lymph volumes and hemocyte counts for half that number, and yet no significant conclusions can be drawn from these compilations except that the insect circulatory system is diverse in its characteristics. No models or generalities regarding the regulation of pulse rate emerge from the many cited studies on the action of a wide spectrum of salines, drugs, and tissue homogenates. Resolution of the longstanding question of neurogenic versus myogenic origin of the pulse rests almost entirely on Miller's excellent work with one species, the cockroach *Periplaneta americana*. The heart rhythm is myogenic, but the heart is richly innervated for reasons that seem yet to be little understood.

The regulation of hemolymph volume is another topic of fundamental importance to insect physiology on which an array of observations has accumulated. Endocrine effects on diuresis have been widely reported, but a coherent picture of either short-term regulation or the basis for the marked developmental changes in hemolymph volume has yet to emerge. It seems, too, that such basic properties of the circulatory system as hemolymph viscosity and fluid dynamics in relation to pump design are quite unknown. On the other hand, several special features of the insect system are well studied, for example the occurrence of accessory pulsatile organs that insure circulation in elongate appendages, although even here nothing seems to be known of circulation in orthopteroid cerci; are they circulatory dead spaces?

Some other physiological aspects of great intrinsic interest are given brief and rather superficial treatment. Thermoregulation, for example, is a function of the insect circulation that, although long suspected, has been subjected to serious evaluation only in this decade. The air-cooled thoracic flight motor proves also to be cooled or warmed, according to requirement, by blood. Another special function of the insect circulatory system is the provision of localized hydrostatic pressure that inflates and expands body parts at the molt. Many examples of this process are cited, but detailed quantitative studies such as Cottrell's on the passage from pupa to adult of the blowfly are barely noticed.

What is known about blood cells in insects, the subject of the author's own principal research, is presented here in some detail. It is a complicated story with much yet to be told. A comprehensive account of the chemical composition of the hemolymph, in particular its diverse enzymatic components, its rich amino acid content, and its carbohydrates, both those of intermediary metabolism and those of cryoprotection, is unaccountably absent from the book. This is a surprising omission considering the physiological and developmental importance of the fluid that bathes all organs of the insect body.

An account of the origin and function of hemocytes and a brief look at immunity conclude the book.

On the basis of the material assembled in this volume, one is forced to the conclusion that, despite the vast literature, there is much yet to be done before it can be truly claimed that there is more significant information about the insect circulatory system than about that of the vertebrates.

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Amphibian Nervous System

Frog Neurobiology. A Handbook. R. LLINÁS and W. PRECHT, Eds. Springer-Verlag, New York, 1976. xvi, 1048 pp., illus. $184.50.

This book gives due recognition to the contributions the frog has made to our understanding of neurobiology. The editors state that their goal was "to assemble as much as possible of the information available on frog neurobiology," and in this they have largely succeeded. The book ranges from membrane biophysics to neuroendocrinology and includes sections on the skin, autonomic nervous system, sensory systems, and central nervous system of the frog. Each topic is covered in depth, and a comprehensive summary is provided at the end of each chapter. No restriction appears to have been placed on the number of figures in the book (one chapter contains 83), and reproduction of the figures, especially of the electron micrographs, is excellent.

The value of the book is not limited to its usefulness to investigators of amphibian morphology and physiology, for, as the editors point out, "much of the now classical knowledge in neurobiology was originally obtained and elaborated in depth in this vertebrate." The comparative aspects of both morphology and physiology are rightly emphasized, especially in the chapter on muscle spindles (Ottoson). The use of the amphibian in studies of development and regeneration is well described in chapters on the lateral line receptors (Russell) and the development of the prosencephalon (Clairambault). A useful chapter on the frog as an experimental animal (Müller) describes habitat, maintenance techniques, diseases, and experimental techniques.

Each author apparently has been allowed free rein, and little attention has been paid to avoiding overlap. For example, in the section on vision, pathways from the retina to the tectum are covered in three separate chapters. Although the chapter on the cellular and synaptic architecture of the optic tectum (Székely and Lázár) supplements that on the nuclear organization and connections of the optic pathway (Scalia), with reference made in each chapter to the other, it is unclear why the chapters, each excellent in its own right, could not have been condensed and combined. In the section on the spinal cord, the subject of electrical interactions between motoneurons has extensive coverage in two chapters and slightly less coverage in two others. Some overlap is unavoidable, but much of that in this book could have been avoided by the editors, shortening the book and (one hopes) reducing the price, which will severely restrict its availability. As it is, I can only urge medical and scientific libraries to obtain the book so that as many students and investigators as possible can take advantage of it.

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Protein Synthesis

Molecular Mechanisms of Protein Biosynthesis. HERBERT WEISSBACH and SIDNEY PESTKA, Eds. Academic Press, New York, 1977. xiv, 722 pp., illus. $55. Molecular Biology.

In the decade and a half since the genetic code was deciphered, we have been learning a remarkable amount about the way ribosomes synthesize proteins. All the ribosomal components have now been purified and RNA and protein sequence studies are well advanced. The arena has shifted from topics that occupied the field a decade ago, such as ribosomal assembly and protein chemistry, to investigations of ribosomal function, ribosomal genetics and regulation, and, perhaps most important, their relation to ribosomal structure. The cutting edge of ribosome research is currently the integration of functional studies with structural information, combining our detailed knowledge of the locations of individual ribosomal pro-

teins with the results of functional experiments.

By their selection of topics, the editors of this book have covered the field of protein synthesis well. They have chosen to emphasize the *Escherichia coli* ribosome, which is understandable because the *E. coli* ribosome has been more intensively studied at the molecular level than have the ribosomes of eukaryotes or even those of other prokaryotes. Occasional chapters (for example I. Smith's "Genetics of the translational apparatus") emphasize other ribosomal systems. Other chapters describe transfer RNA; initiation, elongation, and termination of protein synthesis; inhibitors of protein synthesis; messenger RNA; and ribosomal genetics. As is to be expected with a collection of papers by many authors, the chapters vary enormously. Many are comprehensive reviews of a subject, whereas others, such as the chapter "Primary structure and three dimensional arrangement of proteins within the *E. coli* ribosome," are dated research reports that make no attempt to review the literature accurately or comprehensively.

One aspect of protein synthesis that is gathering increasing interest is the detailed mechanism by which the correct aminoacyl-tRNA is selected. In his chapter, C. Kurland deals with this question and discusses possible selection mechanisms. He describes the two-step process proposed by Ninio (*J. Mol. Biol.* **84**, 297 [1974]) and kinetic proofreading, also a two-step process, proposed by Hopfield (*Proc. Natl. Acad. Sci. U.S.A.* **71**, 4135 [1974]) and discusses his own proposal (Kurland, Rigler, Ehrenberg, and Blomberg, *Proc. Natl. Acad. Sci. U.S.A.* **72**, 4248 [1975]) that tRNA selection is a multistep process driven perhaps by changes in the conformation of the aminoacyl-tRNA that are produced upon tRNA binding. Stimulated by the kinetic proofreading ideas, Thompson and Stone (*Proc. Natl. Acad. Sci. U.S.A.* **74**, 198 [1977]) have recently published results suggesting that a second tRNA selection occurs following initial guanosine triphosphate hydrolysis but before peptidyl transfer. The kinetic proofreading ideas also complement the newly developed concept (Lake, *Proc. Natl. Acad. Sci. U.S.A.* **74**, 1903 [1977]) of a recognition (R) tRNA binding site that provides for an initial codon selection at the R site and for a second checking before entry into the aminoacyl (A) site. Because the location of the R site was suggested by immune electron microscopy and the two-step tRNA selection schemes were suggested by other data, this recent work demonstrates how approaches discussed in different chapters of the book are being combined into new concepts of protein synthesis.

The book is loaded with ideas that are certain to start connecting with each other in the coming years, and it represents our current, advanced knowledge of protein synthesis. Although the title is ahead of its time, it reveals the spirit and promise of the field.

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North American Prehistory

Amerinds and Their Paleoenvironments in Northeastern North America. Papers from a conference, New York, Feb. 1976. WALTER S. NEWMAN and BERT SALWEN, Eds. New York Academy of Sciences, New York, 1977. vi, 570 pp., illus. Paper, $35. Annals of the New York Academy of Sciences, vol. 288.

The utilization in archeology of techniques and findings from many other fields has resulted in a proliferation of publications aimed at interdisciplinary synthesis. *Amerinds and Their Paleoenvironments in Northeastern North America*, consisting of 43 papers presented at a conference whose purpose was "to synthesize our present knowledge and to point up some of the major problems still awaiting solution," is another such attempt.

A few of the papers consider the natural environment as it may have affected prehistoric people. For example, Edwards and Emery discuss in an interesting way without the use of jargon the archeological potential of the continental shelf. They report new understanding of the dynamic processes acting on the shelf, reconstruct the coastal morphology for two early-Holocene intervals, plot the distribution of mammal and mastodon finds, and discuss possible techniques for underwater archeological surveys, such as the use of dredges with finer mesh than those commonly employed by sea-scallop fishermen, as well as the use of free divers and underwater vessels. In a paper about the Delaware coast, J. C. Kraft also discusses a geomorphological investigation relevant to an archeological problem. He describes the changing coastal zone of Delaware and relates it to the environmental variables for Paleo-Indian, Archaic, and Woodland times. A paper by Foss on the soils of two Pennsylvania and Virginia archeological sites is a further successful effort at interdisciplinary research, as is the discussion of the Hirundo project in central Maine by Sanger, Davis, MacKay, and Borns. Here the archeological sequence of a site 4000 to 5000 years old is placed in the context of vegetational changes revealed by pollen analysis of nearby sites, and river and coastal changes are related to the postglacial rise in sea level.

One of the most important archeological sites recently under investigation in the Northeast is Meadowcroft, a rock shelter soutwest of Pittsburgh with basal radiocarbon dates from 12,000 to 16,000 years ago on charcoal associated with undoubted artifacts. A paper by Adovasio, Gunn, Donahue, and Stuckenrath summarizes the sediment stratigraphy and the cultural sequence. The great antiquity of this site provides the occasion for four additional papers on the ever-lively question of the antiquity of human cultures in North America, including one by Stalker that deals entirely with western Canada and thus has little to do with the Northeast. As is customary with early sites, skeptics require unequivocal stratigraphic proof of great antiquity, and in the case of Meadowcroft Haynes calls attention to the possibility that the radiocarbon samples were contaminated with coal fragments and to the anomalous occurrence of hardwood nuts "less than 100 miles from the late Wisconsin ice border." The coal problem is said to be under further investigation, but the Meadowcroft report would have been enhanced by the inclusion of a companion paper considering the likelihood of hardwood nuts in the boreal forest or even tundra that may have prevailed in western Pennsylvania before 12,000 years ago.

Apart from these and a few other honest efforts at interdisciplinary synthesis, most of the papers in the volume are narrow in scope. Several contributions concern glacial geology or vegetation history of particular parts of the Northeast, but their authors have nothing to say about the contemporaneous cultural scene or about the potential effects of ice-lobe fluctuations or vegetational changes on human cultures. Half the paper by Sirkin on vegetational history deals with the Sangamon and the Wisconsin before 20,000 years ago; certainly no archeological sites can claim this antiquity. Other papers deal with specialized topics like statistical pollen analysis, phytolith identification, and radiocarbon dating or are straightforward descriptions of cultural sequences for particular regions (for