of data. An attempt has been made to achieve a balance between theoretical papers and experimental ones. The authors are deeply interested in the mechanism of evolution and particularly primate and human evolution. Ever since Darwin the issue of human evolution has seemed so important that authors have tried to run before they could walk and have confused philosophical issues that could not yet be approached scientifically with the few issues that might be so approached. As its title indicates, this volume is not immune to the tendency to go too far too soon. "Molecular Primatology" would have been a more descriptive, though less appealing, title.

Grand generalization and controversy continue to be the mark of literature on evolution. Even in the most observationally oriented parts of the book a feeling that the authors are in a hurry is conveyed. This of course makes for lively reading, if not for careful, incontrovertible argument. The issue of the rate of change of protein molecules and its relevance to the rate of morphological evolution pervades the book. Each step is a matter of controversy. Is there a "molecular clock"? Has the rate of protein evolution changed dramatically in later primate evolution? Can we from modern codogenic sequences infer the sequences of species that form ancestral branch points? If so should we use the principle that the smallest possible number of changes have occurred (maximum parsimony), or should we use some more subtle statistical approach? The fact that the past events are not now measurable (and may never be) fuels all the controversies. Fortunately, the "neutralist" versus "selectionist" controversy is present here only as occasional dying embers. Much of what is said in the book about codogenic sequences will have to be rethought now that determinations of hemoglobin messenger RNA and structural gene sequences have shown that very few of the possible synonymous codons are actually used.

The evolution of the DNA sequences is touched on lightly in this volume for the good reason that little is known about it. In a short chapter Jones reviews measurements of certain satellites in human and higher primate chromosomes. There is an interesting chapter (by Hilschmann and 14 coauthors) on the evolution of antibody specificity, with many data on variable-region sequences.

The book ends with a long philosophical chapter by Zuckerkandl, full of henomenology, ideas, and possibilities, that pays little heed to the matter of verification or falsification by measurement. A major idea is that "progressive evolution" is based on the existence of only a limited number of possible variant states of the system of gene regulation. I am not sure "progressive evolution" is a scientific concept, but I am sure we don't know the prime source of variation in evolution and don't know the mechanism or system of gene regulation, nor can we guess whether the system has few or many states that could occur as a result of frequent genomic changes.

On the current state of theoretical evolutionary work as described in this volume I quote higher authority: the Red King acting as judge in *Alice in Wonderland*. The phrase "Red King hypothesis" is used by Moore (chapter 7) to describe maximum parsimony, in full knowledge (I assume) of the Red King's best line: "If there's no meaning in it," said the King, "that saves a world of trouble, you know, as we needn't try to find any."

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Vital Processes

Nutrition and the Brain. RICHARD J. WURTMAN and JUDITH J. WURTMAN, Eds. Raven, New York, 1977. Vol. 1, Determinants of the Availability of Nutrients to the Brain. xii, 324 pp., illus. $25. Vol. 2, Control of Feeding Behavior and Biology of the Brain in Protein-Calorie Malnutrition. x, 314 pp., illus. $25.

The field that properly comes under the heading of "nutrition and the brain" may be divided into one large subsection and two much smaller ones. The large one is concerned with undernutrition and the developing brain. Its subject is of evident importance in a world in which the great majority of children are, to our shame, suboptimally fed, and at a time of life when their brains are passing through periods of demonstrable vulnerability to nutritional deprivation. One of the smaller subsections, both in volume of literature and in numbers of affected individuals, is that part of adult clinical neurology which deals with certain specific syndromes of vitamin deficiency, mostly relating to members of the B group of vitamins. It is perhaps surprising, in view of the wide distribution of serious malnutrition, that these specific vitamin-deficiency neuropathies and encephalopathies are uncommon. It would be necessary to search the more erudite departments of neurology in our larger medical centers to find examples of them, and they are not prevalent in Third World populations. The third subdivision of research on nutrition and the brain is that stemming from recent important discoveries made in part by the editors of the series of books these two volumes inaugurate: that fluctuating concentrations of tryptophan and tyrosine in the bloodstream, due to fluctuating dietary intake, help determine concentrations of important biogenic amines, for which these amino acids are essential precursors, in the brain. The mechanism by which such effects occur and their biological significance remain largely obscure, although they are potentially important because of the supposed neurotransmitter functions of the amines concerned.

These three topics, developmental undernutrition, vitamin-deficiency neuropathies, and biogenic "aminology," might have been expected to occupy the pages of the present volumes in the approximate proportion 90:5:5, but the relationship we actually find is nearer to 25:18:10. Moreover, these subjects occupy only about half the text, the remainder being devoted to subjects having only a tenuous relevance to "nutrition and the brain," notwithstanding the endeavor of the authors and editors to justify their inclusion.

The less relevant chapters in many cases are of better quality than the others. The reviewer's task is therefore unenviable: he must criticize many of the relevant chapters for being poor and the good ones for not being relevant. Of course relevance is a relative matter. Practically all processes in the mammalian organism can be represented as ultimately controlled by the central nervous system, as destined themselves to control it, or, often more reasonably, as components of a system whose parts are so interdependent as to render idle any speculation about which controls which. But the ubiquity of the brain in the natural order of things should not exempt editors from closer adherence to the title of their text.

Always more difficult for editors is the achievement of uniformity in style and in level of presentation. In the present volumes we have explanations of what neurons and vitamins are and of the limitations of light microscopy when applied to the brain. None of the explanations would disgrace an undergraduate text, but these are postgraduate volumes, and there should be none among their intended multidisciplinary readership who need to be spoken to in such elementary terms.

In the first volume there is a fascinating and detailed dissertation by Gaulin and Konner entitled "On the natural diet of primates, including humans." The subject is treated largely from the evolutionary point of view. The chapter is compendious and erudite (there are 342 references) and is much more interesting than it would have been had it in fact been limited by the confines of its title to the primate order. It is required reading for all vegetarians. What it has to do with "nutrition and the brain," except in the general sense already discussed, is obscure. Similarly, the chapter "Cerebral nutrition and energy metabolism" by Sokoloff, Fitzgerald, and Kaufman, though a masterpiece, has very little to do with nutrition except in the general sense that the brain depends on glucose and at times can derive important amounts of energy from ketones. The discussion of the changing energy metabolism of the brain during ontogeny, which has been allotted only one page out of the 50 the chapter occupies, might have been somewhat more rewarding, and the contents of the chapter as a whole were already available in many a more suitable context. The authors are among those who still believe it is the blood-brain barrier that restricts brain metabolism and is responsible for its idiosyncracies. How do they know that the egg came before the hen? Pardridge's chapter on the availability of amino acids to the brain treats us to a repeat account of this elusive and probably mythical structure, with the difference that Pardridge writes about it as if he knew where it is in precise morphological terms. His incursions into the metabolism of almost every other major organ and tissue take us even further from the general title of the work; and he is dogmatic about the manner in which the concentration of tryptophan in plasma determines the concentration in the brain, a subject about which there is still, properly, much controversy.

The chapters by Ordóñez on the availability to the brain of folic acid, vitamin B_{12}, and choline and by Dakshinamurti on B vitamins and nervous system function are generally well written but include yet another essay on the blood-brain barrier and a wealth of biochemistry that will be of interest only to biochemists.

Volume 2 opens with a voluminous chapter (145 pages with 827 references) on the control of eating behavior. Long as it is, this chapter is short for the size of its subject; but some sorts of nutritionists and neurobiologists will find it useful. Shoemaker and Bloom's chapter on the effect of undernutrition on brain morphology is a brave effort. It deals with what is probably one of the most important aspects of the whole subject, and the one genuinely important growing point, but the technical difficulties of quantitative neurohistology have so far prevented any substantial incursions into the pathology of brain growth. This is not the authors' fault. But they have padded out their chapter with much undergraduate stuffing and a lot else about neurotransmitters that is not morphology; and they misunderstand and misrepresent the attitudes of your reviewer to a degree which, painfully aware as even he is of his own obscurities of thought and language, left him pale, trembling, and aghast.

The last two chapters of volume 2, on the effects of protein-calorie malnutrition on biochemical aspects of brain development (Nowak and Munro) and on protein-calorie malnutrition and behavior (Pollitt and Thomson), are both excellent. In spite of some oversimplification of the clinical syndromes of kwashiorkor and marasmus and their respective etiologies (surprising coming from such distinguished undernutritionists) Nowak and Munro's is an informative and authoritative summary of existing knowledge, though it has to do mainly with changes in brain chemical composition rather than with the processes of brain biochemistry. Pollitt and Thomson's chapter convincingly portrays the complexity of the task of evaluating environmental effects on developing human behavior. Nutritionists and biochemists will do well to heed this complexity and pay it more respect, since it infinitely exceeds that of their own already complex subjects. If behavioral scientists quarrel among themselves (and some will certainly quarrel with Pollitt and Thomson) this is understandable and even healthy, for the entanglements and intricacies of their problems are profound. Let no one ever again be so simplistic as to ask "Does early undernutrition cause mental retardation?"

There has been a sizable crop recently of books about nutrition and the brain, your reviewer probably being the only person in the field who has not written one yet. The Wurtmans' two volumes are in some ways a substantial addition, but are often too contrived and cannot justify their important title.

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Books Received

Actinomycetes. The Boundary Microorganisms. Papers from a symposium, Tokyo, 1974. Tadashi Arai, Ed. Toppan, Tokyo, 1976 (U.S. distributor, University Park Press, Baltimore). x, 652 pp., illus. $98.60.

Biological Reactive Intermediates. Formation, Toxicity, and Inactivation. Proceedings of a conference, Turku, Finland, July 1975. David J. Jollow, James J. Kocsis, Robert Snyder, and Harri Vainio, Eds. Plenum, New York, 1977. xii, 514 pp., illus. $49.50.

The Biology of Marsupials. Bernard Stonehouse and Desmond Gilmore, Eds. University Park Press, Baltimore, 1977. viii, 486 pp., illus. $39.50. Biology and Environment.

Biomedical Computing. W. J. Perkins, Ed. University Park Press, Baltimore, 1977. x, 362 pp., illus. $39.50.

Comprehensive Virology. Vol. 8, Regulation and Genetics: Bacterial DNA Viruses. Heinz Fraenkel-Conrat and Robert R. Wagner, Eds. Plenum, New York, 1977. xii, 350 pp., illus. $29.50.

Contemporary Topics in Immunobiology. Vol. 6, Immunobiology of Oncogenic Viruses. Michael G. Hanna, Jr., and Fred Rapp, Eds. Plenum, New York, 1977. xiv, 290 pp., illus. $27.50.

Decoding the Human Message. Henri Laborit. Translated from the French edition (Paris, 1974) by Stephen Bodington and Alison Wilson. St. Martin's, New York, 1977. 240 pp. $15.95.

Extinction Is Forever. Threatened and Endangered Species of Plants in the Americas and Their Significance in Ecosystems Today and in the Future. Proceedings of a symposium, New York, May 1976. Ghillean T. Prance and Thomas S. Elias, Eds. New York Botanical Garden, Bronx, N.Y., 1977. vi, 438 pp., illus. Paper, $20.

Frontiers in Laser Spectroscopy. Papers from a summer school, 1975. Roger Balian, Serge Haroche, and Sylvain Liberman, Eds. North-Holland, Amsterdam, 1977 (U.S. distributor, Elsevier, New York). Two volumes. xxxvi, 908 pp., illus. Each volume, $65.50; the set, $114.50. Les Houches, Session 27.

Genese et Organisation des Formes Verbales chez l'Enfant. De l'Aspect au Temps. J.-P. Bronckart. Dessart et Mardaga, Brussels, 1976. 152 pp. Paper, 660 BF. Dossiers de Psychologie et de Sciences Humaines, 10.

Hospital-Acquired Infections in Surgery. Hiram C. Polk, Jr., and H. Harlan Stone, Eds. University Park Press, Baltimore, 1977. x, 158 pp., illus. $16.50.

Human Hemoglobins. H. Franklin Bunn, Bernard G. Forget, and Helen M. Ranney. Saunders, Philadelphia, 1977. x, 432 pp., illus. $18.

The Insects and Arachnids of Canada. Part 2, The Bark Beetles of Canada and Alaska, Coleoptera: Scolytidae. Donald E. Bright, Jr. Agriculture Canada, Ottawa, 1976 (U.S. distributor, Unipub, New York). 242 pp., illus. Paper, $12.95.

Long-Term Surgical Results in Children. Papers from a meeting, Munich, Sept. 1975. P. P. Rickham, W. Ch. Hecker, and J. Prévot. Urban und Schwarzenberg, Baltimore, 1977. x, 322 pp., illus. $29.50. Progress in Pediatric Surgery, vol. 10.

Masters Theses in the Pure and Applied Sciences Accepted by Colleges and Universities of the United States and Canada. Vol. 20. Wade

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