ART. III.—*Observations upon the Affinities and Analogies of Organized Beings.* By HUGH E. STRICKLAND, Esq., F.G.S.

I HAVE read with much interest the paper by Mr. Westwood, at page 141, on affinity and analogy. The writings of this gentleman are distinguished no less for scientific accuracy than for a spirit of sound philosophy, untainted by those visionary and theoretical views entertained by some of our modern zoologists. Instead of assuming an *à priori* system of his own, and then twisting facts into a partial coincidence with that system, he is content to take Nature as he finds her, and not the less to admire her luxuriant variety because she refuses to marshal her irregular troops into straight lines,

circles, or pentagons. This healthy tone of mind imparts a high value to all that proceeds from Mr. Westwood's pen, and it is, therefore, with much diffidence that I venture to make a few remarks on the short essay above referred to.

There is no branch of the philosophy of Zoology so obscure as the subject of affinity and analogy; and although many naturalists can correctly apply these two kinds of relations to particular cases, yet few can give any clear explanation of the rules which influence their practice. Mr. Westwood's remarks go deeper into the subject than those of most of his predecessors, yet it seems to me that he has not quite set the question in its true light. Before referring to his observations, I will endeavour to explain my own views on this difficult subject.

Relations of affinity and analogy are in my opinion perfectly distinct from each other in every point of view. In order to arrive at their definitions, we must first prove the existence of a real *natural system*, a subject which involves an enquiry into the designs of creative power, one of the most awful themes which the human intellect can attempt. The most obvious and undeniable examples of design in the organised creation are seen in the adaptation of each species to the circumstances in which it lives. Now, if this were the *sole* mark of design, if each species constituted a being *per se*, adapted to its peculiar condition of existence, but not allied in physiological structure to its fellow species, there would then be no *natural system*;—man might indeed classify such objects according to their accidental or fancied resemblances, but there would be none of those essential peculiarities of structure which we find to pervade vast groups of beings whose external forms are often widely dissimilar. The existence then of a comparatively few grand types of structure, or "centres of creation," from the different modifications of which the innumerable species now existing derive their characters, may be taken as a proof that species were created not absolutely, but relatively, — not merely with reference to their destined mode of life, but also with reference to other species whose destination was similar, though not identical with their own. If these views be correct, it results that the *resemblances* of *different* species in essential points of structure, furnish evidences of design, less obvious, perhaps, but not less certain, than the *adaptation* of any one species to its external condition of existence; and the "natural system" thus acquires an air of truth not inferior to the ocular demonstrations of anatomy. The reality of the natural system is not affected by the difficulty experienced

by man in detecting it; for it is no more to be expected that systematists should have already unravelled all the resemblances between species contemplated by the Creator, than that anatomists should have arrived at the final cause of every organ of the human body. The variety of classifications adopted by different naturalists, shows that we are still far from the true system of Nature, yet I think there can be no doubt that naturalists have already sketched out its principal features with considerable accuracy. Who, for instance, can doubt that such groups as *Vertebrata*, *Insecta*, *Mammalia*, *Pisces*, *Coleoptera*, &c., are not merely human generalizations, but real apartments in the edifice of the Divine Architect? It is not, however, sufficient, that man should detect these natural groups,—he must also give a definition of their characters,—not of the *superficial* and *arbitrary* ones, but of the *essential* and *important*, and this is often the most difficult part of his task. Although these *essential characters* form the groundwork of the natural system, yet no rule can apparently be laid down for their determination in particular cases. All that man can do is to use his best judgment in selecting such characters for a group, as seem to him the most important in their influence on the vital functions of the beings which compose it. They must, in great measure, be left to the determination of what Linnæus called a "latent instinct" which Professor Whewell defines to be "an unformed and undeveloped apprehension of physiological functions.[1]"

When by these considerations we have arrived at the notion of a natural system, composed of natural groups arranged in a determinate order, we may proceed to define *affinity* as *the relation which subsists between two or more members of a natural group*, or in other words, *an agreement in essential characters*. After the *essential characters* of such a group have been discovered and defined, then all the objects which possess those essential characters are said to have an affinity for one another. Hence we see why the idea of a *natural system* is necessary to the definition of *affinity*, for in an *artificial system* the characters of the groups are not *essential*, but *arbitrary*, and the relation between the members of such a group would be, not *affinity*, but mere *resemblance* or *analogy*. Thus, if an author were to establish the characters of the class *Pisces*, not on the essential characters derived from the circulatory system, but on the arbitrary one of being adapted for swimming, he would then include the *Ce-*

[1] History of the Inductive Sciences, vol. iii. p. 312.

tacea and the *Phocidæ* among his fish. Now, on comparing a porpoise with a cod, no one could deny that they both were fish according to the assumed definition, yet no naturalist would assert the resemblance between them to be one of affinity. It is evident then, that the word affinity derives its meaning from a belief, acknowledged or tacit, in a *natural system*, and I do not see how a person who denies the latter, can attach any meaning to the former, as distinguished from *analogy*.

From the above definition of affinity, it follows that *the degree of affinity is inverse to the rank of the group*, in other words, that the members of the lowest group have the highest or nearest affinity, and *vice versâ*. The nearest of all affinities is that which subsists between species of the same genus, and the most remote is that between *animals* and *vegetables*, as members of the next highest group, viz. *organized bodies*. The affinity between two very distantly allied species, is merely that between the highest separate groups to which they belong. Thus, the affinity between a bat and a goatsucker (to take Mr. Westwood's illustration), is merely that which subsists between mammals and birds, as members of the group *Vertebrata*, and is seen quite as perfect in the whale and the humming-bird, or any other examples of the two classes. By parity of reasoning, the affinity of a goatsucker to a dragon-fly is merely that which subsists between the subkingdoms *Vertebrata* and *Annulosa*, as members of the natural group *Animals*, and is, therefore, quite as strongly exhibited in the case of a shark and a butterfly, or an elephant and a mite, &c. We thus perceive the distinction between affinity and analogy to consist, not in *degree*, but in *kind*, for there is undoubtedly a very strong *analogy* between a goatsucker and a dragon-fly, though the *affinity*, as above shown, is very remote. Analogy, in short, is nothing more than *an agreement in non-essential characters*, or a resemblance which does not constitute affinity. Hence, analogy is necessarily a very partial resemblance, existing, as Mr. Westwood remarks, in the "numerical minority" of characters, and often confined to one organ alone. Analogy originates, not in the *intentional relation* of one species to another at their first creation, but in the other instance of creative design above referred to, viz. the *adaptation* of organic beings to their destined conditions of existence. To perform any given mechanical action, there is one, and in general, only one, arrangement of mechanical structure which is better adapted to that end than all others, and hence, when any two beings, whose affinities are remote, are destined to per-

form a similar function, we find that they are provided with more or less similar instruments for that purpose. The *resemblance*, in such a case, goes no further than the fulfilment of the required object, and may, therefore, be regarded as *unintentional*, or, in common parlance, accidental. For instance, there can be no question, that a lengthened form, destitute of sharp angles, and anteriorly pointed, is the best adapted for passing through the water; and accordingly, we find it to prevail, not only in fish, but in *Cetacea*, aquatic birds, *Dyticidæ*, *Notonectidæ*, cuttlefish, &c., and man imitates it in his naval constructions. Yet we have no evidence that such *resemblance* is *intentional*, or in other words, that whales and *Dyticidæ* were created *for the sake* of resembling fish, but we merely suppose that in each case, the boat-shaped structure was given to adapt the animal to an aquatic life. The examples of these analogies are innumerable, and appear to me to be owing to the fact, that the real variations of circumstances which this planet affords are very few, compared with the number of organized beings destined to inhabit it, so that the performance of the same function continually recurs in different groups of the natural system, and requires, in each case, a corresponding or analogous organization. Thus, e. g. there are not more than *four* principal varieties of *locality*, viz. the air, the ground, shallow water, and deep water. These four variations of *habitat* have determined the structure of the four orders of birds, *Insessores*, *Rasores*, *Grallatores*, and *Natatores*. Again, the twofold division of *food* into *animal* and *vegetable*, has caused the group *Raptores* to be divided off from the *Insessores*, and we thus get the five groups under which the class, birds, is commonly arranged. Now, as every other species of animal must inhabit one of the above four localities, and must feed on one of the above two kinds of food, it follows that the organs of locomotion and of nutrition, are susceptible of comparatively very few grand differences of structure, and that the inhabitants of the same element, or the eaters of the same food, must present numerous points of resemblance, quite independent of their *natural* or *essential affinities*. This it is which has given to distantly allied groups an *appearance* of regularity in their analogies, whence has arisen the "theory of representation," respecting which I will take occasion to say a few words.

The theory of representation announces, that "the contents of every circular group are symbolically or analogically represented by the contents of every other circle in the

animal kingdom.'" This has always appeared to me one of the most unsound and unphilosophical of the doctrines maintained by the advocates of the circular system. It seems derogatory to Creative Power to suppose that the principle of *representation* had any place in the scheme of creation, or that certain organs were given to species, not with a view to the discharge of certain destined functions, but for the apparently useless object of *imitating* or *representing* other species in a distant part of the system. The advocates of this theory would have us believe that the long tail of the horse was given it, not for the purpose of brushing off flies, but in order to represent the long "tail" [train] of the peacock,[2] and that both pigs and humming-birds have small eyes, *because* they are the tenuirostral types of their respective "circles."[3] Without wasting words upon the serious discussion of such puerilities, I will merely repeat my deliberate conviction, that relations of analogy are not to be regarded as affording any evidence of προαίρεσις, or *intention*, in the scheme of creation, but are mere coincidences of structure, incidental to the grand design of adapting a large number of organized beings to perform a comparatively limited number of functions.

It will be seen that the above view of affinity and analogy differs considerably from that of Mr. Westwood, in p. 143 of this Magazine. Mr. W. seems to regard affinity and analogy as the same relation under different points of view, and as depending upon the numerical majority or minority of the points of agreement between the objects compared. Mr. Westwood's views may be explained by the following tabular arrangement, showing the number of points of agreement between four analogous genera.

Goatsucker.	Bat.	Dragon-fly.	Dionæa.
Organized,	Organized.	Organized.	Organized.
Animal.	Animal.	Animal.	
Vertebrate.	Vertebrate.		
Fly-catching.	Fly-catching.	Fly-catching.	Fly-catching.
4	4	3	2

According to Mr. Westwood, the dragon-fly would be said to have an *affinity* to the bat or goatsucker, and an *analogy* to the *Dionæa*, because it agrees with the former creatures in three points, and with the latter in only two. Again, the bat has an *affinity* to the goatsucker, from agreeing with it in

[1] Swainson, 'Geog. and Classif. of Animals,' p. 230.
[2] Swainson, 'Classif. of Birds,' vol. ii. p. 159.
[3] Ib. vol. i. p. 43.

four points, and an *analogy* to the dragon-fly and *Dionæa*, from agreeing with them in only three and two points respectively. So that an *affinity* subsists between the bat and dragon-fly, when compared with the *Dionæa*, and an *analogy*, when compared with the goatsucker. This seems to me to be a correct statement of Mr. Westwood's views, if I rightly understand them, and they certainly merit the praise of ingenuity. It seems to me, however, that they contain a fallacy, owing to Mr. W. not having attended to the distinction between *essential* and *non-essential* characters. Thus, the words *organized*, *animal*, and *vertebrate*, in the above table, refer to characters of the highest importance to the vital functions of the creature, and consequently, to its place in the natural system, whereas the word *fly-catching* merely relates to a point of detail in the habits of the creature, of very secondary value, compared to the former characters.[1] I should say then, that these four creatures have *affinities* for one another, in consequence of their agreeing in the essential characters above stated, and that the degree of their affinities is proportionate to the number of the essential points in which they respectively agree, but that their *analogies* are derived solely from the one non-essential point of *fly-catching*, which applies to them all in an equal or nearly equal degree. In short, however strong may be the *analogy* which the goatsucker bears to the dragon-fly, I do not consider that it has any more *affinity* to the latter, than it has to a beetle, a lobster, or any other of the *Annulosa*.

Since writing the above, I have referred to the very valuable remarks by Mr. Blyth on affinity and analogy, in 'Mag. Nat. Hist.,' vol. ix. p. 399, &c., to which I had not sufficiently attended at the time of their publication. His views appear to me to be more nearly correct than any others which I have seen in print. The chief point in which they differ from mine, is in the introduction of a third term, *approximation*, as distinct both from affinity and analogy. Mr. Blyth considers it to be a strong resemblance between certain members of groups really distinct, and he illustrates it by the similitude of *Anthus* to *Alauda*, of *Ornithorhynchus* to birds, of *Myxine* to *Mollusca*, &c. Now, it seems to me, that this *approximation* resolves itself into affinity or analogy, accordingly as we admit one or other of these two propositions, either that natural groups are quite distinct from each other

[1] I only mean that the character of *fly-catching* is unimportant in comparing groups of such high rank, but of course it becomes an essential character when applied to smaller groups, such as *families* or *genera*.

in every part of their contents, or that they touch or show a tendency to touch each other at some particular point. Thus, if we suppose *all birds* to be equally distinct in essential structure from *all mammals*, *all Vertebrata* from *all Mollusca*, it is plain that the *approximation* between *Ornithorhynchus* and birds, and between *Myxine* and *Mollusca*, resolves itself into mere *analogy*. But if birds have a *tendency* to unite with *mammals* by means of *Ornithorhynchus*, and *Vertebrata* with *Mollusca* by means of *Myxine*, then this *approximation* must be regarded as an affinity. So that in either case, *approximation* is not to be considered as a distinct principle, but only as an undetermined analogy or affinity.

With regard to the above enquiry, I am inclined to believe that the larger natural groups are not only widely separated, but have no real tendency to unite,—that no mammal, for instance, is in essence any nearer a bird,—no vertebrate any nearer a mollusc than another. Be this, however, as it may, we cannot assert the same complete separation of natural types, when we look to the smaller groups. There can be no doubt that the lower groups, such as families and genera, do, in numerous instances, come into contact, or *pass into* one another, and in other cases, where the contact is not complete, yet a *tendency* towards it is very evident, and in such cases, the *approximation* becomes one of real affinity. Such is most probably the case with *Anthus* and *Alauda*, quoted by Mr. Blyth as examples of approximation.

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April 10, 1840.