The Inheritance of Acquired Characters.

FOR a generation it has been a cardinal principle of thought and teaching with a majority of biologists that acquired characters are not inherited. Under the influence of Weismann and his doctrine of the independence of germ and soma this position has frequently been adopted even in its extreme form, that the inheritance of acquired characters is an impossibility. Botanists, on the other hand, have usually been less dogmatic on the subject, probably because in higher plants there is no such early segregation of germ-cells and somatic cells as occurs in many animals.

But in recent years new experiments have exhibited the problem in fresh lights, and the tendency to dogmatism which had grown up around the subject is fast disappearing. Prof. E. W. MacBride, in a trenchant article (*Science Progress*, January) which will mark a new stage in the discussion of this problem, subjects various aspects of Weismannism to a searching criticism, and shows how arguments which seemed so triumphantly unanswerable in Weismann's time are no longer in accord with the modern facts of experimental biology.

Perhaps the most fundamental of the defects of Weismannism as a philosophy of the organism was its foundation upon purely morphological conceptions of heredity, variation, and organic structure. While we shall always be indebted to him for the emphasis which he laid upon the chromosomes as a basis of heredity, yet a considerable part of the superstructure which he built on that foundation is no longer in accord with modern experiment. As Prof. MacBride points out, Weismann's view that the differentiation during ontogeny is the result of differential divisions of the chromosomes in mitosis is contrary to the evidence of both experimental embryology and cytology. Rather, the conclusion seems clear that all the nuclei of an organism are equipotential, the splitting of the chromosomes being, as it appears under the microscope, an equal one. If that is the case, then the nuclei may be looked upon as the conservative repositories of many at least of the differences which arise between species, while the mass divisions of the cytoplasm account for the greater part of the differentiation which takes place during development.

Another weakness in Weismannism which Prof. MacBride points out is the assumption that although the germ-cells of an organism might be affected by climate, they could not be modified by the fluids from the body-tissues in which they were immersed. The physiologists, by means of hormones, enzymes, antibodies, cytolysins, etc., have helped to rescue us from the untenable position that the germ-cells are completely insulated within the organism, and the work of various investigators has led us to see that germinal changes can be experimentally produced.

This does not, however, necessarily involve the principle of the inheritance of acquired characters, but it does render it reasonable to suppose that such inheritance may take place. The question then reduces itself to one of unprejudiced evidence, and on this point Prof. MacBride refers to the much-discussed investigations of Kammerer, whose results can now be contradicted only by imputing fraud, and to the perhaps even more important, because incontrovertible, evidence recently obtained by Messrs. Guyer and Smith (see article by Prof. Dendy in NATURE for February 3, p. 742) in producing a race of rabbits with defective eyes by the action of a cytolysin on the mother.

It is clear that the Lamarckian principle of use and disuse, as well as the various Neo-Lamarckian subtleties involving the inheritance of acquired characters, will have to be reckoned with seriously in future as an evolutionary factor. There is one point, however, in which we would venture to differ from Prof. MacBride, and that is with regard to the evolutionary significance to be attached to mutations. It is true that many of the mutations studied in plants and animals are more or less pathological or abnormal, and would stand a very poor chance of surviving in equal competition under wild conditions. On the theory of mutations this is to be expected, as well as the occurrence of many lethal factors such as are now known in Drosophila and Œnothera. But viable mutations, or even those which in some circumstances will have an advantage over the parent species, are by no means unknown. Bridges (*Biol. Bull.*, vol. xxxviii., p. 231) has recently described a mutation in Drosophila with white ocelli, which maintained itself in equal numbers in competition with the type in mass-culture for about 175 generations. The character-difference is here insignificant, but in wild species of plants there are innumerable records of single variations which have arisen and perpetuated themselves, having neither an advantage nor a disadvantage in competition with the parent species so far as can be determined.

Mutations are also by no means all *loss* characters. In the Œnotheras a series of forms is now known having a whole extra chromosome in their nuclei; and since the doubling of the whole series of chromosomes (tetraploidy) was investigated in *Œnothera gigas*, a large number of genera of plants have been found to contain tetraploid species, showing that this particular type of mutation is not only in a sense progressive, but has also taken part in the phylogeny of various genera and families.

May we not, then, suppose that mutation and the Lamarckian factor have both played their part in evolution, natural selection frequently coming in to adjudicate between mutations, while the Lamarckian factor has been at work in many cases of adaptation?

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Home-grown Wheat.

THE Ministry of Agriculture has instituted a campaign to secure by educational methods an increase in the wheat production of this country. An account of the addresses delivered in connection with this campaign by the principal of the Harper-Adams Agricultural College appeared in the Ministry's General Service for December 11 last. These addresses dealt with the subject from two points of view: the need for stimulating production and the best methods of raising the average yield.

Though Great Britain obtains its wheat from many parts of the world, and it is scarcely conceivable that a shortage would occur through simultaneous failure of the crops in all these countries, yet it is imperative that our own yield should be increased, since the available figures from other producing countries and