into the various phenomena connected with one of the three great departments into which the study of nature is divided, and which is familiarly styled the Vegetable Kingdom. And this inquiry should extend as well to the investigation of the outward forms and conditions in which plants, whether recent or fossil, are met with, as to the examination of the various functions which they perform whilst in the living state, and to the laws by which their distribution on the earth's surface is regulated. We may conveniently arrange these several phenomena under two heads. The one may be called the "Descriptive" department of the science, being devoted to the examination, description, and classification of all the circumstances connected with the external configuration and internal structure of plants, which we here consider in much the same light as so many pieces of machinery, more or less complicated in their structure ; but of whose several parts we must first obtain some general knowledge, before we can expect to understand their mode of operation, or to appreciate the ends which each was intended to effect. In the "Physiological," which is the other department, we consider these machines as it were in action ; and we are here to investigate the phenomena which result from the presence of the living principle, operating in conjunction with the two forces of attraction and affinity, to which all natural bodies are subject.

(3.) *Subordinate departments*. — Each of the two

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departments mentioned in the last article admits of subdivision; and the several subordinate departments thus formed become a register of special observations. Thus, the descriptive department will include a "Glossology," or mere register of technical terms—composing a conventional language, by which the description of plants is facilitated, and a comparison of their forms and peculiarities rendered clear and precise, without any periphrasis or unnecessary prolixity. It will also include an "Organography," containing a particular account of the several parts or organs of which plants are composed. A third subordinate department is styled "Phytography," in which a full description of plants themselves is given: and lastly, we have the "Taxonomy" of this science, in which plants are classified in a methodical manner, according to some one or other of those various methods or systems, which serve to facilitate our knowledge of the forms and relations of the numerous species already discovered. We do not, however, propose to treat our subject with so much technicality. In descriptive botany we shall chiefly restrict ourselves to the more general details of Organography, and include in this department whatever we may find it necessary to say on Glossology. The reader may then consult the general index at the end of the volume, whenever he meets with a word which requires explanation, and he will be referred to the page and article in which such explanation is given. Phytography is entirely subordinate to Taxonomy, or Systematic Botany, which forms no part of our scheme, beyond what is necessary to give the reader some general notions of the manner in which plants are described and classified in the most celebrated systems of systematic authors. We shall enter somewhat more fully into the details of Physiological Botany, as this subject possesses a more general interest, owing to the numerous and striking phenomena, of practical and economical importance, which it enables us to explain.

It is more usual, indeed, to restrict the term Botany entirely to the descriptive departments, in which, as might have been expected, and as the nature of the case requires, much greater progress has been made than in the physiological. It is, in fact, only very lately that any successful attempt has been made to connect the numerous facts which have been long accumulating relative to the various phenomena which attend, and the laws which regulate, the functions performed by the living vegetable.

(4.) *Advantages of our pursuit.*—The old and by-gone sneer of “*cui bono*,” by which the naturalist was formerly taunted, now offers no serious impediment in the way of those who are willing to inquire for themselves. Even the few who still think that no advantage would result from the encouragement of natural history as a branch of general education, no longer attempt any very decided opposition wherever they meet with others prepared to uphold it. Our pursuit has been so often and so satisfactorily shown to be productive of direct practical benefit to the general interests of society, that nothing further need here be said on that topic. But we would more especially recommend it as a resource which is capable of affording the highest intellectual enjoyment; and as much worthy of general notice for mental recreation, as air and exercise are for our bodily health. All who feel an unaccountable delight in contemplating the works of nature; who admire the exquisite symmetry of crystals, plants, and animals; and who love to meditate upon the wonderful order and regularity with which they are distributed; possess a source of continued enjoyment within themselves, which is capable of producing a most beneficial effect upon their temper and disposition, provided they do not abuse these advantages by making such studies too exclusively the objects of their thoughts and care. Above all, they must beware of pampering the ridiculous ambition of surpassing others in the extent of their collections, or of fostering an absurd and captious jealousy

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about maintaining the priority of their claim to this or that particular observation or discovery. We do not go so far as some persons, who seem inclined to believe that these pursuits are of themselves capable of producing a decided improvement in our moral sensibilities; but we hail that joy which is felt in the pursuit of such occupations, as a sacred gift, which may be compared to the rain from heaven, sent for the benefit of all: for increasing the temporal welfare both of the just, and of the unjust: for procuring blessings equally to the good and to the evil; but which the former only know how thoroughly to appreciate, and to apply to the highest and best advantage.

Botany has its peculiar interest, from embracing the study of natural bodies which form the connecting link between the animal and mineral kingdoms. If plants ceased to grow, animals would cease to exist. No animal derives its food immediately from unorganised matter; and though there are many which prey upon other animals, yet the victims have always been themselves nourished by some plant. Nothing can exceed the wonderful manner in which provision is made for the constant supply of those myriads of animated beings which people the earth, ocean, and atmosphere. Most of them are not content with every chance vegetable that may be growing in their path; and many are to be fed, and can only be fed, upon some one or two kinds of vegetable, and would inevitably starve upon every other besides! When, then, we seek to investigate the laws by which the distribution and the very existence of animals is regulated, it is of consequence that we should not overlook even the minutest moss or fungus that we can detect. It is by such plants that the first step must often be made towards rendering the barren and desolate rock a fertile and productive soil, and converting a spot apparently destined to eternal silence into a scene of lively bustle and delight.

(5.) *Unorganised Bodies*.—The most prominent distinction that subsists between the various natural bodies

that surround us, is derived from their possessing or being destitute of an organised structure. The want of organisation is the peculiar characteristic of mere brute matter, and affords an evidence of the absence of the living principle ; and is a clear proof that it has not been present in those bodies during their formation or increase. On the other hand, the slightest trace of organisation discoverable in any natural body is a complete proof that life is, or at least was once, present in that body. The separate particles of which unorganised bodies are composed, are either elementary atoms, or compound molecules, in which certain elementary atoms are united together by the force of affinity in a definite proportion. When these separate particles, or "integrant molecules" as they are termed in mineralogy, are allowed gradually to coalesce from a state of solution or of fusion, they then arrange themselves into various regular geometric forms, called crystals. These crystals can increase in size only by a further juxtaposition of similar molecules added to them *externally*. When the peculiar circumstances under which they may be placed do not allow these integrant molecules to arrange themselves into crystalline forms, they may still be able to combine together into shapeless masses, which possess the same homogeneity of character as though they had been regularly crystallised. All such combinations of unorganised matter are termed "simple minerals." Compound minerals, such as rocks and stones, the ocean, the atmosphere, are merely heterogeneous admixtures of simple minerals, which naturally exist under a solid, liquid, or gaseous form. When aggregated into large masses, these "compound minerals" constitute our earth, and probably also all the various heavenly bodies.

(6.) *Organised Bodies*. — Although organised bodies are made up of the same elementary atoms as those which compose unorganised bodies, yet are they distinguishable from these latter, not merely by the presence of the living principle, but completely and satis-

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factorily by the manner in which they increase. The various parts or organs of which such bodies are composed are not homogeneous in their structure, like those of simple minerals; and their increase is effected by an assimilation of certain particles adapted to its growth, which are received into the system through certain cavities, or vessels, from whence they are elaborated, by a peculiar process, into specific compounds, adapted to the nutrition and development of the individual. These effects depend upon the presence and activity of a distinct force, peculiar to the condition under which organised matter exists, viz. that mysterious principle which we call "life," — a something totally different in its mode of action from any of the forces to which unorganised bodies are subjected; and capable of controlling, and, to a certain extent, of counteracting, the effects of those forces. One striking peculiarity in the vital force is its variable condition, and ultimate secession from all organised bodies whatever. However effectual, for a time, in counteracting the influences of the two other great forces of nature, attraction and affinity, a period, sooner or later, does always arrive, in which it ceases to operate, and abandons to silence and inactivity the dust and ashes which it had for a little while collected, and employed in forwarding the high interests of animated nature.

(7.) *Animals and Vegetables.* — We may distinguish organised bodies into animals and vegetables; and our daily experience is sufficient to satisfy us of the propriety of such a division. Yet is it extremely difficult, and has hitherto baffled the attempts of naturalists, to point out the precise limits which separate these two kingdoms of organised nature; and no definitions of what is a plant, and what is an animal, have yet been framed sufficiently guarded and precise to satisfy all the conditions under which different organised bodies are found; but, to this day, there are some objects which it is very doubtful under which class they ought to be arranged. Among the higher tribes of organised bodies,

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indeed, there is no difficulty in pointing out numerous lines of demarcation between the two kingdoms; but, as we descend in the scale of each, we find an increasing similarity in external characters, and a closer approximation between the analogies existing in many of those functions which mark the presence of the living principle, both in the animal and in the vegetable kingdoms. Perhaps, until the contrary shall be distinctly proved, we may consider the superaddition of “sensibility” to the living principle as the characteristic property of animals; a quality by which the individual is rendered conscious of its existence or of its wants, and by which it is induced to seek to satisfy those wants by some act of volition. It has been supposed—and both analogy and experiment appear most fully to confirm the supposition—that a sense of pain is very nearly, if not entirely, absent in the inferior tribes of animals. Even in the higher tribes, certain parts of the body are incapable of receiving pain; and there seems to be no absurdity in considering that an animal may be endowed with just so much sensibility as may be sufficient to prompt it to select its food, though at the same time its body may be so organised as to be incapable of transmitting painful sensations. But the most constant, if not universal, distinction,—and one which we can readily appreciate, between animals and vegetables,—consists in the presence or absence of those internal sacs or stomachs, with which the former alone are provided, for receiving their food in its crude state, previously to its being elaborated by the organs of nutrition.

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PART I.

DESCRIPTIVE BOTANY.

SECTION I.

ORGANOGRAPHY AND GLOSSOLOGY.

CHAPTER I.

ELEMENTARY ORGANS AND TISSUES.

EXTERNAL ORGANS— CONSERVATIVE AND REPRODUCTIVE (9).
 — INTERNAL STRUCTURE ; ELEMENTARY TEXTURE ; CHEMICAL
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 VASCULAR TISSUES (13.). — COMPOUND ORGANS — INVESTING
 AND COMPLEX (28.). — PRIMARY GROUPS OR CLASSES (33.).

(8.) *Organs.* — THE various parts of which a plant is composed have been called its “organs ;” and this term is equally applied to those external portions, which may readily be recognised as being subordinate to the whole, such as its leaves, roots, flowers, &c., as to certain minute cells and vessels, of which its internal structure consists. De Candolle has included every inquiry, both into the external and internal organisation of plants, under the title of “Organography ;” although such details as belong to their external characters have a more exclusive reference to our descriptive department, whilst those which relate to their internal organisation are more especially introductory to our physiological.

(9.) *External Organs.*— The principal external or-

gans of which a plant is composed are familiar to every one. They are, the root, stem, branches, leaves, flowers, &c. These organs may be conveniently grouped under two heads, characterised by the nature of the functions which they are severally destined to perform. The root, stem, branches, leaves, and some other appendages to each of these, are concerned in carrying on the function of nutrition, or that act by which the life of every separate individual is maintained; and these are, in consequence, styled the “Conservative” organs. The flower and fruit, with their various appendages, are connected with the function of reproduction, by which the continuance of the species is provided for; and these are, therefore, named the “Reproductive” organs.

(10.) *Conservative Organs.* — The conservative organs, again, may be separated into two series. Every one is acquainted with the fact, that the stems of most plants are above ground, and that they affect a more or less erect position, and are constantly being developed upwards, whilst the roots of most plants penetrate the soil with an evident tendency downwards. An imaginary plane, intersecting the plant at the point whence these opposite tendencies originate, is called the neck: the stem, and the various organs which accompany it, are styled the “ascending,” and the root and its appendages the “descending” series. But these definitions do not exactly represent the truth, since there are certain stems which are strictly subterranean, and have a tendency to creep below the surface of the soil; whilst there are also certain roots which are aerial, and some of these scarcely indicate any downward tendency. The terms employed in defining the two series must, therefore, be considered as indicating certain facts, which are very generally, though not universally, applicable to the several organs included under each.

(11.) *Reproductive Organs.* — The reproductive organs may also be classed under two series. The first is the “Inflorescence,” which includes the flower and the various appendages to that part of the stem on