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Structure, Functions, and Classification of Animals, Volume 1

John Fleming

Excerpt

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THE
PHILOSOPHY
OF
ZOOLOGY.



THE contemplation of the works of God, as exhibited in the material world, forms one of the most suitable, gratifying, and useful employments of his rational creatures. These works present themselves to our notice under different aspects, and require the employment of various methods for their examination. The results of these investigations constitute the different branches of *Natural Science*.

The examination of the forms, magnitudes and motions of the heavenly bodies, is the peculiar business of the *Astronomer*. In the prosecution of his object, he employs measurement and calculation, for the purpose of discovering the laws by which the celestial phenomena are regulated.

The beings which constitute this terraqueous globe, are subject to various changes, in consequence of their mutual actions on one another. These the Experimental Philosopher professes to investigate. When the actions here referred to are accompanied with obvious motions, but do not produce a permanent change in the constitution of

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those bodies subject to their influence, they constitute those phenomena which the science of *Natural Philosophy* professes to examine and explain. The instruments of investigation employed in this department, like those of the astronomer, are measurement and calculation, aided by experiment. When the actions which take place among bodies, produce a permanent change in their constitution, unaccompanied with motions which admit of measurement, they are considered as belonging to the Science of *Chemistry*. Experiment is the only instrument of investigation which can be employed with safety in this department.

When the beings which constitute this terraqueous globe, are considered as related to one another, exhibiting particular forms, and adapted by their structure to the situations in which they are placed, they are regarded as the subjects of the *Natural Historian*. The establishment of a *System of Nature*, to which all his labours are directed, can only be completed when all the creatures of the globe shall have become known, and their mutual connections ascertained. Observation is the peculiar instrument of research which he employs.

All these sciences mutually explain and illustrate one another. The doctrines of the one are often employed with success, to solve the difficulties which occur in the other; and the instruments of the one may be substituted for those of the other, in particular circumstances, with the happiest results.

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Excerpt

[More information](#)

DIVISION OF NATURAL OBJECTS. 3

CHAP. I.

ON THE DIVISION OF NATURAL OBJECTS, AND THE PECULIAR CHARACTERS OF INORGANIC BODIES.

THE objects which present themselves to the notice of the Natural Historian, on the surface of this globe, exhibit innumerable varieties of form, structure, action and position. But, however diversified in appearance, they readily admit of distribution into various groups, each including numerous species, capable of farther arrangement into subordinate tribes. The most extensive of these groups, are two in number,—the one called the ORGANIZED,—the other the INORGANIC Kingdom. The limits which separate these two divisions, are so well defined, that the distinction has been universally received.

Philosophers and poets, in all ages, have been anxious to point out a certain gradation of perfection in earthly objects,—a CHAIN OF BEING, the links of which consist of all created beings, passing by insensible degrees from the simplest to the most complicated, and constituting one harmonious whole, unbroken and dependent. Crystallization, they say, is the highest link of the inanimate part of the chain, and connects the Mineral with the Vegetable Kingdom. The lichen which encrusts the stone, is but one step higher in the scale of being than the stone itself. The mushrooms and corals, form a bond of union

A 2

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[More information](#)

between the Vegetable and Animal Kingdoms; and the vast interval by which Man is separated from his Maker, is occupied by different orders of superior intelligences.

All this appears at first sight plausible, and in some respects in conformity with those arrangements of Nature which we witness taking place in the subordinate divisions of animated beings. But when we examine attentively the characters which distinguish inorganic from organized beings, and animals from vegetables, we perceive, at once, that there are intervening chasms by which different parts of the chain are separated; nor can the most acute observer detect on either side the remaining portions entire, although he may be able to collect a few fragments and disjointed links.

I. Independence of the different parts of Inorganic Beings.—The different parts of an inorganic body enjoy an independent existence, while the parts of a body belonging to the organized kingdom, depend on their relative situation for the continuance of their structure and properties. The value of this distinctive mark will appear more obvious by the following examples. If we remove, from a bed of basalt, one of the jointed columns of which it consists, neither the bed nor the column suffer by the disjunction; and the latter retains the same form and structure as before the separation. If the joints be divided from one another, each joint will continue to preserve its character, although no longer in connection with those of which the column originally consisted. If the joint be split into a number of pieces, each fragment will be found to preserve its form and structure as permanently as the concretion from which it was detached. How widely different are the appearances exhibited by an organized body, when subjected to similar treatment!

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Excerpt

[More information](#)

INORGANIC BODIES.

5

When we pull off a branch from a tree, the stem itself is injured, while the detached portion speedily exhibits a change in every sensible quality. The leaves wither and drop off, the pliant twig stiffens, and the fresh bark assumes the appearance of a shrivelled crust. Changes equally obvious present themselves when a limb is separated from the body of an animal. Putrefaction soon reduces part of it to earth, and disengages the remainder in air.

In all these circumstances we find, that the instant the parts of an organized being are separated, a destructive process commences, to which there is nothing analogous in the mineral kingdom. The bodies which formerly attracted one another, and in their combinations exhibited to us the finest forms, and executed the most complicated movements, now appear to repel one another, and hasten to have the bond of union dissolved. This character, therefore, which we have now stated, independent of any other, is sufficient to point out the magnitude of that interval which separates the inorganic from the organized kingdom, and divides the living from the dead.

II. *Permanence of Inorganic Bodies.*—If we take a saline mixture, and induce crystallisation, symmetrical bodies are obtained, which are considered as the most perfect models of inorganic existence. These crystals, of whatever size, would continue to exhibit the same form and structure, unless acted upon by some external force of a chemical or mechanical kind. Within, every particle is in its proper place, nor does there exist any power to alter, increase or diminish. But the case is widely different with organized bodies. They acquire definite forms and structures, which are capable of resisting for a time, the ordinary laws by which the changes of inorganic matter are re-

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Excerpt

[More information](#)

6

PHILOSOPHY OF ZOOLOGY.

gulated. Internally, however, there is no rest. From the period that the existence of the plant or animal commences, to the day of dissolution, there is no stationary point. Increase and decay succeed by turns. Youth follows infancy, and maturity precedes age. It is thus with the mushroom and the oak,—with the mite and the elephant,—life and death being common to all of them.

III. *Integument distinctive of Organized Bodies.*—The substance of a stone or a crystal, is the same at the surface and the centre. Minerals possess no covering to defend them from external injuries, and preserve their form. When they increase, it is by the addition of matter to their surface; when they decrease, it is by the abstraction of the exterior particles. But organized bodies are enveloped in a covering which differs in structure from the parts within, which defends those parts from the action of external agents, and which is susceptible of extension and contraction. The increase of size is produced by the addition of particles to the interior, and an enlargement of this integument. A diminution of size takes place from the removal of particles from the interior, and a consequent contraction of the covering.

Were it necessary, many characters besides those which have been enumerated, might be exhibited, as distinguishing the inorganic from the organized kingdom. The individuals belonging to the former do not require nourishment and a suitable temperature, neither do they possess a circulating system. Animals and vegetables, on the other hand, stand in need of a supply of food and air, and a suitable temperature, for the continuance of their existence, and are nourished by particles prepared in appropriate organs, and conveyed by peculiar vessels. Inorga-

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Excerpt

[More information](#)

ORGANIZED BODIES.

7

nic bodies can neither boast of youth nor age, parent nor child; while organized bodies have the power of reproduction as well as the tendency to decay.

Such are the characters by which inorganic and organized bodies may be distinguished, as constituting the two great and primary classes of natural objects. Let us now direct our attention to the structure of the organized kingdom, for the purpose of ascertaining those subordinate divisions of which it is susceptible.

CHAP. II.

ON THE PECULIAR CHARACTERS OF ORGANIZED BODIES.

THE infinite variety of species which constitute the organized kingdom, possess many common properties, independent of the remarkable differences which they exhibit in their structure and appearance. By attending to these common properties, we shall be able to discover some of the qualities of that principle to which they owe their character, and by which their arrangements are regulated.

All organized bodies consist of Solids and Fluids. The former exhibit the appearance of fibres or laminae, of which cells and tubes are constructed, destined to contain the fluids. These solids and fluids are very differently arranged in the different classes of organized being, although similar in individuals of the same species.

I. The Characters of the Vital Principle.—When we examine a plant or an animal as near to the origin of its existence as possible, we witness its embryo or *germ*,

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Excerpt

[More information](#)

8

PHILOSOPHY OF ZOOLOGY.

small indeed, but possessing a power capable of developing in succession the destined phenomena of existence. By means of this *power*, the germ is able to attract towards it particles of inanimate matter, and bestow on them an arrangement widely different from that which the laws of chemistry and mechanics would have assigned them. The same power not only attracts these particles and preserves them in their new situation, but is continually engaged in removing those which, by their presence, might prevent or otherwise derange its operations.

1. **LIMITED IN ITS POWER.**—But there is a limitation of this power in the exercise of its functions, to the production of a body of a certain magnitude, form, structure, composition and duration.

A. *Magnitude.*—In each particular species, it is restricted in its efforts to the production of a being of a determinate size. When this size has been attained, sometimes by a slow, sometimes by a more rapid growth, the body remains for a time, as it were, stationary as to bulk. The absorption and ejection being equal and opposite, counterbalance each other. There is a proportion likewise preserved between all the parts,—between the roots and the stem,—the limbs and the trunk.

B. *Form.*—In each species, this power is restricted to a determinate form. Hence it is, that the external shape being the same in all individuals of the same species, it becomes an easy matter to recognize them. The seed of a fir-tree never expands into the shape of the ash, nor does the germ of the sheep evolve the appearance of the ox. In the various stages of their existence, certain organized beings are destined to undergo a variety of changes in size and shape; but these, however complicated or numerous, all pave the way for the assumption of the destined forms of the individual. In consequence of the uniformity of

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Excerpt

[More information](#)

VITAL PRINCIPLE.

9

these operations, we can predict with certainty, that from the small egg of the butterfly shall burst forth the destructive caterpillar; that this, in its turn, shall appear a dormant pupa, and, in due time, assume the elegant form and variegated colours of the sportive imago.

C. *Structure*.—This same power, which is restricted as to the form and size of the being it is destined to construct, is likewise regulated with regard to *structure*. Thus the germ of the palm-tree is destined to produce a stem, which shall increase by the addition of matter on its central aspect, and the fibres or nerves of whose leaves shall be arranged nearly in straight lines. The germ of the oak, on the other hand, is destined to construct a trunk which shall increase in size by the addition of layers to its circumference, and the nerves of whose leaves shall exhibit a reticular arrangement. The germs of animals, in like manner, are regulated by similar laws. Individuals of the same species are constructed according to the same plan, and are furnished with the same members and organs, although they differ more or less from those of every other species. In short, in each species there is a power capable of producing all the modes of that species, and incapable of producing those of any other.

D. *Composition*.—The power which organized bodies thus possess of attracting towards them the particles of inorganic matter, is not exercised indiscriminately. There is a principle of selection, which displays itself in the production of different substances from the same materials. The plants which grow on the same soil, which are nourished by the same water, and invigorated by the same temperature, select from that soil the particles suited to their nourishment. But all do not select the same particles. The wheat, barley and oats, draw towards them the particles adapted to construct their respective systems.

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The horse, the sheep, and the cow, though all feeding in the same field, and consuming the same herbage, select different particles from the same mass, and appropriate these to the production of their peculiar organs.

Even the different members of which an organized body consists, possess this power. From the same circulating fluid, bone, muscle, cartilage, and fat are produced by the selective agency of the particular organs. In consequence of this power, each species, and the separate parts of each species, have an individuality of composition by which they are characterized. Thus, within the bark of the oak, we confidently expect to find wood of a more obviously fibrous structure, and of greater strength, than underneath the bark of the birch-tree: and the flesh of the sheep has always a different flavour from that of an ox or a horse. Even the particles which are secreted from organized bodies, differ according to the species. Thus we find the perfume of the rose different from that of the thyme, and the smell of the herring, from that of the smelt.

E. *Duration*.—The same power which we are now considering, is restricted in its action to a determinate *duration*. It collects the different particles suited to the composition of the individual, with unceasing industry, arranges them with amazing regularity, and, in spite of numerous obstacles, reaches the measure of the standard by which it is regulated. For a time it appears stationary, as to size, structure, and composition. By degrees, however, the functions of this power are exercised with less energy; the fluids decrease in quantity, and the solids become more rigid; the prelude to the total cessation of all its influence over the inorganic matter with which it is surrounded, and the very organs which it has constructed.