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NUTRITION OF POULTRY

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Genetics and Animal Nutrition

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At present the widest possible definition that may be given of the science of genetics is that encompassed by the phrase 'the study of variation in living things'. In the early days of Mendelism it could, perhaps with justification, be limited much further by the use of the term 'heritable variation'. It may be useful to illustrate these conceptions, which characterize the fundamental change in thought that has taken place within the minds of geneticists. Since this meeting concerns itself with the nutrition of poultry, examples relating to the fowl will be given.

In domesticated poultry the comb may be of a particular type: single (as in Leghorns), rose (as in Wyandottes), and more rarely walnut or pea, as in some other breeds. The comb is a morphological structure present in the chick at hatching and its characteristic shape is retained in recognizable form throughout the life of the individual, although its size may be affected by hormonal stimulus provided by male or female sex glands. The researches of Prof. Punnett at Cambridge showed quite conclusively that in so far as comb type is concerned the variation is heritable. From appropriate crosses, interbreeding or back-crossing the subsequent generations provided a series of distributions of comb types in discrete classes, of which the proportions could be mathematically analysed and the mode of inheritance determined. In such a case genetics fulfils all that can be expected of a science: it gives an accurate forecast of the results of a known sequence of events. Had all our problems in the animal field been of this order and concerned with the inheritance of qualities which, once expressed, remain immutable, astonishing improvements in stock quality would have been possible—if they had not already been made by practical breeders.

It was natural to employ the comparatively new science in the approach to problems of a complex physiological nature, such as the production of eggs or milk, on which rests the economic basis of our animal industries. That the early hopes of a genetical solution of the problems of attaining high annual egg yield were not realized depends mainly on the fact that we are dealing with a persistent recurring process in time, which can be affected by influences both intrinsic and extrinsic to the animal. This results in continuous variation which masks the segregation of heritable entities into recognizable genetic classes. Even when the cyclic phenomenon is resolved into its constituent features, the parts are still not susceptible to a direct analysis of the results in terms of Mendelian theory.

For those not conversant with poultry I shall describe the kind of data involved. Chickens are hatched in the early spring months in order to get pullets that begin to lay in the autumn, when they are about 5–6 months old. If a high egg yield is to be obtained, they should lay throughout the winter months without a pause; they should have a high intensity of production; they should not cease production through going broody, and they should lay continuously until the year is completed. There are indications that genetical forces determine the character of these several parts of the egg cycle within limits—but only within limits. Examples from our own experience may serve to illustrate my remarks. There are two points in the production cycle of the hen which are easily measurable; one is the age from hatching at which she produces her first egg, and the other is the day on which she produces the last egg before the onset of the moult. On the question of age at sexual maturity we have collected some interesting data. Even with an inbred population, it was found impossible to reduce the variability in this character in spite of positive selection to this end; but when chickens were hatched in August instead of in the early spring months, the range of variation was substantially reduced. With the date of last egg of the production cycle we were able to show that 25% of the birds in the flock produced their last egg in successive cycles on a date within 3 days of that terminating the pullet laying year. Such a result strongly indicated the presence of genetic influences, but the variation exhibited by the other 75% of the birds was such as to prevent a straightforward analysis in terms of inheritance. These two instances, out of many which could be mentioned, are sufficient to indicate the difficulties in the investigation of problems where the environment in the widest sense can be a limiting factor in the expression of inherent tendencies.

Techniques, it is true, are now becoming available for estimating the relative extent to which characters are controlled by genetic and non-genetic forces. Nevertheless, a still more acute appreciation of non-genetic variability is needed in our approach to problems of interest in both the academic and applied fields. The geneticist must seek the co-operation of workers in many branches of science, not the least important, of course, being those engaged in the science of nutrition. But if the geneticist needs to know more of the extent and nature of variation, it is equally important that those other workers in the different sciences, both in the laboratory and in the field, should have some knowledge of the inherent tendencies of the samples of animal populations they use, for, from them, as a result of experiment, important general principles may be deduced.

It is, in fact, an important reciprocal function of the biological sciences to provide one another with tools to further their researches into the natural variability of animals. In this respect I believe that Genetics and Nutrition have much to give one another.