Book Reviews

Manual of quantitative genetics. Walter A. Becker (ed). Academic Enterprises, Pullman, Washington, USA. 1984. Pp. 190. Price \$9.95.

Although there are renowned text books giving the theoretical basis and methods for the study of the inheritance of quantitative variation these often do not give sufficient detail, particularly for the uninitiated, of the steps involved in calculating all necessary statistics from experimental data. Thus there is a need for “toolkit” publications such as this to fill the gap. This is the 4th edition of this particular manual, the first being published in 1964, and its longevity is testimony to its relevance. Essentially it is a list of recipes showing what particular genetical information can be extracted from a particular experimental design. As such it is aimed at undergraduates or postgraduates coming to grips with quantitative genetics. However it is also useful as a reference manual for investigators in a wide variety of disciplines who wish to extract genetical information from their experiments. One note of caution for plant geneticists. It is very much orientated towards experiments on domestic animals and is a bit weak on analyses used in studying self-pollinating crop species in particular.

Most of the chapters are very short and well written, and topics can easily be found from the index. The first three chapters, which only occupy 11 pages, are introductory, giving the notation used, the underlying assumptions, and the formulae and parameters for the covariances between relatives. The following three chapters, again occupying only nine pages, describe how to calculate selection statistics and give examples of how to calculate predicted gains and correlated responses. Next follows a chapter on calculating statistics from human twin data and then a chapter on repeatability. Then comes the real meat of the book, and to me the most useful, a very large chapter (nearly half the book!) on “Estimation of variation components and heritability”. This presents details of the analysis of the most commonly used mating designs (such as the North Carolina designs) and goes into great depth on how to carry out the ANOVAs, how to calculate the components of variation, what they represent, and how to derive other relevant statistics. A pretty comprehensive chapter. Following this there are chapters on calculating statistics from parent/offspring data and on calculating genetic and environmental correlations between characters. Finally there are chapters on developing selection indices and calculating breeding values from information on relatives.

The book covers most of the types of analysis that are likely to be encountered. One thing it does not do much of, and, I suspect, this is by design rather than chance, is to interpret the statistics obtained to any great

extent. Thus reference to a text book will be necessary to discover the relevance of the values obtained.

Inevitably when reading a book of this kind one can make suggestions about what other analyses should be included. My prejudices suggest that it could contain more on analyses between homozygous inbred lines using single crosses and multiple cross designs. In this respect it is also disappointing to find that there is no attempt to link the different terminologies used in quantitative genetics, namely the Mather and Jinks notation, and the rest! The different notations, although they can very simply be translated, invariably cause confusion to students moving from one reference to the next. A book of this type should be the vehicle for clearing up such confusion.

The manual contains few typographical errors although there seems to have been a lapse in concentration in changing the third edition into the fourth. For example, I counted eight references missing from the bibliography and the index of Tables is wrong. Overall however, the book is very useful for learning the mechanics of estimating genetical components of quantitative variation.

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Induced mutations in plant breeding. W. Gottschalk, G. Wolff. Springer-Verlag Monographs on Theoretical and Applied Genetics 7. 1983. Pp. x + 238. Price DM98.00.

Methods for inducing new genetic variability in crop plants by the application of mutagens have been used by plant breeders for at least 40 years. Yet, according to Professor Werner Gottschalk and Dr Gisela Wolff of the University of Bonn, many geneticists and plant breeders remain sceptical as to its effectiveness. Certainly there has been no lack of research interest, as the 50-page bibliography of this book testifies. Surveys by the International Atomic Energy Agency have indicated increasing numbers of officially released cultivars derived from experimentally induced mutants, whilst their use by researchers for fundamental studies on gene action and regulation has been extensive. The use of induced mutants in plant breeding has been particularly successful in the barley crop. In Sweden seven barley varieties, originating from three X-ray-induced mutants, have been released since 1960. In Czechoslovakia the cultivar Diamant was derived from an X-ray-induced mutant in 1965 and was used in the German Democratic Republic as a parent of the variety Trumpf which has been widely grown in Europe and which, under the name Triumph,

occupied about 40 per cent of the UK spring barley acreage—more than any other variety—in 1983. The spring barley variety Golden Promise was selected directly as a gamma-ray-induced mutant and has dominated the barley acreage in Scotland for many years.

Why then are many breeders still sceptical about the value to plant breeding of induced mutants? First, desirable mutants are usually rare, so that effective screening methods for their isolation from large populations must be developed. Second, by far the commonest mutants are recessive and their recognition limited effectively to crops which are diploid, inbreeding and seed-propagated. If desired mutants are identified they are likely to be associated with undesirable background effects, also induced by the mutagen. Thus hybridisation and selection may be necessary before the new mutant is acceptable agronomically.

These problems are honestly faced and discussed by the authors of this book in their introductory chapter. They concede that time and patience will be needed if geneticists, plant breeders, phytopathologists and biochemists are to be convinced of the usefulness of these methods.

The book provides an extensive review of papers published since 1965 in the field of applied mutagenesis in plant breeding. References are also given to review papers containing older results but these are not discussed. The subject is considered under 22 chapter headings and most of the chapters are further sub-divided. They vary considerably in length—presumably reflecting the attention given by research workers to the respective topics, but also perhaps, the partialities of the reviewers. Chapter 9 on mutations affecting the root system is but one page long whereas Chapter 20 on the alteration of seed storage substances extends to 42 pages. Surprisingly perhaps, Chapter 13 on disease resistance accounts for only 12 pages.

The chimerical nature of induced mutations is discussed in Chapter 2 following the Introduction. The higher the number of initial embryonic cells surviving mutagenic treatment of the seed the smaller the mutant sector of the M1 plant and the lower the proportion of mutant plants in the respective M2 family. Thus even in large M2 populations a recessive mutant gene may not be discernible. The frequency of mutant segregants may additionally be reduced in each generation by differential fertilisation favouring normal pollen with faster pollen tube growth.

The book is commendable for its detailed treatment of, for example, protein mutants in cereals but, as already observed, the overall coverage is uneven. There are a great many summary tables which provide an excellent entry to the bibliography and the book is illustrated by figures and occasional plates concerned almost exclusively with *Pisum sativum*, the crop on which the authors have conducted most of their own researches.

Typographical errors are few but occasionally confusing and the English style is rather obviously laboured in places but these are minor criticisms of a book which performs a useful function in drawing together the results of an enormous body of literature on a subject

which should be of interest not only to plant breeders but to many other researchers in plant science.

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Genetic engineering, principles and methods, Vol. 7.
J. K. Setlow and A. Hollaender (eds). Plenum
Publishing Corporation, New York and London.
1985. Pp. x + 359. Price \$52.50.

The advent of molecular biology has revolutionised our understanding of gene structure and regulation. It has also resulted in a gulf between classical descriptive genetics and molecular genetics. This is due at least partially to the development of a massive range of specialised procedures which seem to be increasing exponentially, and to the accompanying vocabulary of jargon. To cross the gulf is a daunting prospect for the classical geneticist who is aware of the power of molecular biology, but uncertain how to harness it. It is therefore a pleasure to be able to recommend the present volume to the newcomer, as well as to the hardened molecular biologist. The latter has almost certainly benefited from previous volumes in this impressive and "long running" (since 1979!) series. It shares the same strengths as previous volumes: a wide range of subjects, up-to-the-minute coverage and a mixture of detailed protocols and discussions of subjects of wider interest. The articles are not only instructive but also very readable, to the extent that I found it a pleasure to browse through the volume.

Although it is not possible to describe the contents of all 15 chapters in detail, an indication of the scope is given by the following range of topics: immunoscreening of expression libraries, *in situ* hybridisation to cellular RNAs, synthesis of RNA probes with SP6 RNA polymerase, the molecular genetics of bacterial pathogenicity in plants and gene transfer with retrovirus vectors. I particularly enjoyed three chapters. The first is a lengthy and authoritative description of computer methods to locate genes and signals in nucleic acid sequences by Staden. This is unusually comprehensible for the non-computer scientist. The second is a fascinating mixture of odds and ends about maize biochemistry and molecular biology by Fedoroff. The author clearly states her intention to "include as many as possible of those small details that don't get published, in the main, but often matter most". Here my appreciation stems from the fact that many of the same problems have been tackled by my colleagues, and largely surmounted with the same mixture of misery, inspiration and luck. Finally I enjoyed the last chapter by Gusella on DNA markers in Huntingtons disease. This not only demonstrated the amazing power of molecular techniques to map and possibly even isolate genes with defined phenotypes but no known products, but is also an intriguing detective