Stellar evolution

Stars and Clusters. By Cecilia Payne-Gaposchkin. Pp. 261. (Harvard University Press: Cambridge, Massachusetts, and London, 1979.) £13.50; $22.50.

PAYNE-GAPOSCHKIN was in no small way responsible for my deviation from the straight and narrow path of pure physics to the ethereal delights of astronomy. I devoured her book *Introduction to Astronomy* (Eyre and Spottiswoode, 1956) during my second year at university and never looked back. That book, like *Stars and Clusters*, is intended for the student and the general reader who may have little background in mathematics or physics. To this end *Stars and Clusters* is written without recourse to any mathematical formula; not a single equation graces its pages. Our inumerate unphysical friend can therefore romp through the text with ease.

But what about the figures? I was immediately struck by the fact that the figures must be considerably more difficult to understand than the text if you didn't "have the mathematics". The intricacies of the Hertzprung-Russell diagram especially when it contains multiple stellar evolutionary tracks are difficult enough to grasp at the best of times. Our non — mathematical student has probably never drawn a graph in his life, has no idea what a logarithm is and must be confused by the unexplained leap from (B—V) to log surface temperature for the abscissa without the added complication that the later scale is inverted. It is highly laudable to write a book with the non — mathematical student in mind, but if this student is to gain most from the book I think he must be taught some maths on the way; he must, to quote Martin Johnson, "discover for himself how little armoury he needs for appreciating the beauty and convincement of tracing an argument in symbols and actual quantities".

Stars and Clusters falls between two stools. The inumerate student would appreciate help with the graphical concepts and the numerate student would benefit greatly from a mathematical treatment. This of course isn't to say that I did not enjoy reading the book. I did. But I was constantly reminded that one small equation must be replaced by many and complex words if the same message is to be conveyed.

The main theme of the book is the effect of evolution on stellar characteristics, the physical processes underlying stellar evolution and the light thrown on to this problem by the observation of open clusters, globular clusters and variable stars. The book is impressively illustrated and it is obvious that enormous care has been taken in the choice of the figures. An indepth study of the Hyades cluster in Taurus is used to introduce the early stages of stellar evolution, and one of the figures is a plot of apparent visual magnitude as a function of (B—V) colour for all the stars in the Hyades field of view. The interpretation of this figure would be a fascinating problem for a first-year astronomy student at university. The same can be said of a figure in the next chapter, the path of a metal rich star of five solar masses on the Hertzprung-Russell diagram. I have the sneaking suspicion that both these would leave the amateur astronomer way behind. The book contains about thirty figures showing photographs of clusters and absolute magnitude against colour plots of their stars; again a fascinating study for the university student. A careful distinction is made between the evolution of single stars and the peculiar mutual influence that double stars exert on each other and on their evolution. The book contains a superb collection of light curves for variable stars; one indication of its thoroughness is that there are 48 for R.R. Lyrae stars alone! The AAVSO star atlas is included at the end of the book so if you want to find, for example, X Geminorum you are shown where to look.

I am going to recommend this book very strongly to my first-year university students. They will be able to understand the figures, and will not need all the footnotes that rather verbosely explain the simple physical concepts. It may seem strange but the fact that it contains no mathematics makes me reluctant to recommend it to an inumerate student. Many of the concepts introduced and most of the concepts illustrated need a more detailed and also a more numerate explanation to make then understandable.

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Conidium ontogeny

Patterns of Development in Conidial Fungi. By G.T. Cole and R.A. Samson. Pp. 190. (Pitman: London, San Francisco and Melbourne, 1979.) £29.75.

SINCE S.J. Hughes in 1953 firmly placed developmental characteristics of conidial fungi amongst the prime ones for classifying Fungi Imperfecti, studies of conidium and conidiophore ontogeny have galloped apace. There is no doubt that these researches have generated abundant new taxonomic criteria or have illumined established ones. The difficulty has largely been in judging the significance of these characteristics. The fact that a number of attempts have been made to erect more or less formal classifications based primarily on features of conidiophore and conidium development shows that conidial fungi undoubtedly *can* be classified by means of these criteria, but what is less clear is whether such classifications reflect the phylogeny of the organisms concerned.

It is because the taxonomic significance of ontogenetic data is still an area of lively controversy that this new book is such a timely and valuable contribution. The authors have brought together an enormous amount of information, chiefly in pictorial form and much of it original (mainly as new scanning electron micrographs), so that the theorising mycologist who wishes to reclassify the fungi and the morphogeneticist who wants to find how fungi come to look the way they do have very little need to look at real live fungi — at least, while they are planning how best to go about their studies. The quantity of factual information is so large and the authors' presentation so good that virtually all that is needed for armchair speculation is available here in a single convenient volume. The authors themselves are reticent about the formal taxonomic implications of the book's contents. They are explicitly and unambiguously concerned with patterns of conidial development, and it is these which they classify, not the fungi themselves.

Two-thirds of the book deals with various modes of conidium ontogeny in Fungi Imperfecti, chiefly hyphomycetes. The remainder includes an account of techniques for studying the development and ultrastructure of conidial fungi. Because so many of the electron micrographs presented are original it was wise of the authors to have included this chapter which effectively amounts to a 'materials and methods' section. There is also a major section on patterns of sporangiospore development in Zygomycetes which serves to illustrate how another group of mycelial organisms has solved problems similar to those facing higher fungi. A glossary eases the way for those not familiar with the subject's specialised terminology.

The text is copiously and beautifully illustrated and astonishingly free from printing errors. The authors write well (that is, they say precisely what they mean), and though they use specialised terms where appropriate, they eschew jargon. The high quality of the book's format is reflected in its price, but despite this it is likely to appear in most mycology teaching libraries, as it furnishes in convenient form so many data and concepts. Researchers in the field of fungal taxonomy and developmental biology will use it for these reasons and as a source of esoteric pleasure.

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