ertheless, many biologists have begun to assert with facility that isolation in Pleistocene forest refuges was a primary cause of lowland tropical species diversity. Such an unquestioned acceptance does not yet seem warranted. It is important to remember that the original studies were at the taxonomic level of superspecies or below. Haffer has been careful to point out that Pleistocene events caused extinctions as well as differentiation. Tropical rain forests were biologically diverse before the Pleistocene. There may have been no net change in the number of species over the last few million years. The major effect of climatic fluctuations may have been to alter distributions of species and to cause intraspecific differentiation rather than speciation.

As a whole, the volume is engrossing and mandatory reading for students of the Neotropics. Many of the studies have heretofore been published only as theses or technical bulletins (for example, Lamas, Toledo) or in journals that are difficult to obtain in the United States (Ab'Sáber). The authors themselves and the data they present point out the strong and weak points of the refuge theory and the need for more geological and biological work bearing on it. Prance is to be commended for his fine editing and for allowing the tropics to be revealed to be as enigmatic as ever.

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Chilopoda

The Biology of Centipedes. J. G. E. LEWIS. Cambridge University Press, New York, 1981. viii, 476 pp., illus. $69.95

Although most animals are basically mobile digestive systems, I can think of no organism whose structural plan is more dominated by the front end than centipedes. The head is often the broadest part of the body, and if the actual mouthparts are of modest size they are overcompensated by a pair of formidable poison fangs modified from the first pair of legs (unique in the animal kingdom), and the entire muscular and flexible creature strikes even the most dispassionate observer as the epitome of frenetic rapacity (an impression abundantly confirmed by its behavior).

Looking beyond this unpromising facade, one finds that centipedes are at once among the most fascinating and least known of all animals. Like many other residents of the soil and litter milieux, they have been neglected by all but a few investigators, and what has been published on them has generally been widely scattered through a polyglot literature. The last general survey of centipede biology appeared nearly six decades ago and has long been obsolete. Unquestionably the lack of a modern authoritative synthesis has been the major deterrent to potential investigators of chilopods, and it is gratifying that this obstacle has now been removed by an internationally respected specialist on these animals.

The Biology of Centipedes follows a traditional organization, treating anatomy, function, behavior, ecology, and systematics in 24 chapters. The author has carefully selected and balanced the subject matter and illustrations. Moreover, his writing style is pleasant. Under each major subject heading the condition is covered in centipedes generally and then for each of the four orders. There is a bibliography of 561 references cited in the text.

One expects centipedes to be somewhat outlandish, but even having some familiarity with the group I found myself repeatedly astonished by Lewis's accounts of their structure, function, and general life-styles. What intriguing animals, and how little is actually known about them! Nearly every page repeats the admission that we are seeing only bits and pieces of a grand pattern. Here is a large group (an arthropod class with over 2500 known species) in which the taxonomy remains chaotic (even the families are not adequately defined), much of the simplest gross anatomy unstudied (let alone its macromolecules), and almost all information about its natural history anecdotal. If ever a group cried out for study on all fronts, it must be the Chilopoda. Whatever the past difficulties with literature may have been, Lewis's book now provides an elegant prelude for a more mature stage of chilopodology.

A critic may be forgiven for wishing to see more of a good thing. If I had jurisdiction over the second edition, I would propose the following changes: adoption of a smaller type size and more compact format, which would yield up to 20 percent more space for text without increasing pagination or decreasing readability; the addition of an introductory chapter on the history of chilopod study and another on biogeographic patterns; and last, but of foremost importance, expansion of the three chapters on systematics. The author states that the inadequate state of the group's taxonomy justifies only superficial treatment, but the same argument could have been used in the case of the other chapters as well. What better place to present a synopsis of the current classification of all supraspecific taxa than in a general reference work? A brief diagnosis for each family or subfamily, with a list of published generic names and pertinent literature, would have given aspiring students access to this difficult subject and placed its coverage on a basis equivalent with the other aspects of the group's biology.

En fin: there can no longer be any justification for any graduate student to pick away at fruit flies, milkweed bugs, and marine invertebrates, splitting molecules and inventing bizarre experiments in an attempt to wring yet another dribble of information from these already exploited creatures. Lewis's book provides a wide-open field for exploration, with a megaproblem per page, and fascinating problems at that, whether one's bent is holistic or molecular, experimental or systematic.

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Circannual Rhythms

Biological Clocks in Seasonal Reproductive Cycles. Proceedings of a symposium, Bristol, England, March 1980. B. K. FOLLETT and D. E. FOLLETT, Eds. Halsted (Wiley), New York, 1981. xii, 292 pp., illus. $49.95. Colston Papers, vol. 32.

Many organisms have seasonal reproductive cycles, presumably to ensure optimal conditions for the survival of offspring and to minimize the costs of maintaining the reproductive system during unfavorable conditions. However, such a strategy entails considerable risk, in that a single mistake in timing could prove extremely costly to entire populations. Thus it is hardly surprising that organisms have adopted a variety of strategies to prevent such mistakes. In many, although not all, cases, however, the seasonal change in daylength (photoperiod) serves as the most reliable and therefore most important signal for the initiation or termination of reproduction.

Most of the contributions in this volume offer reviews of progress since the 1960 Cold Spring Harbor symposium on biological clocks as well as some new empirical findings. The advances are characterized not so much by new ideas as by the elaboration and refinement of