purpose *can* be exhibited by a physical mechanism. In pursuit of this goal Boden gives detailed and illuminating expositions of McDougall's views on purpose, instinct, sentiments, emotions, temperament, the organization of behavior by the self-image and "master sentiment of self-regard," and various other topics. In the case of each she offers stimulating suggestions for computer simulation. The book is also generously larded with references, by way of parallel and contrast, to the views of many other psychologists and philosophers. The author may not have succeeded in reviving McDougall as a major force in contemporary psychology (nor indeed was it her purpose to do so), but she has succeeded in providing a fresh context, and some fresh perspectives, for the age-old controversy between mechanism and purpose.

WILLIAM P. ALSTON
Douglass College,
Rutgers University,
New Brunswick, New Jersey

Hominids and Their Relatives

The Functional and Evolutionary Biology of Primates. Papers from a symposium, Burg Wartenstein, Austria, July 1970. RUSSELL TUTTLE, Ed. Aldine-Atherton, Chicago, 1972. xii, 488 pp. + plates. $15.

One of the most widely known contributions of the Wenner-Gren Foundation, and often an important one, to the field of anthropology has been the support and stimulus given to a series of conferences on current anthropological topics from which valuable books have been derived. The system works in this way: a conference organizer is invited to attract participants, who submit drafts of their contributions for private circulation which are then debated by the participants and modified, prior to publication, in the light of the discussion. In effect, the academic wash is put through the machine in private, in contrast to the treatment meted out to those who brave the *Current Anthropology* technique. The conference from which the volume under review stems was held at a castle in Austria, according to Tuttle in an "enriched environment," whatever that means in human ecological terms.

The think-tank situation has a lot to offer in interactions among those who participate and in the topics that are under discussion; but inherent in the use of the system are several questions that must be raised. Clearly, whoever acts as convenor, whom he selects to participate and what is to be discussed are crucial to the success of the conference and therefore to the published volume that results. Scientific elitism of this kind can succeed only in the presence of an elite whose areas of expertise are so closely related that in the process of debate the refinement can operate effectively. It is not for a reviewer to comment on the choice of the participants, but it seems open to question that a conference as broadly based as that covered by the title of this book can produce debate of the quality that has been reported in some earlier publications of this series. The decision to exclude the transcript of discussions from publication is disappointing, for the reader is denied the pleasure of following the arguments that led to new conclusions, and more particularly those that led nowhere.

The papers are grouped into five sections, on fossil primates, on skull structure, on brain and endocasts, on limb morphology, and on behavior, any one of which is worthy of a conference on its own account.

In the fossil primate section Szalay gives a useful review of the earliest primates, with a personal flavor, and Simons and Pilbeam review the current state of hominoid paleontology and explore the global prospects for new excavations. In the same section Tobias provides an updated catalog of early man in sub-Saharan Africa and touches on sexual dimorphism, posing again the question of its relevance in australopithecine studies.

The section on skull morphology exemplifies the broad approach in that it contains a most stimulating and provocative essay by Cartmill questioning the arboreal explanation of primate skull features. Much of his evidence is negative, in that it exemplifies other arboreal mammals that are without the primate specializations usually said to be due to tree life, but his case is closely argued and of great interest. Howells's new analysis of modern human cranial dimensions shows that interpopulation differences involve the same morphological pattern as individual variation within populations.

Stephan, Radinsky, and Holloway all wrestle with an intractable field of research. The study of cranial endocasts seems like an assault on Everest, necessary because this material exists to be conquered, even though it appears biologically almost unassailable.

The postcranial morphology section is uneven, the matters included ranging from a simple investigation of the vertebral anatomy of primates to the world of Fourier optics, lasers, stressed plastic cut-outs, and "multivariate morphometric" analyses, all exemplified by the remark, "This is comparative anatomy at the flick of a switch" (Oxnard, p. 345). Perhaps the peak of the distribution is the meticulous work reported by Tuttle on catarrhine hand muscles.

The section on behavior is rounded off by an amusing and informative piece on mathematical modeling by Cohen. His astringent style and realistic approach to research revived your reviewer and restored his faith in behaviorists.

This is a book for specialists, each of whom will find something of importance. It is a volume of loosely grouped papers and not the outcome of a concerted scientific attack on a specific problem with the big guns deployed. If the emphasis was intended to be on "research strategies," the outcome was results; but then results are far more interesting anyway.

M. H. DAY
Department of Anatomy,
St. Thomas's Hospital Medical School,
London, England

Problems in vitro

Invertebrate Tissue Culture. Vol. 1. C. VAGO, Ed. Academic Press, New York, 1971. xiv, 442 pp., illus. $25.

Choose almost any review on invertebrate (or insect) tissue culture written during the past 15 years and the first paragraph will contain a sentence stating how unexpectedly difficult it has been to obtain actively proliferating cells in vitro. After reading J. L. Vaughn's introductory chapter on culture media one might justifiably wonder that we have had any success at all.

Optimally, a culture medium should provide the nutritional and physical factors to insure that the metabolism of the cells in vitro closely approaches that of their counterparts in vivo. One means of determining such factors is simple empirical testing; another is quantitative analyses. That the latter means has been woefully neglected is made apparent in Vaughn's review: ". . . very little investigation of the anion requirements of invertebrate cells *in vitro*"; ". . . few studies . . . on the amino acids requirements"; ". . . use of carbohydrates . . . has been investigated only

on a limited basis"; ". . . few studies on the effect of *p*H. . ."; "Little attention has been paid to the osmotic pressure of the culture media"; and so on. One of the few parameters which have been investigated quite extensively and subsequently incorporated into culture media is the Na/K ratio in the hemolymphs of the intact animals. Possibly to atone for the lack of quantitation noted above, the authors of the various chapters have seized upon this one parameter with fervor, and the hapless reader is subjected to a seemingly endless barrage of Na/K ratios.

Yet despite the inadequacies of the culture media employed, prolonged survival as well as differentiation has often taken place in organ cultures, as has growth for varying lengths of time in cell cultures. N. Le Douarin discusses organ culture methods and media, both liquid and gel, for explants ranging from the eye-antennal disks of *Drosophila* larvae to fragments of gills and intestine from a bivalve, *Barnea candida*. Five chapters are devoted to cell cultures obtained from representatives of the various insect orders and one chapter each to crustaceans, mollusks, and the lower invertebrates (sponges, *Hydra*, and so forth).

The authors of these chapters should be commended on two counts. The references amassed, dating back to the early 1900's, are truly impressive and can well serve as a complete bibliography for the entire field up to the year 1968. Second, technical details for surface sterilization, microsurgery, and the isolation and explantation of cells and organs, given merely a nod in most articles, are quite explicit and readily followed.

On the other hand, most of the authors appear content simply to summarize the results obtained in their particular areas and make little attempt to laud the good and expose the bad. Prior to 1965, there was an unfortunate tendency for investigators to make rather dogmatic statements as well as use considerable imagination in describing their results. Much of this hyperbole has not withstood the test of time, yet the authors voice no word of caution to the unsuspecting reader. Moreover, some rigorous editing could have eliminated much of the redundancy in this book. For instance, almost every chapter has some paragraphs discussing culture media in general before turning to specific media for a particular group of invertebrates.

Three other chapters, devoted to the disparate subjects of aseptic rearing of insects, electron microscopy, and the morphology and physiology of the cultured cells are all quite thorough and merit attentive reading.

Some one hundred tables are included in the book, most of them listing the components of culture media devised throughout the years and used with varying degrees of success. The photographs are numerous and, on the whole, excellent in quality.

The lag between submission of manuscripts and the date of publication seems to have been inordinately long for this volume. The most recent references are two or three years old, with the exception of one footnote which dates to 1970. Hence readers may well obtain an erroneous impression of the extent of progress in the field. This is particularly true with respect to the establishment of bona fide invertebrate cell lines, a feat once considered remarkable but now becoming increasingly common.

To my knowledge, this is the first treatise devoted solely to a review of invertebrate tissue culture, and I suspect both laymen and specialists in the field will be surprised at the sheer volume of studies involved. But it would have been a much better book had more emphasis been placed on critically assessing these studies.

IMOGENE SCHNEIDER
Department of Entomology,
Walter Reed Army Institute of Research,
Washington, D.C.

Productivity

Fertility of the Sea. A symposium, São Paulo, Dec. 1969. JOHN D. COSTLOW, JR., Ed. Gordon and Breach, New York, 1971. In two volumes. Vol. 1, xii pp. + pp. 1–308, illus. $19.50. Vol. 2, xii pp. + pp. 309–622, illus. $14.50.

This collection of symposium papers includes a broad spectrum of topics connected with problems of fertility of the sea: primary plant productivity, food web relations, the inorganic nutrients which in many cases control the level of fertility, and physical oceanographic processes which affect the availability of the nutrient supply. There are also a few papers on pollution, the effects of land drainage on coastal fertility, and possibilities for artificial fertilization.

A large proportion of the symposium consists of reports of original work rather than review articles and is essential information for oceanographers who are working with this kind of problem. Inevitably, however, the papers are quite specific in content and do not cover the whole spectrum of fertility problems as completely as might be desired by the general reader or the beginning student.

Oceanic circulation and processes of vertical mixing and upwelling receive considerable attention. These processes are essential for bringing nutrient-rich deep water up to the surface layer, thus fertilizing plant growth. There are other papers on nutrient-plant relations and primary productivity. Together this group of interrelated topics constitutes about half the book.

The intricate relations of the remainder of the food web receive much less comprehensive attention. There is documentation of cases in which fertile regions, particularly in areas of upwelling, support a large biomass of herbivores and carnivores, including bottom fauna in deep water, but the details of the relationships are not spelled out. There are few papers devoted specifically to fishes or other pelagic carnivores or to bathypelagic food webs. The knotty problem of animal productivity is largely neglected.

This is not intended to be a critical comment, but merely an account of what the reader can expect to find. A volume of original papers is not expected to be a comprehensive treatment of a topic as broad as this one, and the papers that are here will stand as a worthwhile contribution to science. The fact that two years elapsed between the symposium and publication is unfortunate but not as serious a flaw as it would be in a volume of reviews, and in the meantime the collection profited from excellent editorial work.

G. A. RILEY
Institute of Oceanography,
Dalhousie University,
Halifax, Nova Scotia

Books Received

Annual Review of Pharmacology. Vol. 12. Henry W. Elliott, Ronald Okun, and Robert George, Eds. Annual Reviews, Palo Alto, Calif., 1972. xii, 528 pp. $10.

Aphasia, Apraxia and Agnosia. Clinical and Theoretical Aspects. Jason W. Brown. Thomas, Springfield, Ill., 1972. x, 310 pp., illus. $14.50.

Atlas of Protein Spectra in the Ultraviolet and Visible Regions. Donald M. Kirschenbaum, Ed. IFI/Plenum, New York, 1972. xii, 290 pp. $25.