

GENETIC COMPLEMENTATION

Molecular Biology and the Origin of Species

Heterosis, Protein Polymorphism and Animal Breeding. By Clyde Manwell and C. M. Ann Baker. (Biology Series.) Pp. xiv + 394. (Sidgwick and Jackson: London, April 1970.) 80s boards; 25s paper.

THIS book has grown out of the authors' researches into the protein polymorphisms of marine organisms and of poultry, which are here set in the context of related studies and organized around two central concepts; the origin of species, and the use of hybrid vigour in animal and plant breeding. (For good measure, there is also a half-topic, so to speak, on pollution as an evolutionary force.) Although this means that we get two books for the price of one, we have to pay for it: parts of the book are written for breeders, whereas other parts have molecular biologists in mind; and this ambiguity of purpose, and an involved style, make the text difficult to read. Nevertheless, because about 1,000 papers are reviewed, there is much of interest to be gleaned; so it is unfortunate that the index is not organized to this end.

The business of the book is heterosis (hybrid vigour), defined as positive when the hybrid is superior to both parents (following East and Jones), or negative when it is inferior (following Stern, but inverting East and Jones). It is argued that the molecular basis of both is "complementation, either between different polypeptide chains in a protein with a quaternary structure, or between functionally related proteins in a metabolic pathway". These very different possibilities are often confused, and much of the text is given over to explaining the physical chemistry of protein structure and the molecular basis of complementation. The literature on the proteins of heterozygotes is thoroughly reviewed, but the arrangement of the chapters leads to some repetition, and the relevance of a point often becomes clear only in the later chapters when the occurrence of hybrid proteins is related to heterosis. Theory and results are then pushed to their limits (sometimes with the aid of incorrectly computed statistical tests), to "prove" the correlation between complementation and hybrid vigour, positive or negative. After all this it comes almost as a surprise to find that the authors view the successes of hybrid breeding with some scepticism. Their criticisms are not new, but it is useful to have them brought together in one place. The breeder may be forgiven, however, if he is similarly sceptical about their prescriptions for the future: "quantitative genetics for animal breeding will combine not only the mathematics of populations and selection but also the mathematics of allosteric effects and reaction rates". He will remember, if he is a poultry breeder, that blood group polymorphisms were once recommended as sure guides to breeding success. But not any more.

The tabulations in this book suggest that "negative" heterosis is common, and this has to be explained. At least in some instances, the reason is that the samples are too small to give reliable estimates of the deficit of heterozygotes found in a population (for example Table 12), and the reader should be reminded that Raymond Pearl laid down strict rules for the proof of selection of particular genotypes, which are not usually satisfied by the data presented. Of course, selective hybrid elimination is well known, but I take it that the authors mean more than this when they cite "negative heterosis as the internal driving force for speciation", namely, heterozygote disadvantage deriving from particular complementing genes. The case for this concept is not rigorously proven.

Heterosis is usually taken to mean the greater vigour of hybrids in terms of growth, survival and fertility. All of these characters are controlled by many genes, and explanations of this vigour which rest on the characteristics of heterozygous alleles (overdominance), or of complementing alleles, are likely to be suspect. There are

no good examples of overdominance, and there is nothing very new about inter-allelic complementation. None the less, the reader who perseveres with this book will find it useful to have an old problem looked at from a new point of view. But it will be hard work for breeders. The book is well produced, and the paperback edition is remarkably inexpensive.

JAMES H. SANG

BONE PHYSIOLOGY

The Physiology of Bone

By Janet M. Vaughan. Pp. xix + 325. (Clarendon Press: Oxford; Oxford University Press: London, April 1970.) 100s boards; 50s paper.

SINGLE author textbooks become rarer and rarer, but, as they do, their merits become more obvious. One author cannot be an expert in everything. Treatment in great depth becomes easier when twenty authors divide up a small field into twenty even smaller parcels, but the gain in depth is often offset by overlapping or even contradiction between different contributors and a patchwork effect which detracts from the overall value and readability of the work.

This is not to deprecate the value of multiple author books but simply to emphasize that works by single authors, when well done, are characterized by an internal harmony and rhythm which enhance their value and the pleasure that can be derived from them. This volume is an excellent example of the species. Written with the judgment that comes from honourable retirement, produced so fast that it is uniformly up to date, and illustrated with exceptional clarity, it will be well received by workers in the calcium field and will no doubt run to as many editions as the author has the strength to produce.

Bone physiology is not a well defined field and this first book on the subject is therefore a trend-setter. The decision as to what should or should not be included under this title must be an arbitrary one, the choice influenced by the inclinations of the writer. Dame Janet Vaughan has chosen well. The principal chapters cover the structure, function and blood supply of bone and cartilage and their constituent cells, as well as the chemistry of the mineralized and non-mineralized components and the mechanism of calcification. She then proceeds to the flow of the relevant ions through the body fluids and in and out of bone, and discusses the hormones and other factors which influence these homeostatic processes. She dwells lightly on pathological conditions, reviews the relevant vitamins and concludes with an excellent chapter on the enzymes in bone.

It is a competent performance. The break-up into sections, sub-sections and sub-sub-sections makes for easy reference and the illustrations are not only profuse and excellently reproduced but chosen with admirable skill and judgment. The bibliography is solid without being extravagant or pretentious and creates the definite impression that only useful papers actually consulted by the author have been included.

This does not mean that the internal balance of the work cannot be questioned. Nutritionists might well argue that nutritional aspects of bone metabolism are glossed over and that such an important and relevant organ as the kidney receives rather short shrift. In reply the author has only to point to the title of the work which indicates clearly both its scope and its limitations. Bone is the focus of the work and occupies the author's principal attention throughout. The kidney and the gut, though interesting, are kept firmly in their respective places and those of us whose particular interests lie in this direction are not entitled to complain.

In brief, then, here is a good review of a difficult subject which will serve as a reference work for those already in the field and an excellent introduction for those who have not yet moved into it.

B. E. C. NORDIN