

The Form of Birds' Eggs.

IN NATURE of June 4 (pp. 111-3), in a paper by Prof. D'Arcy Wentworth Thompson read before the Zoological Society, April 28, the way in which form in birds' eggs is to be accounted for is discussed. Referring to the accepted causes of variation in form of eggs, Prof. Thompson says:—"Whatever truth there be in these apparent adaptations to existing circumstances, it is only by a very hasty logic that we can accept them as a *vera causa* or adequate explanation of the facts; and it is obvious to my mind that in attempting to deal with the forms assumed by matter, whether in the organic or the inorganic world, we ought first to attempt to deal on simple physical lines with the forces to which it has been subjected, that is to say, the intrinsic forces of growth acting from within, and the forces of tension and pressure that may have acted from without."

In other words, for the antecedent cause (adaptation to surroundings) is substituted modification resulting therefrom or the consequential cause; and far from it being "very hasty logic" to assume the former, it is, to my mind, hasty logic to rule it out and to substitute for it an effect. In any case, the consequent is not a "*vera causa* or adequate explanation," as must at once be apparent. Again, force or energy determines the "forms assumed by matter"; and in a question of this kind we cannot compare the inorganic and organic worlds, since in the latter we find conscious effort and thought an attribute, so far as we know, not applicable to the former, and in causation either can play a very effective part. In regard to adaptation to surroundings or influence of external conditions, which to all is not meaningless, we may state the following premises:—

(1) There is a distinct evolution in form from a spherical, through various forms of ellipse, to the elongated conical egg-shell of the guillemot cited.

(2) In abnormal and embryonic eggs, normally non-spherical, there is often a reversion to the spherical form.

(3) Certain types of eggs characterise birds morphologically allied, addicted to the same mode of life, and subject to the same incident physical surroundings.

(4) Correlated with identity of form is unity of type in coloration, and it seems reasonable to suppose that this is due also to influence of surroundings—arising from which adaptations, protective resemblance, &c., may become necessary.

(5) When an egg retains permanently a form that it appears reasonable to regard as suited to environment, the same type of egg is not usually found to characterise other birds habituated to a different environment.

From (5) and the preceding premises, even though partly inferential, we may logically conclude that the form of eggs is connected with environment, for experiment, indeed, shows that all types of egg but that of the guillemot will roll off a table more readily than the latter, to instance one case alone; and it is generally admitted that the most potent factor in the production of modifications is the influence of environment. Furthermore, the egg-shell is not an indispensable product of reproduction, but has become necessary as a result of the acquired characters of different species of terrestrial organisms, so that we may regard this as further evidence of the influence of surroundings upon the bird and its egg; and thus variation in nesting-site, contributing to variation in form of egg, appears to follow by means of modifications arising from the causes indicated.

The determination of a force, in fact, is antecedent to its consequential mode of action. The latter is surely not an efficient cause, but an effect of an antecedent which we may call an efficient cause if we like. The one is subjective, the other objective, in nature, and these cannot be substituted. Function in an organ, or mode in which an organ performs its function, is not equivalent to cause. On this and the influence of surroundings reference may be made to the writings of Sir Ray Lankester ("Embryology and Classification," pp. 36-9), on the influence of memory and energy in evolution, Prof. Cope (*Amer. Nat.*, 1882, pp. 454-69), Ribot ("Heredity"), Hyatt ("Bioplastology," pp. 60-87), Herbert Spencer ("Principles of Biology").

Whether we regard the corpuscular or germ-plasm theory as the only tenable one, or whether we favour the dynamical theory, we can, I think, in either case allow that memory persists; and if it persists can it not recall in answer to stimulus a response given by the ancestor of a species? Cells may contain or retain by virtue of memory the characters of the species, but effort or energy is no doubt the means by which a response to stimuli, causing new characters to arise (and become fixed), may be conveyed. We may regard it as feasible that modifications are indirectly due to the influence of energy and memory on the germ-plasm, the specific type preserver, and that heredity or variation may be influenced in nature by the characters acquired by incidence of physical surroundings, whilst a response in an organism to outside stimuli creates a response from within, stimuli acting from within and without reacting upon one another. An organism being "a combination of rhythmically acting parts in moving equilibrium," it follows that "a change to a new state of equilibrium" will bring "the actions of all organs, reproductive included, into harmony with these actions," and the fact that "the units and the aggregate must act and react upon each other" (Herbert Spencer) more or less illustrates the view adopted. When the influence of memory and energy, and the reactions they give rise to, are duly appreciated, the recurrence during successive generations of identical characteristics is more readily understood, and the action of pangenesis becomes obscure if this excludes the perpetuation of all characters arising during the phylogeny of the group or the history of the individual.

The validity of the mode in which eggs assume different forms described by Prof. Thompson I freely admit, but in claiming it, as he does, as a cause of their variation I cannot agree with him, since mode of action follows determining cause, and, as Hyatt says, "The action of physical causes takes effect upon an irritable plastic organism which necessarily responds to external stimulant by an internal reaction or effort."

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Leicester Corporation Museum, June 17.

Lord Kelvin's Philosophy.

THERE is one word in Sir Oliver Lodge's interesting article, under the above heading, published in NATURE of July 2, to which I think some exception may reasonably be taken. In speaking of explanation in terms of force and action-at-a-distance, or in terms of motion and a continuous medium, Sir Oliver says that "To Lord Kelvin it would appear that both solutions were equally satisfactory, and that it was only a question of which was the most tractable." It is the word "equally" which is rather strong. He might indeed, as Sir Oliver says, prefer "to resort to the Boscovich doctrine"; but he would only do so in virtue of the tractability of the process, leaving aside for the time the question of the greater fundamentals. It was not at all a question of philosophy. It was a question only of the desirability of partial progress in place of no progress. His philosophy was Newtonian, postulating forces but reserving a medium.

In attempted explanation of certain elastic qualities in matter, he postulated a "simplest" Boscovichian system. That failing, he adopted a "second-simplest" system. Similarly, in attempted explanation of matter and energy, he postulated a simplest foundation in his vortex theory. That failing, he would doubtless have gladly framed a second-simplest foundation had he seen it to be possible. He was content to wait, meanwhile continuing his attack on the unknown along more presently promising lines.

In a letter of date December 1, 1905, referring to the molecular (Boscovichian) theory of magnetism and the "interesting truth" which it represents, he said "which will be added to when we know the physical quality of a molecular magnet and its relation to ether and to torrents of electrions through ether." In this spirit he was willing to wait for a knowledge of the physical quality underlying any other Boscovichian figuration.

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University College, Dundee, July 8.