factor theory as a basis for the design of experiments which can give guidance to the process of artificial selection. Prof. K. Mather himself has recently made important contributions to our understanding of the genetical systems involved, and this exposition of the ideas and technique required in their analysis is to be cordially welcomed as both timely and stimulating.

Because of general relevance to the theory of heredity, the earlier sections, which outline the properties of polygenic systems, will merit the attention of all biologists, and not merely that of professional geneticists. The value of a metrical character is affected by each one of an associated set of polygenes, which are inherited in Mendelian fashion. Their effects are similar and cumulative. Thus the character is a function of the allelic combination present, the non-heritable variation blurring the distribution of its values in a population. A polygene differs from a classical gene only in failing to have a major phenotypic effect. But since a great variety of allelic combinations entail equally advantageous phenotypes, it is the polygenes which constitute the main reservoir of useful genetic variance, and are "the genes of smooth adaptive change".

Identification of the polygenes of a system is neither possible in practice nor necessary. Instead, attention is given to certain statistical properties of the whole aggregate concerned. The familiar genetic concepts form the starting point of the analysis, but in the methodology they yield natural place to bulk properties. This is analogous to the way in which, in physics, individual dynamical properties of molecules are subsumed in bulk characteristics such as temperature or entropy. In particular, the unit of biometrical genetics is not the isolated polygene but the *effective factor*, a complex of linked polygenes, which is not permanent over the generations, but which at any stage of the selection process is the structure of interest to the breeder.

The development of these concepts, which is Mather's main theme, is admirably illustrated by the consistent use of experimental data, much of which is here subjected for the first time to this kind of analysis. This will make the book invaluable to anyone engaging in this field, even though, to keep it to a digestible length, the author has not aimed at an exhaustive treatise. Mather, as usual, has achieved a remarkably clear presentation of an intricate subject, and for a first reading the ideas of the analysis of variance should see one through.

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PLANT BREEDING IN SWEDEN

Svalöf 1886–1946

History and Present Problems. Edited by Prof. Å. Åkerman, Dr. O. Tedin and Dr. K. Fröier; English Technical Editor: Dr. R. O. Whyte. Pp. v+389. (Lund: Carl Bloms Boktryckeri A.-B., 1948.) n.p.

THE Plant Breeding Institute of the Swedish Seed Association, commonly known as "Svalöf", was founded in 1886. This account of its history and activities was prepared on the occasion of its sixtieth anniversary; but the main purpose was "to indicate the willingness—even the eagerness—of Swedish Plant Breeding to take part again in the international collaboration of scientific plant breeders" after the period of isolation during the War.

The book consists of a series of twenty-two articles by different authors who have been allowed freedom of choice of theme and treatment—an arrangement that has inevitably led to some repetition. Some of the papers deal with the history and organisation of Svalöf and its branch stations. One of them describes the climate and soils of Sweden, and shows how the great diversity of agricultural environments demands a correspondingly wide range of crop varieties. Most of the papers are concerned with the practice of plant breeding. A general account of the problems involved in producing improved varieties of crops, of the development of breeding technique at Svalöf, and of the methods in use at present, is given in articles on "The Breeding of Self-fertilized Plants by Crossing", "Natural Selection and the Breeding of Cross-fertilizing Plants" and "In-breeding in Herbage Plants". Much the same ground is covered in greater detail in other articles by specialists on particular crops.

Three papers describe recent work at Svalöf on artificially produced polyploids and mutations. The discovery early in this century that polyploidy is common in flowering plants, and that polyploids are often of larger size than the related diploids, suggested that high-yielding crop varieties might be obtained by experimentally inducing an increase in the chromosome number. At first the only methods available were heat-shock treatment and hybridization; but since 1937 the colchicine technique has enabled polyploids to be produced with much greater frequency and less labour. None of the raw polyploids has been of practical use, but it has been found possible to improve them by continued breeding, and it is hoped that, by starting from a large number of polyploid individuals, commercially useful types will eventually be bred. Some types of *Triticale*, produced by crossing wheat and rye, have valuable properties such as a high protein content of the grain, good baking quality and extreme winter hardiness and earliness, and yield well on poor sandy soils. Work has been in progress for nearly twenty years on mutations induced by treatment with X-rays and, very recently, with mustard gas and neutrons. So far, no artificially induced mutants have been introduced into agriculture, but some of the *erectoides* mutants of Maja barley, which combine earliness and stiff straw with a good yield, may prove to have practical use. The ultimate aim of being able to control and direct mutation is still far from being achieved.

The account of the work of the Cereal and Chemistry Laboratories amounts to little more than a list of investigations. Many of these relate to problems, such as the artificial drying of combine-harvested grain, that are of immediate concern in British agriculture. A short statement of the results obtained would have been valuable, especially as many of them have not been published elsewhere.

Though this book is presumably intended primarily for plant breeders, many of the articles will be of interest to a wider audience of agriculturists. A reader who wishes to browse will find the lack of page headings a minor obstacle. In other respects the book is well produced and illustrated.

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