field. This critique will be carefully studied by many readers.

The author describes the procedure by which he has selected the 253 references he cites. Some other citations could aid the balance of contrary theories and hypotheses. Some subjects of widespread interest and importance —such as fluoridation in regard to caries susceptibility—receive very brief treatment, and some subjects of lesser immediate concern are covered in considerable detail.

The book is intended and is suitable for readers at the level of graduate students in the physical and biological sciences. It can be profitably studied by those engaged in apatite research. It will undoubtedly stimulate further development of the field.

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Fragile Ecosystems

Proceedings of the Colloquium on Conservation Problems in Antarctica. Blacksburg, Va., Sept. 1971. BRUCE C. PARKER, Ed. Virginia Polytechnic Institute and State University, Blacksburg, 1972 (available from the editor, Department of Biology, Virginia Polytechnic Institute). vii, 356 pp., illus. $10.

Described as "a continent for science," Antarctica has truly become so through researches and an international treaty now 14 years old. Recently some of the scientists, particularly those who study the unique biology of that austere land and its frigid seas, have become aware that man, a recent invader, can, and already has, set in motion the seeds of possible destruction of Antarctica's fragile ecosystems.

In 1971, a conference was called by those scientists to consider human impact and conservation problems in Antarctica, particularly near American bases. The proceedings of that conference provide insight into the problems and their possible solutions. Most of the 19 papers can be categorized into two groups: those that report scientific results indicating the uniqueness and instability of the ecosystems, and those that describe environmental damage and suggest methods of prevention. In the first group are papers about the benthos, the freshwater organisms, including fungi, and their environments; and the terrestrial ecosystems of East Antarctica. In the second are papers that consider trace elements in the atmosphere; contamination of snow by engine exhaust, heavy metals and chlorinated hydrocarbons in marine organisms and marine-feeding birds, radioactive contamination from global fallout and scientific experimentation, destruction of native subantarctic vegetation by man and introduced animals, and problems of human waste, trash disposal, and environmental contamination with exotic microorganisms. There are a few papers that do not easily fit into these categories and would likely be overlooked by those who saw only the title of the volume or its table of contents. For example, I. E. Wallen's paper "Why preserve the Antarctic?" is a general discussion of management in conservation that describes already-tried measures in various parts of the world not Antarctica, and Jay T. Shurley's paper considers psychoecological viewpoints, particularly in isolated human small groups.

The information in this volume will be of most interest to those who have worked, or will be working, on antarctic research. This is especially so because George Llano's paper gives references to relevant conservation recommendations and the appendices contain the texts of the Antarctic Treaty, the "agreed measures" for the conservation of antarctic fauna and flora from the various Antarctic Treaty Consultative Meetings, and recent agreed measures for the conservation of antarctic seals. There are also four work group summaries of recommendations for future conservation measures, both general and specific, including consideration of tourism and scientific projects, and valuable comments in the printed discussions of the papers. I believe that others interested in environmental problems will find this volume of interest because it considers an area of the globe where there has been very little human influence and where unique ecological conditions exist. It could give us some insight into problems of man's impact on space exploration environments, as Roy E. Cameron notes in his paper.

I feel obliged to comment on the editing and printing of this volume. It is unfortunate that there are so many typographical errors and printing mistakes, including a few dropped lines, slanting lines, and imperfect letters. This, together with some poor photographic reproductions, inclusion of many, sometimes interesting, "special figures" which do not relate to the text, and large conspicuous numbers on all figures, detracts from the readability of a volume which has much to tell those interested in the problems of man's ability of sustaining his environment, including the environment which provides material for his own research activities.

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Gamete

The Genetics of the Spermatozoon. Proceedings of a symposium, Edinburgh, Scotland, Aug. 1971. R. A. BEATTY and S. GLUECKSOHN-WAELSCH, Eds. Published by the organizers of the symposium, Edinburgh, 1972. 406 pp., illus. For copies, apply to the Librarian, Department of Genetics, University of Edinburgh.

Spermiogenesis constitutes one of the most sophisticated seriations of differential events to be observed in multicellular organisms; its end result, the mature spermatozoon, is one of the most complex and highly specialized cells known. These facts alone would amply justify extensive and diverse efforts to study this facet of development. The function of the spermatozoon is, *sensu stricto*, the transmission of genetic material from the male parent to the zygote. The realization of this naturally evokes numerous practical aspirations ranging from the identification and selective elimination of genotypically abnormal sperm to the use of specifically appropriate sperm in animal breeding programs.

The first symposium on the genetics of the spermatozoon has brought together electron microscopists, immunologists, and developmental geneticists. The resulting breadth provides an excellent perspective for the primary concern of the symposium, gene expression in the various cells of the male germ line, and renders the proceedings valuable to functional anatomists, reproductive biologists, and developmental geneticists alike.

Although it contains a paper on *Chlamydomonas*, an occasional micrograph of a cat or a chinchilla spermatid, an occasional reference to a freemartin or a hinny, the volume is clearly dominated by studies of fruit flies, mice, and men. This is as it should be. Included are accounts of

selection experiments performed with mice and demonstrating the genetic control of the size and shape of spermatozoan organelles. Additional evidence of gene expression in spermatogonial cells and in primary spermatocytes abounds while the question of haploid genome expression in spermatids pervades the entire proceedings without clear resolution. Immunological studies demonstrate the presence of antigens of the major histocompatibility loci on the surface of murine and human sperm yet provide no evidence for post-segregational gene expression. Furthermore, mouse spermatozoa with unbalanced genomic constitutions participate in fertilization in proportion to the frequency with which they are expected to be produced. In fact, the classic case of non-Mendelian recovery of the T-locus alleles in the mouse appears to be the only well-documented instance of haploid genome expression in mammals.

The level of sophistication which can be achieved with *Drosophila* is illustrated by the observation that sperm devoid of any portion of the entire genome are functional. The symposium proceedings include detailed accounts of the effects of SD (segregation distorter), an autosomal locus which condemns to degeneration spermatids containing the sensitive homologous autosome. RD (recovery disrupter), an X-chromosome locus causing fragmentation of the Y and a concomitant reduction in recovery of Y-bearing sperm, is discussed. The classic case of meiotic drive of the Bar-of-Stone translocation is reexamined. An intriguing hypothesis postulating X-chromosome inactivation during spermatogenesis is developed.

Among the numerous informative references to human material contained in the volume, the most gratifying report is that of the recognition of X- and Y-bearing sperm by the absence or presence of bright fluorescing spots within the head region.

Finally, the time-honored concern with the interaction of genotype and internal environment is evident throughout the proceedings and constitutes the central theme of some of the papers. This should extend the readership of the volume to include endocrinologists and physiologists in general.

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Radiation Biology

The Effects of Irradiation on the Skeleton. JANET M. VAUGHAN. Clarendon (Oxford University Press), New York, 1973. xvi, 298 pp., illus. $29.50.

"Be well informed but always leave room for doubt" is how Vaughan begins her comprehensive review of the human and animal data now available for the determination of safe levels of radiation exposure to the skeleton.

With two-thirds of her references taken from 1962–72, she evaluates the data pertaining to external radiation: natural levels at Edinburgh, Dundee, and Aberdeen, man-made radiation at Hiroshima and Nagasaki, x-radiation exposure of radiologists and fetuses, and so on. It was Court Brown and Doll's data on ankylosing spondylitis that were, "to a large extent, the reason for the decision of the International Commission on Radiological Protection to accept a linear relationship between radiation dose and radiation malignancy as a working hypothesis. . . ." Vaughan carefully describes the pathology of skeletal tumors in relation to what is known of their cell of origin. In evaluating the effects of internal radiation, she focuses upon radium, strontium, and plutonium.

To the discussion of these data Vaughan brings wide experience both in pathology and in animal experiments with bone-seeking radioisotopes. Concerning external radiation to man she says "the large scale surveys of populations . . . have had a relatively short follow-up period so it is possible that only the myeloid leukemias have been fully recognized." She warns against using dose-response data from mice, particularly from CF1 mice "with a known bone dyscrasia and an endemic virus," to establish radiation protection standards. The human radium cases are of "extreme scientific importance." They show an "unusually high incidence of fibrosarcoma." "The data are still reconcilable with the threshold hypothesis," but before accepting such a threshold "it would appear wise to wait until all the patients . . . have lived their full life span."

Degenerative changes or gross skeletal damage has not been seen at the lower doses still capable of inducing cancer. "The most hopeful approach to an experimental determination of low-level risks must lie in attempting to understand the mechanisms by which radiation induces malignant transformation."

Plutonium is "probably the main hazard facing the modern world." "The present maximum permissible body burden of Pu^{239} . . . may well prove too high." Plutonium "gains access to the body of man most commonly from wounds or inhalation but may be absorbed from the gastrointestinal tract particularly in very young animals." A bone-surface seeker, plutonium bombards directly the osteogenic tissue, the bone cells which are at carcinogenic risk because of their proliferative potential. Plutonium may also accumulate in bone marrow so that malignant blood dyscrasia of great importance from the point of view of radiation hazards might be expected.

Vaughan asks, "How far can the relative biological efficiency (RBE) of a radionuclide in a young dog be used to estimate RBE in an adult man when the pattern of trabeculation and rate of bone turnover varies with both species and age?" The last of 11 conclusions in this excellent monograph is that determination of doses to the sensitive tissues in different species and in man should make it possible to extrapolate radiation toxicity in animals to man with more confidence than when average dose to bone is used.

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Books Received

Adolescence and Youth. Psychological Development in a Changing World. John Janeway Conger. Harper and Row, New York, 1973. xviii, 574 pp., illus. $10.95.

Advances in Behavior Therapy. Vol. 4. Proceedings of a conference, Washington, D.C., Sept. 1971. Richard D. Rubin, J. Paul Brady, and John D. Henderson. Academic Press, New York, 1973. xviii, 304 pp., illus. $16.

Advances in Geophysics. Vol. 16. H. E. Landsberg and J. Van Mieghem, Eds. Academic Press, New York, 1973. viii, 438 pp., illus. $32.

Advances in Raman Spectroscopy. Vol. 1. Proceedings of a conference, Reims, France, Sept. 1972. J. P. Mathieu, Ed. Heyden, New York, 1973. xiv, 640 pp., illus. $44.

Agromyzidae (Diptera) of Economic Importance. Kenneth A. Spencer. Junk, The Hague, 1973. xii, 418 pp., illus. 110 Dutch guilders. Series Entomologica, vol. 9.

Aims, Methods and Assessment in Advanced Science Education. D. E. Billing

(Continued on page 852)