passant, most of the evolution of structure and function by natural selection. Each of these narrow strategies, when vigorously pursued, can appeal to a particular audience. There is no doubt, for example, that a student already well prepared in the natural sciences can, upon arrival at a university, understand and benefit from Watson's *Molecular Biology of the Gene* or Lehninger's *Biochemistry*, two texts normally used by upperclassmen. But there are few such students. Most of us need, and some even want, a broad and responsible introduction to biology taught in a serious way at a high level. Fortunately for us, Keeton's third edition is now available.

There are many features of the new edition that set it apart from its competitors and represent improvements over the second edition. Keeton's approach has always been to begin with the rudiments of chemistry, proceed to the structure and function of macromolecules, cell structure and function, and thence on through behaviour, genetics and evolution, community ecology, the origins of life and the description of the phyla. He covers each topic thoroughly, judging the depth and breadth with care, and adding the proper notes of scholarly caution and scepticism. The book has an air of authority; too many introductory texts (and lecturers) substitute glib metaphor for real explanation (see our earlier reviews in *Nature* **284**, 106; 1980). The text consequently does not always make for a good read, but since it is aimed mainly at students in the natural sciences, and at those graduate students (and their teachers) reviewing areas outside their special competence, this cannot be faulted. No one could be expected to remember everything in this book; indeed, Keeton says in the introduction that he obviously could not remember it all himself.

The broad theme running through Keeton is that evolutionary theory accounts for adaptive strategies. It is the thread that ties together the material on the cell, energy transformation, the biology of whole organisms and, of course, genetics, evolution, behaviour and population biology. This not only gives students some feeling for the deep structure of the discipline but, as important for a beginner, supplies the outline of an image whose shape is finally supplied by what at first sight is an incoherent body of detail, often alarming in its variety.

The prose is enhanced enormously by first-rate illustrations and photographs, full colour as well as black-and-white. Many examples could be given. Two that stick in our minds are the drawings combined with electron micrographs to illustrate typical plant and animal cells with pleasing clarity, and the beautiful colour photographs of the world's major biomes and of plant pollinators in the act.

Inserts on special topics are also used; this is now a fairly standard pedagogical ploy, but it is nonetheless effective, for it allows small essays on advanced or special topics that would otherwise interrupt the text.

A list of test questions and a teacher's manual accompany the text. The former, in our view, is useful but not exceptional. The latter we can recommend, especially to lecturers who have not previously taken on an introductory course. It has several strengths, not the least being excellent advice on how to pose examination problems and on which of the areas covered in the lectures most often confuse the students.

Keeton's untimely death last year was a sad loss. This excellent text is likely to stand as a memorial for some time. □

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Maths applied

P. T. Saunders

Statistics and Experimental Design. 2nd Edn. By G. M. Clarke. Pp.188. (Edward Arnold/University Park Press: 1980.) Flexi £6.50, $24.50. *Mathematics and Statistics for the Bio-Sciences.* By G. Easen, C. W. Coles, and G. Gettinby. Pp.578. (Ellis Horwood: 1980.) Hbk £25, $90; pbk £8.50. *Statistics for Biologists.* By D. J. Finney. Pp.165. (Chapman and Hall/Methuen: 1980.) £3.75, $9.95.

WHEN the first edition of *Statistics and Experimental Design* appeared, *Nature's* reviewer wrote that it was "clear and well written and may be strongly recommended to non-mathematical students requiring a common-sense grounding in statistical methods". I entirely agree with this judgement. The explanations are lucid, and well illustrated with examples. There are many exercises, for which model solutions are provided. The author has also added a liberal sprinkling of comments which contribute towards an understanding of the methods he is describing and which should help the reader to avoid some of the pitfalls that await the unwary user of statistics.

The contents are not much changed from the first edition. They include an introduction to probability theory, tests of significance (both parametric and non-parametric), correlation and regression, the principles of experimental design, and an account of factorial experiments including corrections for missing observations and non-normality. Students and research workers who can master the material in this not-too-large book should be well equipped to begin using statistics; those who cannot might be better advised to leave statistics alone.

Statistics for Biologists covers a similar range of material, but deals with fewer topics. This is partly because it is shorter, and partly because the author is more concerned with introducing the principles of statistics than with providing instruction in how it is used.

To some extent he succeeds, but I feel he often devotes to comment and discussion space which could more profitably have been used for techniques, even with his stated aim in mind. For example, regression occupies over four pages, yet the author neither explains the principle of least squares nor gives the formula for fitting even a straight line. Surely this must reduce the chance that the student will understand regression, if only because he cannot be given numerical examples to work out.

As an indication of the level to which students are taken, the author writes that the distinction between one- and two-tail tests is "logically rather subtle" and suggests that the reader should ask a statistician to explain it to him later on. I would have thought that this was one of the basic principles that students ought to learn; it is even hard to read many statistical tables if you don't understand this point. The problem does not arise within the book, as no full tables are provided. Students who find the author's style to their taste will profit from reading this book, but it will leave them with a lot more to learn.

If *Mathematics and Statistics for the Bio-Sciences* had been better written, it could have helped to satisfy a real need. But there are too many things wrong with it. The authors have chosen to write in a rather formal style, which they do not always handle well. I was not impressed with their explanations of such important ideas as limits and derivatives; these are difficult concepts for beginners to grasp, and require a better and more carefully worded treatment than they receive here.

The presentation is often slipshod. For example, while it is certainly true that "Two matrices **A**, **B** can only be equal to each other if they are the same size, say $m \times n$, and all their corresponding elements are equal", the authors should have made it clear that this is the *definition* of equality, and that there is not, as their statement implies, some further condition to be satisfied. It also seems odd to introduce the Poisson distribution and even calculate its mean and variance without mentioning the assumptions on which it is based and (therefore) its main application.

The one really good feature of the book is the large number of realistic biological examples and exercises. Anyone teaching mathematics to biologists will find these very useful. But I cannot recommend the book to students, either for classroom work or for individual study. □

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