

I need not multiply examples of this world-wide fallacy. We have the two words *mass* and *weight*; let us keep them distinct, and thereby help towards an understanding of the nature of an absolute unit of force and other physical entities.

"K." says "the earth's weight, or mass, is  $6 \cdot 14 \times 10^{21}$  tons. What is meaningless or unscientific in this clear, intelligible, and accurate statement?" Answer, the identification of *weight* with *mass*. He is mistaken in supposing that Prof. Poynting's book has a double title. It is simply "The Mean Density of the Earth." The determination of the "constant of gravitation" is a deduction, and is, of course, so treated by Prof. Poynting.

THE REVIEWER.

#### Icebergs and Weather.

WITH reference to the notice in NATURE of May 3 (page 15), of a letter by Mr. Russell on icebergs and their relation to weather and temperature, I should like to give you a personal experience of my own with an iceberg in mid-Atlantic, when on board the steamship *India*, on its voyage from New York to Newcastle-on-Tyne, in June last year.

Our recorded temperatures of  $43^{\circ}$  F. and  $45^{\circ}$  F. of one day fell to  $34^{\circ}$  F. in water and in air on the next day. On reporting this to the chief officer, an extra look-out was kept, and the vessel put on half-speed, as the weather was foggy, and icebergs were likely to account for the sudden fall of temperature. Twenty minutes afterwards an iceberg was sighted, which showed a length of 1200 feet, and a height of 200 feet above water.

Leeds, May 7.

A. SYDNEY D. ATKINSON.

#### Early Arrival of Birds.

I WAS at Sellack, Ross, Herefordshire, on March 22 and following days. Chiff-chaffs had arrived on the 22nd; cuckoos were heard on the following day. The willow-warbler and garden-warbler followed.

In quest of food, birds follow the path of least resistance. Thus their migrations, in the economy of nature, depend not simply on food, power of flight, distances, temperatures, &c., but on the associated extent of systems of wind.

May 4.

W. CLEMENT LEY.

#### THE EFFECT OF EXTERNAL CONDITIONS UPON DEVELOPMENT.<sup>1</sup>

THERE is now ample justification for the belief that evolution is not due merely to internal causes, though we are as yet by no means quite clear as to the manner in which external influences have formed and transformed organisms. There is still a conflict between rival theories, and important points, though often apparently clear, are in reality not so.

It is often assumed, without sufficient proof, that a particular variation of an organism is the direct consequence of some external influence, simply because some causal connection exists between the two; but such an assumption is based upon a totally false idea as to the interconnection of the phenomena. In many cases this will be readily granted; take, for instance, that of the leaves of *Mimosa*, which close when they are touched. The actual cause of the movement is here due to the peculiar constitution of the plant, and not to the touch. The geotropism of plants, again, is not the direct effect of gravity, but is due to a special power of adaptation possessed by the plant. In reference to the histological adaptation of animal tissues, let us take as an example the structure of the lattice-work in spongy bones. Roux has shown that this is due to processes of selection and for a struggle for existence between the various parts of

the body. Prof. Weismann speaks of this process as "intra-selection," and attempts to show that its effects are not inherited, as assumed by Roux, but that heredity only concerns those potentialities from which structures are developed by intra-selection. He believes that the potentialities have not arisen through the struggle between the parts of an organism, but through that between individuals; not by intra-selection, but by the ordinary process of natural selection. The *causa efficiens* of this histological adaptation is not, therefore, the tension or pressure which acts on the bones, but the adaptive material upon which such forces operate. The theory of intra-selection thereby loses nothing of its value, but on the contrary, is admitted to be of the greatest importance in maintaining the "co-adaptation" of parts during the metamorphosis of species.

The organism can, however, also be affected by external influences for which it is not adapted in advance. This is the case as regards the ordinary seasonal dimorphism of butterflies; but even seasonal differences may be produced by adaptation—here a double adaptation—in which the external influences of temperature do not act as the direct causes of change, but only as stimuli, which determine as to which of the two forms of the species shall arise.

In the case of neuters of social insects, the external influence—scanty food—is not, as Herbert Spencer assumes, the true *causa efficiens* which produces the sterility of their caste, but only the stimulus by which the primary constituents (*Anlagen*) of the worker-type are brought into activity. At least three kinds of primary constituents—those of the male, the fertile female, and the worker—must be contained in the eggs of ants, bees, and termites; the nature of the stimulus acting upon the egg determines the kind of primary constituent which shall come into activity. These opinions are confirmed by experiments made on flies, which show that insufficient nourishment supplied to the larva does not in any way affect the development of the ovary. The disappearance of typical organs—such as the ovarian egg-tubes of bees and ants—is thus shown to be a phylogenetic and not an ontogenetic process: it does not depend on mere influences of nutrition, but on variation in the primary constituents of the germ; and thus can only come about in the course of numerous generations. The case of social insects is therefore far from contributing any support to the view that acquired characters are inherited, and that the inheritance of the effects of use or disuse play a part in the transformation of species, as is assumed by Herbert Spencer.

Thus we see that external influences in many cases serve as the impulse which starts the process of development in certain of the primary constituents. The actual cause of these individual dissimilarities is in all cases to be sought in the modification occurring amongst the primary constituents of the body itself; and such purposeful modifications can only have originated by selection. Even when to all appearance external influences have had direct action in causing purposeful modifications, a more careful examination will always show that they have only served to bring some preformed adaptation into activity. This is proved in a specially conclusive manner by the consideration of sterility in the workers of bees and ants: the sterility is not due to poor nourishment, but to natural selection, which has determined the nature of the primary constituents in the ovary. This case is of especial interest, as it has been so much relied on as a support to the Lamarckian principle of the inheritance of acquired qualities. Here, as in all other instances, the Lamarckian hypothesis is untenable; selection has been the only principle on which the development of the organic world has been guided on its course.

<sup>1</sup> Abstract of the Romanes Lecture delivered in the Sheldonian Theatre at Oxford, on May 2, by Prof. August Weismann, Ph.D., D.C.L.