neurophysiology has been led astray by too much emphasis being laid upon equivalent circuits and too little consideration of the underlying physical chemistry. This may be a valid criticism of the work of some biophysicists, but not of the field in general where in laboratories throughout the world the analysis of single-channel conductances by the patch clamp technique is being vigorously pursued alongside the search for the molecules underlying these unitary events.

Dr Tasaki's insistence on chemistry is undoubtedly correct, and the growing understanding of the biochemistry and pharmacology of these putative channel proteins and the realization that their properties depend amongst other things on their ionic environment should be music to his ears. Had he attempted to integrate this new wave of channel chemistry with his own experimental results on the electrical and optical properties of perfused axons, something very special might have emerged. As it is, the book is likely to find only a very limited audience. □

P.F. Baker is Halliburton Professor of Physiology at King's College, University of London.

Biological rhythms out of harmony

J.T. Enright

Biological Timekeeping. Edited by John Brady. Pp.197. Hbk ISBN 0-521-23307-0; pbk ISBN 0-521-29899-7. (Cambridge University Press: 1982.) Hbk £22.50, $39.50; pbk £9.95, $17.95.

THIS is the fourteenth volume in a "Seminar Series" sponsored by the Society for Experimental Biology, and is the outgrowth of a one-day symposium on biological clocks held in London in early 1981. It is not, however, a typical "proceedings" volume; instead, the participants were invited after the meeting to prepare essays which could, under Brady's editorial guidance, constitute chapters in "a student text ranging widely over the whole subject".

The coverage is indeed as broad as promised. With the exception of mathematical modelling, there is at least passing mention of essentially every aspect of research on endogenous timekeeping. Four of the eleven chapters are devoted to zoological aspects of the subject; two deal only with botanical issues; one is on circadian rhythms in man; and the others cover research which knows no photosynthetic boundary. There are three essays on adaptation to season (photoperiodism); one on temporal components of animal orientation; and another which emphasizes ecological–adaptive aspects of circadian rhythms. The final chapter is an all-too-brief attempt to summarize the many recent and exciting studies, in both vertebrates and invertebrates, which have been undertaken to localize the circadian clock and to characterize the physiological mechanisms which produce the whole-animal rhythm.

The quality of the individual contributions ranges from passable to outstanding, the level of treatment from elementary to rather technical. The research interests of the contributors tend to be strongly emphasized, and although this is to some extent unavoidable, the chapter on tidal and lunar rhythms seems to me to be a particularly extreme case. In it, for example, Naylor describes research from his own laboratory, dating from 1969 onward, on entrainment of tidal rhythms by cycles of various stimuli, and then says, "The first evidence for mechanical disturbance as an entraining agent" was published in 1975. The appropriate but uncited reference here is in fact from 1965 (*Science* **147**, 864), a citation which would put Naylor's own research in a somewhat different perspective. Naylor also provides an enthusiastic discussion, with a schematic diagram, of the 1959 claim by Chapin and Wing that the Moon probably influences the breeding cycle of the wide-awake tern on Ascension Island. In fact, the relationship between Moon phase and the breeding data could scarcely be more random, but Ashmole's 1963 critique (*Ibis* **130b**, 297) is unmentioned.

Author biases show in other ways as well. For example, I was surprised to read, in Saunders's chapter on photoperiodism, "It is thus possible that all photoperiodic clocks are oscillatory in nature" — all the more disconcerting since it is immediately preceded by a description of Lee's compelling and unrefuted evidence for hour-glass (non-oscillatory) timing in aphids.

But weaknesses of this sort in some of the individual chapters are a secondary issue; the more important question is whether this volume would be — as intended — a satisfactory textbook for advanced undergraduates. I think not. Overall, *Biological Timekeeping* is too disjointed and author-biased for such readers and Brady's editorial attempts to stitch together a patchwork quilt from these contributions just do not manage to give the whole an adequate sense of coherence; it remains a collection of essays. As a more coherent and definitive alternative, I would instead recommend *Biological Rhythms*, Vol.4 of the *Handbook of Behavioral Neurobiology* (edited by J. Aschoff; Plenum, 1982): it is more expensive than a paperback copy of this book, but there is much more for your money. □

J.T. Enright is Professor of Behavioral Physiology at the Scripps Institution of Oceanography, La Jolla, California.

Darwin and Dohrn

J.Z. Young

Charles Darwin, Anton Dohrn: Correspondence. Edited by Christiane Groeben. Pp.118. (Gaetano Macchiaroli Editore, via Carducci 59, 80121 Naples: 1982.) L7,000.

ANTON Dohrn and Charles Darwin were very different characters and it may come as a surprise to learn that they exchanged many letters in the latter years of Darwin's life. The correspondence began in 1867, when Dohrn sent to Darwin a copy of his paper comparing limbs of crustaceans and insects. Darwin answered kindly, although the views expressed must have seemed rather strange. Dohrn was overjoyed and wrote back a typically enthusiastic letter full of "Compliments and deep Veneration which flows out of the heart of a young ardent champion for truth and Liberty".

Then, in 1869, Dohrn explained his "idea of founding not only Aquariums, but Zoological Stations or Laboratories at different points of our European coast". Darwin replied with typical modesty that "your scheme has my good wishes, but I am sure that you estimated my opinion and judgement much too highly". He also suggested "one caution, as Demosthenes said 'action, action, action' was the soul of eloquence, so is caution almost the soul of science".

And so the correspondence went on, even until the last year of Darwin's life. The letters are most revealing of the character and activities of both men. Dohrn writes with great zest though (excusably) often imperfect English grammar. His topics were partly scientific in the early letters but later mainly concerned with the worries of the Zoological Station. From the start until today it has had financial difficulties and battles with both central and local government. Those who have had letters from Anton Dohrn's son Reinhardt and grandson Peter will recognize that they inherited not only Anton's problems but also the character that overcame them as well as Anton's flair for writing with verve and enthusiasm.

The family and the Station they directed have always had strong international connections. Darwin obviously approved of this and was pleased to give practical support. In 1874 he sent a "subscription of £100, and one of £10 each from my two sons George and Francis". Then, in 1880, near the end of his life, Darwin was awarded the Bressa Prize of L12,000 (£100) and offered it to the Station. In accepting this gift Dohrn decided to devote it to encourage "English Naturalists to come more frequently to Naples". While agreeing to this, Darwin characteristically warned that the sum was so small "it appears to me that it would be prudent in you not to speak of the use to which you propose to put it until you are assured of receiving considerable additions".