still widely known and thus serve to show how far and in what direction the science has moved since his demise. That a textbook in physical anthropology could get by with only about ten pages on anthropometry, one of Hrdlička's specialties, would have appalled him. He would have been almost as appalled by the strong emphasis placed on human genetics: two sections that total 75 pages and many statements elsewhere, but especially in the section in which "racial varieties" are described. What would he have thought, for example, of the following quotation from Hulse's description of Caucasoid populations? "As in India, the inability to taste PTC has a high incidence. The female breast is usually hemispherical and well developed. At the MN locus, the balance between the two alleles is very close in most groups. At the Duffy and Kidd loci, the frequency of the positive allele is between 60 percent and 70 percent in most groups which have been tested." All of this, of course, is in keeping with the current practice of emphasizing the genotype instead of the phenotype. The de-emphasis of anthropometry is a result.

Obviously Hulse's book is needed to keep pace with the present teaching of physical anthropology. I predict that it will be well received and widely used. Hulse's extensive field work on peoples in different parts of the world (recently from the genetic standpoint) and his long teaching experience—at Colgate, the University of Washington, Northwestern, and now the University of Arizona—give him requisite background for authorship. To this he has brought a natural aptitude for clear expression and a good sense of the dramatic. The combination insures an authoritative and engrossing text. Twelve photographs of primates other than man and 45 photographs of human varieties, all different from those usually reproduced, add to the distinctiveness of the book. The numerous line drawings are unusual in their simplicity.

Perhaps because some schools permit students to satisfy the science requirement by taking physical anthropology, more than 150 pages at the beginning are devoted to the broad biological subjects indicated by the following section headings: The Qualities of Life, The Transmission of Life, The Varieties of Life, Ecology and the Evolution of the Vertebrates, The Evolution of the Mammals, and The Primate Pattern.

The sections of the book which deal with the remains of ancient man (about 100 pages) leave me unhappy. So much of our knowledge here comes from the older literature that the limitation on references and the consequent lack of details about the individual finds can only be considered a deprivation to the student. Thus, for example, the drama of the Australopithecine discoveries is omitted and Raymond Dart, one of the discoverers, is mentioned only in connection with his claim for an osteodontokeratic culture (published in 1957). Space limitations undoubtedly are responsible for this situation, but even so it is regrettable that the discoverers of ancient man, along with Hrdlička and other such colorful pioneers, had to be sacrificed in an introduction to physical anthropology.

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Plant Breeding

Recent Plant Breeding Research: Svalöf, 1946–1961. E. Åkerberg and A. Hagberg, Eds. Wiley, New York; Almquist and Wiksell, Stockholm, 1963. 346 pp. Illus. $10.

This book is a sequel to the volume *Svalöf 1886–1946* which was published in 1948. More recently a memorial volume, published in Swedish, was prepared in observance of the completion of 75 years of activity by the Swedish Seed Association. In view of the international interest in the 1948 volume and in response to many requests, the present volume was prepared to provide a report on selected aspects of the scientific investigations conducted at Svalöf since 1946.

One contributor (V. Stoy) comments that during the last few decades plant breeding changed from an area in which mainly applied genetics was utilized to an extensively ramified branch of agricultural science which draws heavily on genetics and cytogenetics, as in the past, but which also makes increasing use of plant pathology, plant physiology, biochemistry, and related fields. This viewpoint is given considerable support by the topics chosen for inclusion in this volume.

The 23 contributions fall readily into seven rather distinct groups. The first group deals with the history and organization of the Swedish Seed Association and with the agricultural regions of Sweden. The next group discusses natural selection in red clover and artificial selection in fodder beets and cruciferous plants. One chapter is devoted to the results obtained by breeding autogamous plants, and stress is placed on the problem of incorporating exotic germplasm into highly adapted indigenous material. The next section is devoted to mutation concepts and the utilization of induced mutations in plant breeding, an area in which Swedish workers have had considerable success. Five articles deal with the results of and the problems that arise from the use of polyploidy in plant breeding. Investigations on insect and disease resistance are covered in three articles. The final section deals with winterhardiness in rape, aspects of plant physiology related to breeding for increased yield, problems of starch and enzyme quality, alpha-amylose in ripening rye, the effects of sulfhydryl and disulfide groups on properties of flour and dough, and quality problems in cruciferous oil crops. A list of 206 publications, which were published in languages other than Swedish but which originated at the Swedish Seed Association during the years 1947 to 1961, completes the presentation.

This volume will be of interest to all plant breeders, providing as it does a record of both operational concepts and recent achievements at Svalöf.

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Ceramic Science

Ceramics: Stone Age to Space Age. Lane Mitchell. National Science Teachers Association, Washington, D.C., 1963. 128 pp. Illus. Paper, 50¢.

Colleges and universities in the United States are training less than half the needed number of graduates with degrees—B.S., M.S., or Ph.D.—in ceramic science or ceramic engineering. Those in the field of ceramics know that the unprecedented demand for men and women trained in the special field of inorganic, nonmetallic ceramic materials and their high temperature reactions and behavior is the result of the needs of the newer technologies (electronics, nuclear, aircraft, and the space-age industries) superimposed upon the continuing require-

ments of the older, more conventional segments of the ceramic industry. The inadequate supply of college graduates can be traced to the fact that the general public, and especially junior and senior high school students and their guidance counselors, are not aware of the meaning of ceramics and its possible impact on their careers or mode of living. *Ceramics: Stone Age to Space Age* will provide the high school student who is interested in science or engineering with a broad concept of the field and a basis for making decisions about a career. Other high school students as well as high school teachers should find it a valuable source of information.

Mitchell has seriously attempted an impossible task: that of covering all aspects of ceramics in ten chapters. The last two chapters, "Carbon ceramics" and "The new ceramics," constitute an excellent introduction to the new requirements made by the electronics, nuclear, and space age industries, but these chapters must be supplemented by other current literature—for example, the article (in two parts) "U.S. in space" published in *Chemical and Engineering News* (23 and 30 September 1963).

The illustrations are excellent, especially those in the last two chapters. The glossary is valuable, because many high school students and teachers are not familiar with the special language of ceramics. The very limited bit of "selected readings" provided at the end of the book should have been greatly expanded for well-qualified students and high school teachers who are eager to learn about "the new ceramics."

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Operations Research

Models for Production and Operations Management. Elwood S. Buffa. Wiley, New York, 1963. xii + 632 pp. Illus. $9.25.

In his preface, Buffa writes that the book "is designed for the individual or for a course where the objective is to develop a comprehension of these new methods so that in operations situations one can make intelligent decisions based on the results of analysis by staff specialists." He hits this target somewhat off center. For nonstaff specialists there is too much "this is what your technical staff should do," and not enough "this is what your technical staff should be trying to accomplish and this is why they should go about it this way." For example, in part 5, "Linear Programming," there is an excellent three-page discussion entitled "Linear programming—distribution methods," but he then devotes 26 pages to calculating techniques, including nine pages on short cuts which are of no interest to managers and of doubtful value to anyone else, since such problems almost inevitably are run on computers. The next chapter, on simplex, does not have initial pages on uses and is wholly devoted to the algorithm.

Perhaps Buffa's selection of material may be described as conventional, since it so nearly agrees with that used by Bowman and Fetter in *Analysis for Production Management*. However, the sequence and grouping are somewhat different, and they are perhaps better. Part 2, "Models of Flow and Man-Machines Systems," contains a load of tabulated data, helpful in indicating what is available: the dimensions of average men and women, comfort ranges for temperature and humidity, and the like, all of which is more suitable for a reference volume than for a textbook. Part 3, "Statistical Methods," seems lopsided—too much on quality control compared with the space devoted to the vastly more important experimental design. Part 4, "Waiting Lines," is rather more adequate than most treatments found in general works. It exhibits a greater variety of applications and is really very well done. I could wish for less focusing on Poisson distributions and first come, first served, queue discipline. Part 6, "Investment Policy," seems somewhat overly concerned with calculating techniques. Part 7, "Inventories Models," seems a first-rate job and so does part 8, "Simulation." Part 9, "Synthesis," is only seven pages long and regrettably slight.

The mathematical level requires about a year of high school algebra. Equations are given, rarely derived, and often no effort is made to obtain intuitive acceptance. Incremental costs are stipulated and occasionally illustrated. Limitations of techniques are sometimes recognized.

The illustrative material is well chosen and adequately presented. The problems are realistic and some of the best I have seen. The references for further reading are excellent. The section entitled "Review questions" seems useful to readers for self-testing and to teachers for use in pushing students into study. I prefer thought-provoking questions that lead to the exploration of managerial purposes and problems and perhaps to social implications and ethics.

Buffa's style is clean, lucid, matter-of-fact—and not very exciting. At times a bit superficial, more often somewhat dogmatic, the book could do more to explain *why* models succeed, *why* they are designed as they are.

On the whole, Buffa's book stands up well in comparison with competing textbooks. I expect it will be widely adopted and generally liked. While much more a textbook than a trade book, managers may well buy it and browse to get some idea as to what the "new management" is all about.

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Geological Society Memoir

Supai Formation (Permian) of Eastern Arizona. Geological Society of America Memoir 89. Stephen S. Winters. Geological Society of America, New York, 1963. viii + 99 pp. Illus.

The Supai Formation of east-central Arizona is strategically situated between well-known and documented Permian sections of West Texas and those of the Grand Canyon region. Winters has made an excellent contribution in providing objective stratigraphic and paleontologic information about this important area and in making a logical synthesis and interpretation of its paleogeography. His purpose in providing lithologic and paleontologic data and thereby contributing to an understanding of the transition between the Colorado Plateau and the New Mexico–Texas Permian sedimentary rocks was realized.

From his 13 detailed surface stratigraphic sections, strategically located in the Fort Apache Indian Reservation, Winters obtained lithic and faunal information that permitted recognition of four members in the Supai Formation: Amos Wash (at the base), Big A Butte, Fort Apache, and Corduroy; with the exception of the Fort Apache Member, all are proposed as new. The author points out that the Supai Formation totals about 1300 feet of reddish-brown