

XLIII. *On Systems and Methods in Natural History.* By
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[Concluded from p. 219.]

IT was the opinion of Linnæus, and continues to be the opinion of some of his disciples, that genera are actually founded in nature as much as species. "Naturæ opus semper est species et genus." *Phil. Bot.* § 162. "Genus omne est naturale, in primordio tale creatum, hinc pro lubitu et secundum cujuscunque theoriam non proterve discindendum aut conglutinandum." *Ib.* § 159. So the excellent and elegant author of the "Introduction to Physiological and Systematic Botany," says, "A genus comprehends one or more species so essentially different in formation, nature, and often many adventitious qualities from other plants, as to constitute a distinct family or kind no less permanent, and founded in the immutable laws of the creation, than the different species of such a genus. Thus in the animal kingdom a horse, ass, and zebra, form three species of a very distinct genus, marked not only by its general habit or aspect, its uses and qualities, but also by essential characters in its teeth, hoofs, and internal constitution." It was the circumscribing these insulated assemblages of species that Linnæus regarded as the business of the accomplished naturalist.

Those therefore who use the word *genus* in the Linnæan sense, do not employ it with the same meaning as those who regard genera as merely conventional, and subject to be broken down to suit convenience. The latter would do well to employ some other term, else one great object will be lost at which we are aiming;—the keeping together under some one common head those small assemblages of species which in some instances are so obvious, and so important in enabling us to comprehend and discourse of the scheme of nature.

Whether such insulated groupings really exist, it is for the naturalist to determine, and this can be only inferred from a very extensive knowledge; but as long as we are witnesses to

minator as the variable part, as he has himself written it; or without the denominator. Write it how he will, the same egregious blunder still remains; namely, his supposing that every part of the integral must separately satisfy the differential equation. His Postscript is not clear; but two things may be gathered from it: one, that he is possessed of a method for measuring the degrees of absurdity; the other, that he is not well assured what is, or what is not, Lagrange's method, although he has, twice in this Journal, accused it of failure. The truth is, that all his arguments are directed, not peculiarly against Lagrange's method, but against the complete integral, reduced to its simplest form, by whatever method it may have been obtained.

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such striking modifications of form as we discover in the genus *Erica*, *Rosa*, *Eriocaulon*, &c., among plants, and in *Vespertilio*, *Strix*, *Scarabæus*, &c., among animals, it would be the height of folly to give up a term so expressive and at the same time so useful, or to transfer its received meaning to some other word which has not been used in the same sense.

As the success of the systematist depends so materially upon the proper use of these abstractions, I shall now proceed to show some distinctions which it is necessary to keep in view while we employ them. We aim, as I said before, at two distinct objects by the use of systems: we use the artificial for becoming acquainted with individuals, and the natural as the means of combining them, and enabling the student to comprehend and speak of the general truths relating to nature by a knowledge of a few particulars.

Division and separation is the end of the artificial system;—to establish agreements is the end of the natural. In one case we reason *à priori*; in the other *à posteriori*. The one is a descending, the other an ascending series. Linnæus understood this distinction when he remarked, “Ordines naturales valent de naturâ plantarum; artificiales in diagnosi plantarum.”—“Cavendo in imitando naturam filum Ariadneum amittamus.” Nevertheless it has appeared to me that many modern naturalists have not adopted these truths; and that it is the prevalent error of the day to attempt to generalize where they ought to analyse; while their arrangements, called natural, are almost all of them framed with a view to distinguish. Let me not be supposed by these remarks to wish to exclude from the natural system every attempt at diagnosis; for it is obvious, that as the business of the naturalist is to study all the characters, he can no more neglect differences than he can agreements. I only wish to point out the two dissimilar objects we have in view, that they may not be confounded.

M. Decandolle, for instance, whose labours as a systematist are invaluable, seems to overlook this distinction. In his *Regni Vegetabilis Systema Naturale*, he starts from things the least known, to reason on things best known. He begins his comprehensive work with a predicate of the stars; and, proceeding downwards to minerals, comes to plants. Here he employs a series of terms expressive of a natural gradation from the highest to the lowest group, attempting fresh combinations at every stage, and making a place for every thing. Thus he has *class*, *sub-class*, *cohort*, *order*, *tribe*, *genus*, *section*, *species*. The extraordinary number of these combinations diminishes their value as a work of natural arrangement. It is a difficulty of sufficient amount to establish a few well marked; and

and when they are so multiplied, it may be suspected that many of them are arbitrary and artificial. This attempt at breaking down good orders and genera into many subordinate and loosely defined groups, and encumbering them with names, involves the subject in obscurity, and may well be questioned as contrary to his main design of presenting those comprehensive views which are afforded by a natural system.

Mr. Brown has adopted a different mode in his *Prodromus*. He has attempted to combine no further than his knowledge would warrant, not even employing the terms class or order as the names of his groups. As his object is chiefly synthesis, he keeps his diagnostic characters apart, thus leaving the mind less embarrassed when it is in pursuit of analysis. It must be admitted indeed, that his work cannot be employed with any success by the inexperienced, or even by those who have occupied themselves only in searching for species; but to have made it subservient to this purpose, would have been to have rendered it less beautiful and complete as a work of synthesis. His aphorisms and remarks not being reduced to exact method, "are," as Lord Bacon expresses it, "still in their growth, increasing in bulk and substance."

Now wherever the object of the systematist is to enable his reader to discover species, it is necessary to define at every step; and where natural characters do not present themselves, we must adopt artificial ones. For this purpose large classes are formed, many of which are necessarily artificial. These again are broken up into orders, mostly of an artificial character; and thus the naturalist is led step by step from more comprehensive definitions to less, from class to order, from order to genus, and from genus to species. In this descending series it will be observed that the essential feature is the facility that is afforded for definition. Hence the Linnæan system of botany has succeeded so well, because its author selected chiefly as the ground of his arrangement the number and proportion of parts most obvious and least liable to vary. His classes and orders are avowedly so many assumptions, which practice has shown to be convenient; but when we come to genera, the artificial system falls in with the natural, as Linnæus framed their characters upon resemblances founded in nature.

Now in the natural system this machinery of terms cannot be employed in the same manner. It is an ascending series from the less to the greater predicate. From genera we proceed upwards to orders, and orders we combine into classes. We become more and more general in our characters, instead of more and more definite. Here indeed we ought not to sacrifice, as in the artificial scheme, to convenience; and break

up well-defined genera and orders because they contain a large number of species. If we find a large genus, for instance, as *Erica*, agreeing in some well-marked characters of structure, form, station, and properties, it appears contrary to the end proposed by the natural system, to divide and subdivide the species into small groups, and to give each of these the same value as is now possessed by the whole. This is frittering away characters which are essential to the use of a genus, and destroying our power over it when we proceed to generalise. The value of generic terms consists essentially in the distinct conceptions we have of them; but if we go on to multiply them, as is at present the fashion, we render it as impossible to circumscribe them, as it is to parcel out the colours of the rainbow; and instead of making Natural History familiar and popular, it will require the compass of a man's life to master the terms we employ. If indeed the object be to analyse, division may be very convenient, because the inquirer may be otherwise bewildered in the multitude of particulars. It does not follow from hence that the student of the natural system may not avail himself of subordinate groups by whatever characters they may furnish; only the giving them equivalent names, and making them co-ordinate, is destructive, as it appears to me, of his system as a means of general reasoning.

In no department of natural history are the inconveniences arising out of this confusion of analysis and synthesis more felt than in Entomology. The multitude of species included in this kingdom of nature is so great, that it requires the most skilful arrangement to enable the student to determine them: yet it is unquestionably the worst furnished with assistance in this way;—a defect which may be attributed chiefly, I apprehend, to the attempt which both we and our continental neighbours have made to combine the natural with the artificial system. We have aimed at analysis and synthesis at the same time. A comprehensive acquaintance with this infinitely varied tribe can alone enable us to synthesise with safety; and a long period must elapse before we can hope to embrace within our synthesis the whole of the insect world.

In the large views taken by means of the natural system, our business will for ever be the labour of separating what we shall know from that which is unknown. The profoundest knowledge will at last be but a fragment. Some groups of nature are so closely related, that they have been observed from time immemorial. "Whatsoever parteth the hoof and is cloven-footed, and cheweth the cud," comprehends a group of animals so obviously connected, that they must have received a generic appellation from the remotest period. As
knowledge

knowledge has increased, more and more families have been separated: still there is always a remainder of unknown things. Take any natural system, and see if this is not the case. Linnæus in his "Fragments of a Natural Method" professes only to separate from the mass those groups which he saw clearly. Again, his definition of vegetables indicates the same truth: "Vegetabilia comprehendunt Familias septem, *Fungos, Algas, Muscos, Filices, Gramina, Palmas:*" and then, to include the remainder, he adds, "et *Plantas;*" defining the last thus, "Plantæ dicuntur reliquæ, quæ priores intrare nequeunt familias." *Phil. Bot.* § 78. Take up Jussieu's *Genera Plantarum*: and besides his "Plantæ incertæ sedis," see how he is obliged to dispose at the end of many orders his "Genera affinia," and "Genera nondum satis determinata." This is true inductive philosophy; yet the same author may be suspected of departing from this mode of investigation when he attempts to edge in his remainder under artificial or sweeping characters, as he has done in *Eleagni* and *Junci*, and when, falling in with this modern innovation, he invents a multitude of new orders to embrace every known species of plant.

The mammiferous animals are arranged with more ease according to a natural system, in consequence of their number being comparatively small, and their forms strongly marked. Nevertheless the system of M. Cuvier, in the *Règne Animal*, clearly shows the vain attempt of finding a place for every thing. Nothing can be more satisfactory and beautiful than many of his orders and divisions; yet see how he is compelled to change his ground when he comes to the *Pachydermata*, and to huddle together species very remotely connected. His birds also exemplify the same fact, where his order *Passeres* is made to include all that his other orders will not hold. "Son caractère semble d'abord purement négatif, car il embrasse tous les oiseaux qui ne sont ni nageurs, ni échassiers, ni grimpeurs, ni rapaces, ni gallinacés." Thus it contains the Warblers, the Shrikes, the Goatsuckers, the Crows, the Creepers; birds of the most dissimilar habits, and living upon the most dissimilar food. The Chough is separated widely from the *Corvi*, and *Anthus* from *Alauda*. Now this is what we might expect from the nature of the subject; only it is desirable that the remainder of unknown things should be distinctly avowed, and not reduced to an exact place in the natural system. Jussieu's was the most philosophic mode, which was to place this residue at the end. Linnæus too was very correct when he pronounced his natural orders to be a "Fragment;" and those persons who imagine it to be necessary or advantageous to find a place for every thing, and to divide and split for the purpose

purpose of making such places, appear to lose sight of the chief object of the natural system, and to destroy its utility as an instrument of general reasoning.

The French writers in general are prone to combine in their systems the very distinct objects of individualizing and generalizing. They are for ever subdividing where the great aim should be to combine, and thus they detract from the utility of their arrangements for either purpose. It is they who have countenanced the use of *sub-classes*, *cohorts*, *tribes*, *stirpes*, *subgenera*, and *sub-species*; and they also are the great contributors to the minute division of genera. Strictly speaking, in the natural system we should employ but few terms of the kind alluded to, and those of loose application. For instance, the word *sort* or *group* would as correctly express any natural assemblage of species, as *sub-class*, *race*, *tribe*, *cohort*, or *stirps*; for what do we know of the relative value of the groups attempted to be pointed out by these expressions? And how can we say they are not co-ordinate or commensurate with each other? The great division of cotyledonous plants may, for aught we know, be only equivalent to the order of Grasses; and a genus in some cases seems as distinct as any class, as *Parnassia* and *Linnæa* among plants, and the *Ornithorhynchus* and *Hippopotamus* among animals. Indeed in the recent work of M. Latreille, *Familles Naturelles du Règne Animal*, he has arranged the monotrematous animals in a class by themselves, and has made two orders; in one case, consisting of a single species, the *Ornithorhynchus paradoxus*, and in the other, of two other species before considered as belonging to that genus. Thus it is, as M. Cuvier remarks, that these animals set at naught all our classification by their osteology and mode of bringing forth.

The adoption of these numerous terms, intended to express fixed ideas, must be looked on with suspicion. The terms *species* and *genus* are too well established by custom, and are so clearly the result of convenience, and moreover conform so closely to the ordinary use of these words, that their utility cannot be questioned; but those numerous subdivisions current among our neighbours, and sensibly increasing among ourselves, may well be doubted as unphilosophical language. To each of them is attempted to be assigned a definite value beforehand, and an impracticable degree of precision; and we deceive ourselves by fancying that we can deal with these delicate and fleeting instruments of thought differently from the rest of the world. But are we to attempt to fetter nature by our systems and terms? "Books should follow sciences, not sciences books," says the immortal Bacon; yet the adoption

tion of systems and technical expressions, which have received their definition beforehand, cannot be employed without the danger of perpetuating false hypotheses, and an apprehension on the part of the ignorant, that these inventions give us some power over nature not belonging to ordinary language.

The more correct mode would be to exclude from the natural method most of these terms, and to employ in their place some convertible words of looser import, as indeed M. Cuvier has to some extent done; such for instance, as group, section, division, to express those larger assemblages of approximations to assigned forms, which are rather predicated than proved; and in many cases to point them out by mere signs, such as are used in printing. Thus, for instance, the word section, or any similar word, might be employed to express the plants severally comprehended in the order *Gramineæ*, the class *Compositæ*, and the division *Monocotyledones*; and where the characters are less definite, the plants pointed at might be assembled under a simple asterisk.

One chief recommendation of the natural system over the artificial, is the liberty which it leaves to the mind. The one shuts it in to the narrowest scope of observation, while the other suffers it to range in search of all the properties belonging to created beings; their functions, their structure, relations and resemblances, affinities and analogies. It is speculative and general truth that the natural system enables us to pursue; and this will never submit to be bound by any fetters which the art of man can invent. Books after all are but a rude mode of holding knowledge together; and language but an imperfect vehicle to convey with precision the just relations of things. At best it bears the image of the earthy, while things themselves bear the image of the heavenly.

XLIV. *Examination of a gelatinous Substance found in a damp Meadow;—as a Contribution to the Knowledge of the Meteors called Shooting-Stars.* By Dr. R. BRANDES*.

MY friend Dr. Buchner communicated some time ago (in Kastner's *Archiv.* v. 182), a treatise on the substance of the meteors called Shooting-Stars, which Kastner has designated by the name of star-jelly. This substance, found in a damp meadow, was of a gelatinous appearance, and was supposed by Dr. Schultes to be *Tremella nostoc*. M. Buchner, however, having examined it, was of a different opinion, not having been able to discover in it any trace of an organic tissue.

* From Schweigger's *Jahrbuch der Chemie*, N. R. Band xix. p. 389.

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