

But there will commonly be found a few individuals which differ so remarkably from their fellows as to catch the eye at once. Such large deviations differ from the smaller ones, at least in most cases, by their extreme rarity; but they have been extensively collected, and most museums contain numerous examples of their occurrence. Some naturalists have been led, from the striking character of such variations, to assume for them a preponderant share in the modification of specific character. These persons assume, if I understand them rightly, that the advantages or disadvantages which accompany the more frequent slight abnormalities are in themselves of necessity slight; and that the effect of such slight abnormalities may be neglected, in comparison with the effect produced by the occasional appearance of considerable deviations from the normal type. They regard change in specific character as an event which occurs, not slowly and continuously, but occasionally and by steps of considerable magnitude, as a consequence of the capricious appearance of "sports."

Without presuming to deny the possible effect of occasional "sports" in exceptional cases, it is the object of the present remarks to discuss the effects of small variations, as it may be deduced from the study of two organs in a single species.

The case chosen is the variation, during growth and in adult life, of two dimensions of female *Carcinus mènas*, recently investigated by a Committee of the Royal Society; and what is here said may be considered an appendix to the report of that Committee.

The questions raised by the Darwinian hypothesis are purely statistical, and the statistical method is the only one at present obvious by which that hypothesis can be experimentally checked.

In order to estimate the effect of small variations upon the chance of survival, in a given species, it is necessary to measure first, the percentage of young animals exhibiting this variation; secondly, the percentage of adults in which it is present. If the percentage of adults exhibiting the variation is less than the percentage of young, then a certain percentage of young animals has either lost the character during growth or has been destroyed. The law of growth having been ascertained, the rate of destruction may be measured; and in this way an estimate of the advantage or disadvantage of a variation may be obtained. In order to estimate the effect of deviations of one organ upon the rest of the body, it is necessary to measure the average character of the rest of the body in individuals with varying magnitude of the given organ; and by the application of Mr. Galton's method of measuring correlation, a simple estimate of this effect may be obtained. In the same way a measure of the effect of parental abnormality upon abnormality of offspring may be numerically measured by the use of Galton's correlation function, and such measurements have been made, in the case of human stature, by Mr. Galton himself.

It is to be observed that numerical data, of the kind here indicated, contain all the information necessary for a knowledge of the direction and rate of evolution. Knowing that a given deviation from the mean character is associated with a greater or less percentage death-rate in the animals possessing it, the importance of such a deviation can be estimated without the necessity of inquiring how that increase or decrease in the death-rate is brought about, so that all ideas of "functional adaptation" become unnecessary. In the same way, a theory of the mechanism of heredity is not necessary in order to measure the abnormality of offspring associated with a given parental abnormality. The importance of such numerical statements, by which the current theories of adaptation, &c., may be tested, is strongly urged.

The report itself describes an attempt to furnish some of the numerical data referred to for two dimensions of the shore crab. The data collected give an approximation to the law of frequency with which deviations from the average character occur at various ages. The conclusions drawn are (a) that there is a period of growth during which the frequency of deviations increases, illustrating Darwin's statement that variations frequently appear late in life; (b) that in one case the preliminary increase is followed by a decrease in the frequency of deviations of given magnitude, in the other case it is not; and that (c), assuming a particular law of growth (which remains, as is admitted, to be experimentally tested), the observed phenomena imply a selective destruction in the one case, and not in the other.

It is not contended that the law of frequency at various ages,

adopted in the report, is exact. It is, however, hoped that the approximation is sufficiently exact to give numerical estimates of the quantities measured, which are at least of the same order as the quantities themselves, and for this reason it is hoped that the method adopted may prove useful in other cases.

SCIENCE IN THE MAGAZINES.

In the February number of the *Fortnightly*, Dr. A. R. Wallace discussed in some detail Mr. Bateson's views on variation in relation to the method of organic evolution. He concludes his attack in the current number, and considers Mr. Francis Galton's views, stated in "Natural Inheritance" and in "Thumb and Finger Marks." It is held that the methods of organic evolution favoured by Mr. Bateson and Mr. Galton have failed to establish themselves as having any relation to the actual facts of nature. The reason for their failure is stated by Dr. Wallace as follows:—"they have devoted themselves too exclusively to one set of factors, while overlooking others which are both more general and more fundamental. These are—the enormously rapid multiplication of all organisms during more favourable periods, and the consequent weeding out of all but the fittest in what must be on the whole stationary populations. And, acting in combination with this annual destruction of the less fit, is the *periodical* elimination under recurrent unfavourable conditions, of such a large proportion of each species as to leave only a small fraction—the very elect of the elect—to continue the race. It is only by keeping the tremendous severity of this inevitable and never-ceasing process of selection always present to our minds, and applying it in detail to each suggested new factor in the process of evolution, that we shall be able to determine what part such factors can take in the production of new species. It is because they have not done this, that the two authors, whose works have been here examined, have so completely failed to make any real advance towards a more complete solution of the problem of the Origin of Species than has been reached by Darwin and his successors."

A story worth repeating here is told by Mr. John Murray, the publisher, in *Good Words*. One day Charles Darwin came to see the late Mr. Murray, and brought with him a MS. As he laid it on the table, he said, "Mr. Murray, here is a book which has cost me many years of hard labour; the preparation of it has afforded me the greatest interest, but I can hardly hope that it will prove of any interest to the general public. Will you bring it out for me, as you have done my other books?" The book was Darwin's famous work on "Earthworms," which in the course of three months reached a fifth edition. Mr. Murray gives the incident as an illustration of the extreme modesty of a very distinguished man. The same magazine contains some stories of snake cannibalism, by Mr. H. Stewart. A very readable story, in which observations of the planet Mars, and projects of signalling to our ruddy brother, are described, is contributed by Mr. J. Munro to *Cassell's Family Magazine*. Mr. Munro makes the Martians signal to us by means of lights from various incandescent elements, the natures of which are detected spectroscopically. He has a lively imagination, and is fairly accurate in his astronomical references. In the *English Illustrated*, we notice another of Mr. Grant Allen's "Moorland Idylls"—this time on butterflies; and also something about lions, by Mr. Phil Robinson. In the *Strand Magazine*, Mr. J. Holt Schooling gives a number of ingenious diagrams for graphically representing statistics relating to the population of different countries. There is also the concluding part of an article by Mr. W. G. Fitzgerald, on "Some Curiosities of Modern Photography," in which, among other illustrations, occur Prof. Boys' pictures of moving bullets, and a good reproduction of Dr. Roberts' photograph of the nebula in Andromeda. Another article of interest to photographers appears in *Le Monde Moderne* for February, under the title "Les Mouvements de l'Ouvrier." A number of excellent reproductions of some of M. Marey's photographs accompany this article. The same magazine contains a description of compressed air systems of tramway traction.

In addition to the magazines mentioned in the foregoing, the following have been received, but they do not contain any articles of scientific interest:—*Contemporary*, *Century*, *Scribner, Chambers's*, *Longman's*, *National*, *Sunday Magazine*, and *Humanitarian*.