INTRODUCTION.

As many persons form erroneous or confused ideas of what is strictly intended by Natural History, it becomes the more necessary, by way of introduction to the present work, to define the object of that science; and in so doing to advert to the distinctions which separate it from other studies to which it is more or less analogous, and with which it is too often confounded.

The word nature in our language, as in most others, among its various significations, has these three: first, it means the qualities derived from original constitution, in contradistinction to those produced by art; secondly, it is used to signify the universe at large; and thirdly, the laws regulating those beings which collectively compose that universe. It is more especially in this latter sense that we are accustomed to personify nature, and to use its name for that of its Creator. Physics, or natural philosophy, includes the consideration of universal being under these three relations, and is either general or particular.

General Physics comprehends, abstractedly, the examination of the properties of those moveable and extended works of creation which we denominate bodies; that department of it called dynamics includes the consideration of solid bodies, for the purpose of determining mathematically, from a few experiments, the laws which regulate their equilibrium and motion.

This branch in its different divisions takes the names of Statics, Hydrostatics, Aërostatics, *&c.*, according to the nature of the bodies, the movements of which are examined.

Optics is confined to the consideration of the particular motions of light, and is a branch of natural philosophy in which experimental knowledge is becoming daily more necessary to the explication of its numerous phenomena.

Chemistry, another division of general physics, is the science by which we estimate and account for the changes produced in bodies by the motions of such of their component parts as are too minute to affect the senses individually. The practical part of chemistry may be said to consist in placing bodies in such positions relatively to each other, as are thereby adapted to produce certain changes. It is, therefore, obvious that this science is the result of experiment, and is not reducible to mathematical calculation, or methodical deduction.

The theory of heat and that of electricity, according to the point of view in which each is considered, appertain almost equally to dynamics and to chemistry.

The method by which the various branches of general physics are cultivated, consists in reducing the several bodies which are respectively the subjects of each particular branch to their greatest attainable simplicity; in examining their various properties when called separately into action, by the exercise either of reflection or experiment, and observing or calculating the results; also, by generalizing and connecting the laws by which they are regulated, so as to form, as it were, certain codes; and finally, if possible, to establish some universal principle into which all such laws so ascertained and methodized, may be finally resolvable.

By *Particular Physics*, or *Natural History*, (for the terms are synonymous,) is intended the particular application of the laws ascertained by general physics to the various subjects of creation, for the purpose of explaining their different phenomena.

In this extensive signification, natural history would include astronomy, which is acquired by the aid of mechanics alone, to the laws of which it is completely subservient. The mode of studying it is too different, therefore, to permit its classification under the head of natural history. We must also exclude meteorology for reasons somewhat similar.

After these exceptions, natural history, restrained from the consideration of the objects of pure calculation and precise experiment, will be found to claim as its proper province the inanimate bodies called minerals, and the various kinds of living beings, both

vegetable and animal, in all of which phenomena may be observed varying more or less from the known laws of motion and of chemical attraction, as well as from every other cause, the analysis of which is appropriated to general physics.

Hence it appears that mineralogy, botany, and zoology form the principal divisions of natural history, as ordinarily understood.

Natural history should, in strictness, be cultivated by the same methods as are adopted in the various branches of general science, and in fact it is so cultivated, when the objects of it are sufficiently simple to permit the usage of such methods. But this is very far from being practicable in every instance. There is this essential difference between the general sciences and natural history: in the former the student possesses a power of regulating the conditions of the phenomena which he studies; in the latter, the phenomena are by no means subject to his control. He cannot, like the experimental philosopher, separate the elementary parts from each other in the objects of his examination. Such objects come under his view in a complex form, and he can decompose them and analyze their component parts only in thought. What a variety of conditions, for example, are necessary to animal life! If, in attempting to analyze the nature of that life, we were in reality to separate from it any of those requisite conditions, its duration must instantly cease, and the object of our researches be frustrated. We must, to use the language of the poet, "lose it in the

moment we detect." Hence we see that dynamics is a science principally of calculation, chemistry of experiment, and natural history of observation.

These terms are sufficiently characteristic of the methods employed in cultivating the three branches of natural science, and also serve to point out the different degrees of certainty attainable in each. Calculation, as it were, commands nature, and determines her phenomena more accurately than observation can make them known. Experiment forces her to unveil, and observation watches her when refractory, and is always on the alert to surprise and detect her.

There is also a principle peculiar to natural history, which is employed with considerable advantage in a variety of instances, in the prosecution of that study. It is that of the *conditions of existence*, commonly termed *final causes*. As no material body can exist, unless it combine all the conditions which render such existence possible, its component parts must be so arranged as to admit of this possibility, not only in itself but in relation also to whatever surrounds it. The analyses of these conditions, or final causes, frequently lead to the discovery of general laws, demonstrated as clearly as are those derived from calculation or experiment: and it is not until all the laws of general physics, and those also which are brought to light by these conditions of existence are exhausted, that the natural historian is reduced to simple observation.

Mere observation will, however, avail but little

without comparison, we must observe attentively the same body in the various positions in which it is at different times placed by nature; and we must compare different bodies with each other, until we can recognise any invariable relations which may exist between their structure and the phenomena which they exhibit. Thus may such bodies, when diligently observed and carefully compared with each other, be considered as experiments ready prepared by the hand of nature, who may be supposed to add to or subtract from each in the manner the experimentalist does in his laboratory with the inert materials subject to his control, and herself to present us with the result of such additions or subtractions.

By these means we may arrive at a knowledge of the laws which regulate the phenomena of natural history, strictly speaking, subject to our observation, and which are employed by the great Governor of the universe with the same determinate precision as those which are opened to our view by the general sciences.

When we have once united the laws of observation with the general laws of matter, and with the conditions of existence, a system of natural science will be complete, and we shall then perceive and feel the mutual influence that prevails throughout the works of nature. This is the grand desideratum, to obtain which the efforts of naturalists should be steadily directed.

But all researches by observation and comparison

seem to pre-suppose that we possess the means of distinguishing accurately the objects of such observation and comparison, and of making the distinctions we establish clear to others. Without this all must be a chaos of confusion, a "rudis indigestaque moles." The first object, therefore, of natural history, the basis of all investigation, must be the formation of some certain system of arrangement, some methodical classification of the countless objects of natural history with which creation presents us.

Such is what is usually termed a system of nature; or, a grand catalogue of nature's works, in which all things may have suitable names, may be recognised by distinctive characters, and be methodically distributed into divisions and subdivisions, from the appellations and characters of which the objects classified under each may be immediately sought for and discovered. That each being may be recognised in this catalogue, the characters by which it is distinguished should be permanent and essential to it; they should never be drawn from properties or habits, the exercise of which is capricious, occasional, or transitory. They must, in fact, be altogether founded upon the principles of its conformation.

But there are very few objects in nature which can be recognised by any one single simple character; the combination of many of these is requisite to distinguish any individual object from others which resemble it in some, though not in all, of

its characters or peculiarities. The more numerous the objects we have to distinguish, the greater must be the accumulation of such distinctive characters, so that accurately to distinguish any one object from every other beside it would be found necessary, without some more concise method, to enter into a complete description of it. To obviate this inconvenience, divisions and subdivisions have been invented. Thus a certain number of objects, similar to each other in general conformation, and differing only in minor particulars, are arranged together, and the gross is denominated a *genus*.

To avoid the same inconvenience in distinguishing the genera the operation is repeated, and the genera which are assimilated to each other are, in like manner, formed into an *order*, and these again which border on each other constitute a *class*. Intermediate subdivisions are also established when necessary. The application of these several divisions of classes, orders, and genera, to the animal world, will be considered hereafter. They are employed in the mineral and vegetable, as well as in the zoological division of natural history.

This scale of divisions, of which the superior contain the inferior, is what is called a system or method. It is, in some respects, a sort of dictionary, wherein, from the properties of things, we proceed to discover their names, thus forming the inverse of ordinary dictionaries, wherein the names direct us to the properties.

But, if any proposed system or method be good,

it does not limit itself to teaching us names only; if the subdivisions have not been capriciously established, but rest upon true fundamental distinctions, upon the essential resemblance of the objects subdivided, such a system will prove the surest means of generalizing the properties of such objects, of expressing them in the fewest, most comprehensive, and most significant terms, and of impressing them most successfully upon the memory.

To invent a system at once rational and serviceable to science, it is necessary to make an assiduous comparison of the works of nature, under the guidance of that principle which is termed the *subordination of characters*, a principle which is itself derived from that of the conditions of existence already alluded to. The separate parts of every being must also possess a mutual adaptation; there are, therefore, certain peculiarities of conformation which exclude others, and some again which necessitate the existence of others. When we know any given peculiarities to exist in a particular being, we may calculate what can and what cannot exist in conjunction with them. The most obvious, marked, and predominant of these; those which exercise the greatest influence over the totality of such a being are denominated its *important or leading characters*, others of minor consideration are termed *subordinate*.

The degree of influence of the peculiarities or characters of any given being, may be frequently determined by considering the nature of the organ

by which they are demonstrated, or, when this fails, simple observation will suffice for the purpose, as the important characters may be generally known by their constancy, and in a series of observations upon a succession of various individual objects of nature, arranged according to a greater or less degree of similitude to some common given type, these important characters will ever be found to be the last that vary. Hence they are properly selected to distinguish the grand divisions, while the subordinate characters are employed with equal benefit to mark the subdivisions. There can be but one rational mode of forming an artificial system, and that will be more perfect in proportion as it approximates more nearly to the system of nature; here is the point of perfection to which the former should be directed; for it is evident, that if it once attained to this, it would exhibit compendiously a perfect impression of its glorious prototype.

Life is the most important of all the peculiarities of created being, and of all the characters the most elevated. It is therefore not surprising, that in all ages it has formed the first and most general of the principles of distinction and arrangement, and that the works of nature have always been separated into two immense divisions, that of animated, and that of inanimate, beings.