es, the nature of decomposition processes, and the nutrition and role of detritus feeders. There are many discrepancies in the results of studies of these subjects owing to differences in techniques or to geographical variation among salt marshes. More critical assessment of the discrepancies could have been included in most of the chapters.

Although this could have been a longer book, it is a good summary of progress achieved so far on Sapelo Island with a thorough survey of the literature on research done in other locations. It will be useful to the advanced student intending to do research in coastal environments as a source of information on what has been done.

IVAN VALIELA
Boston University Marine Program, Marine Biological Laboratory, Woods Hole, Massachusetts 02543

Movement of Animals

Vertebrate Locomotion. Proceedings of a symposium, London, March 1980. M. H. DAY, Ed. Published for the Zoological Society of London by Academic Press, New York, 1981. xviii, 472 pp., illus. $89.50. Symposia of the Zoological Society of London, No. 48.

Vertebrate Locomotion is the proceedings of a symposium celebrating the tercentenary of the first edition of Borelli's *De Motu Animalium*. It should not be confused with a 1961 symposium of the Zoological Society with the same title.

The current volume is divided into four sections covering swimming (five papers), flight (three papers), walking and running (five papers), and primate arborealism (four papers). Most of the contributions are comparative summaries, although a few are detailed analyses of locomotion in a single species. In the latter category, Videler examines swimming in cod, Batty uses the new technique of silhouette cinematography to observe locomotion in tiny, transparent plaice larvae, and Blake presents an exceedingly complicated mathematical model for paddling propulsion based on analysis of an individual angelfish.

The 1961 symposium began with a chapter on general principles of locomotion by Sir James Gray. One of the problems of the current effort is that it lacks such a unifying force. Each paper addresses its assigned topic without much reference to the others. The most obvious example of this is in the primate section. Fleagle *et al.* present a functionally based argument that vertical climbing is a biomechanical link between brachiation and human-type bipedality and that so-called brachiators (which often spend much more time in vertical climbing than in brachiating) are thus preadapted for bipedality. Their electromyographic studies show that many of the large shoulder muscles of apes are actually more active during vertical climbing than during brachiation, and kinematic and force-plate analyses indicate that during vertical climbing ape hindlimb movement is more like that of humans than any other primate. Rollinson and Martin examine primate locomotion by means of gait analysis and allometric regressions of limb elements. They conclude that the allometric differences between living apes and humans are so large that "evolution of human bipedalism from any ancestral form with definite brachiating characteristics is highly unlikely" (p. 413). Neither set of authors addresses the arguments of the other.

Several of the papers concern locomotor physiology. Johnston reviews the structure, physiological characterization, innervation, and metabolic biochemistry of fish muscle, a topic that connects nicely with Roberts's summary of motor control by fish nervous systems. Much of Goldspink's paper on energy conservation in locomotion has been published in at least three other symposium volumes. Armstrong, on the other hand, presents an interesting and timely review of fiber-type distribution and recruitment in mammalian muscle.

Perhaps the paper that best combines physiological and morphological concerns is Alexander's study on the economy of tetrapod gaits. Comparing the calculated power requirements of animals using different gaits with actual force-plate records, he is able to show why turtles use a gait that at first would appear to offer low stability and why mammals switch gaits at the speeds they do. Although some of these data have been presented elsewhere, much of the analysis is new. Other integrative papers include those by Rewcastle (evolution of stance and gait in tetrapods), Rayner (flight adaptations), and Lanyon (locomotor loading of limb bones).

The current *Vertebrate Locomotion* attempts to answer many of the same kinds of questions as the earlier symposium in a somewhat more thorough manner. Perhaps not surprisingly, the major difference is in techniques, with the earlier dissections and relatively slow cinematography now supplemented by more powerful mathematical analysis, faster films, including x-ray cinematography, and such new tools as electromyography and microwave Doppler radar. The 1961 symposium presented several papers that have been quite influential; those interested in vertebrate locomotion will find its 1981 descendant equally informative.

JAMES L. EDWARDS
Department of Zoology, Michigan State University, East Lansing 48824

An Excitatory Amino Acid

Glutamate. Transmitter in the Central Nervous System. P. J. ROBERTS, J. STORM-MATHISEN, and G. A. R. JOHNSTON, Eds. Wiley-Interscience, New York, 1981. xii, 226 pp., illus., + plates. $41.50.

Can one have too much information about a neurotransmitter? This question is prompted by the latest of several books published in recent years dealing with glutamate and related amino acids. The book arose from a symposium organized at the September 1979 International Society for Neurochemistry meeting in Jerusalem. In contrast to earlier volumes, it is more than just a summary of papers presented at the symposium, and it includes some thorough and well-written reviews—for example, Cotman and Nadler on biochemical and pharmacological evidence that glutamate and aspartate are transmitters in the hippocampus and Abdul-Ghani, Coutinho-Netto, and Bradford on studies of the release of glutamate in vivo. The latter is an important topic because the release of glutamate is an essential aspect of glutamate-mediated transmission, about which there is a marked dearth of reliable information.

Glutamate uptake is far better understood, for it has been studied since the pioneering work of Krebs and his collaborators more than 30 years ago. But does the presence of even high-affinity uptake provide incontrovertible enough evidence that glutamate is a transmitter to justify devoting two papers to the topic, as is done in the book? According to the paper by G. A. R. Johnston, carriers of high-affinity uptake of excitatory amino acids are only poorly selective and blockers of uptake appear to have no effect on synaptic potentials. Moreover, as was first proposed by Quastel and by van den Berg, glutamate appears to be taken up principally by glia, being there transformed to glutamine, which, having minimal excitatory actions, can be safely released into the extracellular medium

for uptake by nerve endings, where it is the most efficient substrate for the production of releasable glutamate (as is described by Cotman and Nadler).

It was to be expected that studies of glutamate binding would flourish as soon as a sufficiently radioactive marker became available. The studies are reviewed in the book by P. J. Roberts. There is indeed much binding in the cerebral mash, but we are left with the old problem: what is functionally significant binding—and in the context of which function—and how does one explain contradictory observations, such as that *N*-methyl-D-aspartate does not bind? On the other hand, a marked stereospecificity of glutamate binding is not in contradiction with electrophysiological data, though the author surprisingly states that it is. It seems to me that binding studies are illuminating only when junctional receptors have been clearly identified (as at peripheral sites of cholinergic and aminergic transmission) or when a correlation can be made with extensive and reliable pharmacological data (for example, with central receptors for dopamine).

That we are far from this kind of situation with glutamate is made especially clear by a review of the relevant pharmacology by J. C. Watkins. Though late in coming round to the idea that glutamate might be a transmitter, the author has been involved in studies of these amino acids longer than anyone else. He authoritatively reviews studies of the possible amino acid antagonists, the number of which is rapidly increasing. So far, none of the compounds has proved very potent or reliable. Although Watkins makes a brave attempt at a systematic survey, the story is very confusing; it is therefore unfortunate that his is the only paper with neither conclusions nor a summary to help a bemused reader.

A newcomer to the field might well wonder why glutamate was ever proposed (and is now so widely held) to be a major central nervous system transmitter. The reason is that, acting in minimal amounts and in a signally rapid manner, it is a surprisingly effective exciter of nearly all central neurons. After nearly a quarter of a century of central nervous system iontophoresis, no other substance naturally present in the brain in more than trace amount has been discovered consistently to show such "transmitter-like" properties. What is distressing about the present situation—and should be a major point of any survey of glutamate—is that we still know very little about its action and whether it is identical to that of the natural transmitter presumably released at excitatory synapses.

There is only a hint of this in the book, in a very brief survey of glutamate action in the hippocampus, by P. Andersen. Andersen wonders whether glutamate action is quick enough to explain the short latency of excitatory postsynaptic potentials observed in the hippocampus, and he would like to know more about conductance changes and reversal potentials (and so on). These are the kinds of questions that need to be asked, and until they have been systematically looked into and answered we are unlikely to progress much further toward deciding whether glutamate is or is not a major excitatory transmitter.

K. KRNJEVIĆ

Department of Physiology, McGill University, Montreal, Quebec H3Q 1Y6, Canada

Books Received

Adhesion Problems in the Recycling of Concrete. Proceedings of an institute, Saint-Rémy-les-Chevreuse, France, Nov. 1980. Pieter C. Kreijger, Ed. Plenum, New York, 1981. xii, 420 pp., illus. $47.50. NATO Conference Series VI, vol. 4.

Adolescent Marijuana Abusers and Their Families. Herbert Hendin, Ann Pollinger, Richard Ulman, and Arthur C. Carr. National Institute on Drug Abuse, Rockville, Md., 1981 (available from the Superintendent of Documents, Washington, D.C.). viii, 114 pp. Paper, $4.50. NIDA Research Monograph 40.

Building Services Engineering. A Review of Its Development. Neville S. Billington and Brian M. Roberts. Pergamon, New York, 1981. xvi, 538 pp., illus. Cloth, $80; paper, $24. International Series on Building Environmental Engineering, vol. 1.

The Cambridge Encyclopedia of Earth Sciences. David G. Smith, Ed. Crown, New York, and Cambridge University Press, New York, 1982. 496 pp., illus. $35.

Cancer. A Comprehensive Treatise. Vol. 1, Etiology: Chemical and Physical Carcinogenesis. Frederick F. Becker, Ed. Plenum, New York, ed. 2, 1982. xxii, 714 pp., illus. $69.50.

Cytoarchitecture of the Human Brain Stem. Jerzy Olszewski and Donald Baxter. Karger, Basel, ed. 2, 1982. 200 pp., illus. $167.25.

Cytogenetic Assays of Environmental Mutagens. T. C. Hsu, Ed. Allanheld, Osmun, Totowa, N.J., 1982. x, 432 pp., illus. $45.

The Defense Industry. Jacques S. Gansler. MIT Press, Cambridge, Mass., 1982. xiv, 346 pp., illus. Paper, $9.95. Reprint of the 1980 edition.

Development and Function of Reproductive Organs. Proceedings of a workshop, Copenhagen, July 1981. Anne Grete Byskov and Hannah Peters, Eds. Excerpta Medica, Amsterdam, 1981 (U.S. distributor, Elsevier North-Holland, New York). xiv, 366 pp., illus. $74.50.

Explorations in Basic Biology. Stanley E. Gunstream and John S. Babel. Burgess, Minneapolis, ed. 2, 1982. x, 260 pp., illus. Paper, $11.95.

Extragalactic Adventure. Our Strange Universe. Jean Heidmann. Translated from the French edition (Paris, 1979) by Maureen Schaeffer and Ann Boesgaard. Cambridge University Press, New York, 1982. viii, 174 pp., illus. Cloth, $19.95; paper, $7.95.

Family Therapy. Major Contributions. Robert Jay Green and James L. Framo, Eds. International Universities Press, New York, 1982. xxii, 564 pp. $30.

Generalized Concavity in Optimization and Economics. Papers from a NATO Advanced Study Institute, Vancouver, Canada, Aug. 1980. Siegfried Schaible and William T. Ziemba, Eds. Academic Press, New York, 1981. xiv, 768 pp. $45.

Genetic Engineering in the Plant Sciences. Nickolas J. Panopoulos, Ed. Praeger, New York, 1981. xvi, 272 pp., illus. $32.50.

Genetic Engineering of Microorganisms for Chemicals. Proceedings of a symposium, Champaign-Urbana, Ill., May 1981. Alexander Holaender and 5 others, Eds. Plenum, New York, 1982. xiv, 486 pp., illus. $55. Basic Life Sciences, vol. 19.

Introductory Spatial Analysis. David Unwin. Methuen, New York, 1981. xii, 212 pp., illus. Cloth, $22; paper, $10.95.

Isozymes. Current Topics in Biological and Medical Research. Vol. 5. Mario C. Rattazzi, John G. Scandalios, and Gregory S. Whitt, Eds. Liss, New York, 1981. x, 230 pp., illus. $36.

Language Development. Vol. 1, Syntax and Semantics. Stan A. Kuczaj II, Ed. Erlbaum, Hillsdale, N.J., 1982. xvi, 492 pp. $39.95. Child Psychology.

Lymphokines. A Forum for Immunoregulatory Cell Products. Vol. 3, Lymphokines in Macrophage Activation. Edgar Pick, Ed. Academic Press, New York, 1981. xx, 450 pp., illus. $49.50.

Man in Competition with the Spruce Budworm. An Application of Differential Equations. Philip M. Tuchinsky. Birkhäuser, Boston, 1981. viii, 78 pp., illus. Paper, $7.95. The UMAP Expository Monograph Series.

Managing Information Security. A Program for the Electronic Information Age. James A. Schweitzer. Butterworths, Boston, 1982. x, 134 pp. $15.95.

Manifolds and Lie Groups. Papers in Honor of Yozô Matsushima. J. Hano, A. Morimoto, S. Murakami, K. Okamoto, and H. Ozeki, Eds. Birkhäuser, Boston, 1981. xii, 460 pp. $30. Progress in Mathematics, vol. 14.

Mycoplasma Diseases of Trees and Shrubs. Papers from a conference, New Brunswick, N.J., Aug. 1979. Karl Maramorosch and S. P. Raychaudhuri, Eds. Academic Press, New York, 1981. xii, 362 pp., illus. $29.50.

Native Language and Foreign Language Acquisition. Papers from a conference, Jan. 1981. Harris Winitz, Ed. New York Academy of Sciences, New York, 1981. x, 380 pp., illus. Cloth or paper, $75. Annals of the New York Academy of Sciences, vol. 379.

***Nature* Directory of Biologicals 1982.** Macmillan Journals, London, 1982. xxxviii, 196 pp., illus. $45.

Network Systems. Modeling, Analysis and Design. Roshan Lal Sharma, Paulo T. de Sousa, and Ashok D. Inglé. Van Nostrand Reinhold, New York, 1982. xiv, 322 pp., illus. $29.95. Van Nostrand Reinhold Data Processing Series.

Pediatric Nephrology. Proceedings of a symposium, Philadelphia, Oct. 1980. Alan B. Gruskin and Michael E. Norman, Eds. Nijhoff, The Hague, 1981 (U.S. distributor, Kluwer Boston, Hingham, Mass.). xii, 530 pp., illus. $69.50. Developments in Nephrology, vol. 3.

Pediatric Nephrology. Vol. 6, Current Concepts in Diagnosis and Management. Papers from seminars, Miami, Jan. 1979, and Bal Harbour, Fla., Jan. 1980. José Strauss, Ed. Plenum, New York, 1981. xiv, 518 pp., illus. $49.50.

Pellagra. Kenneth J. Carpenter, Ed. Hutchinson Ross, Stroudsburg, Pa., 1981 (distributor, Academic Press, New York). xvi, 394 pp., illus. $48. Benchmark Papers in Biochemistry, vol. 2.

Petrology. Igneous, Sedimentary, and Metamorphic. Ernest G. Ehlers and Harvey Blatt. Freeman, San Francisco, 1982. xviii, 732 pp., illus. $29.95. A Series of Books in Geology.

Pulsed Neutron Scattering. C. G. Windsor. Taylor and Francis, London, and Halsted (Wiley), New York, 1981. xii, 432 pp., illus. $85.

Rational Homotopy Theory and Differential Forms. Phillip A. Griffiths and John W. Morgan. Birkhäuser, Boston, 1981. xii, 242 pp., illus. $14. Progress in Mathematics, vol. 16.

Rattlesnakes. Their Habits, Life Histories, and Influence on Mankind. Laurence M. Klauber. Abridged by Karen Harvey McClung. Published for the Zoological Society of San Diego by University of Chicago Press, Berkeley, 1982. xxii, 350 pp., illus., + plates. $19.95. Abridgement of the 1972 edition.

Recent Advances in Differential Equations. Papers from a conference, Miramare, Trieste, Italy, Aug. 1978. Roberto Conti, Ed. Academic Press, New York, 1981. xiv, 448 pp. $35.

Survey of Contemporary Toxicology. Vol. 2. Anthony T. Tu, Ed. Wiley-Interscience, New York, 1982. xiv, 248 pp., illus. $50.

Synopsis and Classification of Living Organisms. Sybil P. Parker, Ed. McGraw-Hill, New York, 1982. Two volumes. xx, 1166 pp., illus., + plates; and vi, 1232 pp., illus., + plates. $149.50.

Taurine in Nutrition and Neurology. Proceedings of a symposium, Mexico City, Nov. 1980. Ryan J. Huxtable and Herminia Pasantes-Morales, Eds. Plenum, New York, 1982. xiv, 552 pp., illus. $59.50. Advances in Experimental Medicine and Biology, vol. 139.

Water Stress on Plants. G. M. Simpson. Praeger, New York, 1981. xii, 324 pp., illus. $38.50.

Wave Propagation Theory. James R. Wait. Pergamon, New York, 1981. viii, 350 pp., illus. Cloth, $42.50; paper, $22.50.