ered to be only indications of how one would start to construct a specific satellite. Until one comes to grips with the actual building of the hardware, the temperature control problem, the vibrations that the satellite will have to stand during the launching, the question of how to separate the satellite itself from the empty last stage, and such problems, treatment of the basic design of a particular experiment is, in a very real sense, incomplete. This is particularly true during this initial period in the development of research satellites, when small size and severely limited weight greatly enhance the various instrumentation and construction problems. Ziegler lists many components that are now available or will soon be available that should be useful in the design of satellite instrumentations. Of particular interest are solar power supplies and transistors. These should make it possible to boil down the required instrumentation weights by a considerable amount.

The typography of *Scientific Uses of Earth Satellites* is very good, and the illustrations are clear. The book should be taken as a compilation of thoughts, in various stages of advancement and completeness, on what research one might do with earth satellite vehicles and how one might go about doing it. Taken thus, it makes worth-while reading and should serve as a valuable source of ideas in the field for some time to come. It stands as a challenge to its various readers to devise other experiments or to improve on those that are described.

HOMER E. NEWELL, JR.
U.S. Naval Research Laboratory

Chromosomes, Sex-Cells and Evolution in a Mammal. Based mainly on studies of the reproductive glands of the gerbil and a new list of chromosome numbers of mammals. Phillip V. Tobias. Lund, Humphries, London, 1956. 420 pp. Illus. 60s.

The author of *Chromosomes, Sex-Cells and Evolution in a Mammal,* who is senior lecturer in anatomy at the University of Witwatersrand in Johannesburg, Union of South Africa, describes and interprets his investigations on the chromosomes in the germ cells of the seminiferous tubules of the gerbil, a desert rat—more specifically, of the subspecies *Tatera brantsii draco*—as a first step toward a comparison of the chromosomal complements of various species of *Tatera*. His presentation of the material is greatly influenced by his acute awareness of "the need to break down the artificial apartheid between chromosomes and their cellular and physiological milieu" (page xvii). Against this background of the new "unitarian biology," the author "treats a restricted set of cytogenetical facts from a morphological and cytochemical, a genetical and evolutionary viewpoint" (page 5). The facts themselves could be more accurately described as strictly cytological, since the gerbil is, genetically speaking, a complete unknown.

Phillip Tobias is fully aware of the limitations of his project. The researches were undertaken between 1946 and 1952, and the literature is covered, in the text of the book, through 1952; the more recent work on mammalian chromosomes, done with improved cytological techniques by Hsu, Makino, and others, could thus not be included. This lack is particularly noticeable in the chapter on the chromosomes of the rat, in which the author introduces the criteria used in characterizing the chromosomes of a mammal and discusses their validity. More recent papers, through 1955, are included in the appendix, which gives the most complete list of mammalian chromosome numbers available at present, covering 264 species and subspecies.

The main body of the book is divided into six parts entitled (i) "Introductory section," (ii) "The chromosomes," (iii) "Descriptive account of spermatogenesis," (iv) "Nuclear behavior during spermatogenesis," (v) "Cytoplasmic behavior during spermatogenesis," and (vi) "The spermatogenetic wave."

The chromosomes of the gerbil offer certain advantages for intensive study. The diploid number is 34 (relatively low for a eutherian mammal) and the average length of the chromosomes is somewhat greater than in the rat (6.0 to 7.9 microns for the largest chromosome as compared with 3.9 to 4.4 microns in the rat). Twenty-two chromosomes have subterminal, and 12 have submedian, constrictions, marking their point of attachment to the spindle fibers. The second part of the book also contains a chapter on chromosomal evolution in rodents and in mammals in general, a highly interesting but speculative subject. For the uninformed reader, the most obvious fact seems to be that morphological evolution of mammals has taken place, together with diversification of chromosome numbers in some groups, without such diversification in others ("multiformity" versus "uniformity"). In "multiform" groups, the mechanisms responsible for the changes in chromosome number are still a matter of debate; however, it seems quite clear that polyploidy has not played an important, if any, role.

In the fourth part, sections of particular interest include (i) a description of the last two premeiotic divisions of the spermatogonia, in which the chromosomes are excessively contracted because of a prolonged prophase, (ii) an account of the behavior of the plasmosomes (nucleoli), and (iii) a detailed description of the behavior of the sex chromosomes, which are the largest pair in the diploid complement, with the Y chromosome slightly shorter than the X; both X and Y possess a submedian centric constriction and two subterminal secondary constrictions that mark off two terminal pairing segments.

If a general criticism of the book can be made, it would be that the treatment of the older literature is too detailed and follows a historical approach more appropriate for a textbook. There are some minor errors and omissions. At the very beginning of the book, and in keeping with the tenets of "unitary biology," the reader would like to have a brief description of the gerbil, which is an unfamiliar animal to most of us, and an account of its natural history. To me it seems illogical to speak of "polysomic loss of chromosomes" and to define polysomy as "the duplication or loss of one or more chromosomes from the complement" (page 79). Any biologist who works with amphibians will object to having this class of vertebrates, following Matthey (1949), referred to as "ancient and almost extinct" (page 88). Under the heading "Experimental induction of polyploidy," a single reference to plants is given, while the work of Beatty and Fischberg on mice, which was first published in 1949, is not mentioned. Labeling of the structural details of the seminiferous tubules in plates ix–xii would be helpful, as would a statement of the magnification. This is omitted from all plates with the exception of one figure.

G. FANKHAUSER
Princeton University

Elements of Engineering Materials. Charles P. Bacha, Joseph L. Schwalje, and Anthony J. Del Mastro. Harper, New York, 1957. 494 pp. Illus. $6.50.

Elements of Engineering Materials is an introduction to the study of engineering materials and is on an elementary level. It is not directed specifically toward any one of the usual engineering curriculums but is intended as a general survey textbook for all engineering students.

The book consists of four sections. Part I, entitled, "Fundamentals of engineering materials," includes a chapter with qualitative descriptions of thermal, mechanical, and electric properties of interest to the engineer. This is followed by a chapter on the principles of strength of materials. There is also a chapter on the structure of metallic materials, with

some brief discussion of crystal structure, behavior of crystalline materials under load, and structure of alloys. Here, also, is considered the interpretation of cooling curves and equilibrium diagrams, and this serves as an introduction to part II.

Part II, "Metallic materials," includes several chapters on the production and properties of iron and steel. In subsequent chapters, other materials considered include copper, aluminum, zinc, lead, tin, magnesium, nickel, and titanium. In each case the author discusses the production of the metal, its properties and uses, the commercial forms available, and alloys of the metal, some of whose properties are indicated in tabular form.

Part III on "The deterioration and protection of metallic materials," contains chapters on corrosion, inorganic and organic protective coatings, and lubricants.

Part IV, consisting of eight chapters on "Nonmetallic materials," deals with wood, cementing materials, concrete, building stone, clay products, glass, refractories, soil, organic plastics, rubber and rubber substitutes, and solid, liquid, and gaseous fuels. For several of these classes of materials there are tables of comparative properties.

The text concludes with an eight-page bibliography.

PAULA FEUER

Purdue University

Demographic Analysis. Selected readings. Joseph J. Spengler and Otis Dudley Duncan, Eds. Free Press, Glencoe, Ill., 1956. 819 pp. Illus. $9.50.

Population Theory and Policy. Selected readings. Joseph J. Spengler and Otis Dudley Duncan, Eds. Free Press, Glencoe, Ill., 1956. 522 pp. Illus. $7.50.

These companion volumes contain 101 papers, three-fourths of which were published in the decade 1946–55. With a few exceptions, these are drawn from periodicals and symposia. American demographers, sociologists, and economists strongly predominate among the 74 different authors, who include a few collective persons, such as the U.N. Population Division.

The items are grouped in 16 chapters, for each of which the editors supply a brief introduction, designed mainly to "provide a framework" but also (in too few instances) to "cover important points which have not received sufficient attention in these readings." For each chapter there is an extended supplementary bibliography, likewise limited largely to "fugitive" post-World War II literature. References to sources of wider scope in time, space, and subject matter are given in footnotes to the individual papers.

The chapter headings and individual titles correctly indicate a rich coverage, although several raise hopes that are disappointed. Almost every topic in the field of population is dealt with, or at least touched on, more than once. Effective use of the materials, however, is regrettably limited by the lack of an index.

Most of the selections should be read with the date of writing or publication borne firmly in mind. Such words as *present, recent,* and *next few years* refer to very different periods of time. For example, "The economic consequences of the present trend of population" was completed in December 1945 and was first published in 1950 and refers only to the United Kingdom; and "Some recent results in population analysis" was presented at the International Population Congress in July 1937. Unfortunately, neither table of contents identifies the individual papers by date of publication—which ranges from 1927 to 1956. In *Population Theory and Policy,* the source and date of each paper are given in a footnote on its title page. In *Demographic Analysis,* most of the papers were apparently reproduced by photo-offset and therefore display a variety of formats, and sources and dates can be ascertained only by a laborious process of working through the "Acknowledgments."

The two volumes were published primarily for use by university instructors and students in this special field, although the bibliographies were planned to be useful, also, "to the reader who wishes to gain an overview of current research in population." Used under the guidance of a keen, critical, well-informed instructor, especially in conjunction with an up-to-date textbook, these materials can be extremely valuable. Anyone who has a good grasp of recent population developments and some knowledge of the earlier literature will welcome the opportunity to browse through, or consult, this large and representative collection.

The more general reader, whatever his specialty and range of knowledge, must be warned to be on his guard in using these volumes. Obsolescence in this field is rapid. A collection of papers on *Population Problems in the United States and Canada* was written in 1924 and published in 1926. Although this was ably planned and well edited, it is now hopelessly out of date, and a new edition today would be startlingly different. Since 1940, long-established trends and relationships have been gravely altered and firm convictions upset. These important facts are not clearly brought out in the volumes under review, although two or three papers discuss some of them, and most of the changes receive incidental mention here or there. A few of the earlier selections are largely obsolete, and several others are obsolete in spots, even though they are less than a decade old. Few of these defects are pointed out or corrected, and the editors even refer in the present tense to "Population policy for the United States," which was published in September 1939, before the unexpected upsurge had radically altered the prospect for future growth.

Time and again the informed reader will be surprised at the wide divergence between current facts and the confident assertions of scholars of high repute in some year before, during, or after World War II and can be sure that the same authors could not now express the same views. But the reader who is unfamiliar with the course of population developments is likely to be misled or confused and to get an unbalanced view of the present state of research and expert thought in this important field. *Caveat lector!*

JOSEPH S. DAVIS

Council of Economic Advisers

The Mechanism of Phase Transformations in Metals. A symposium organized by the Institute of Metals and held at the Royal Institution, London, 9 Nov. 1955. Institute of Metals monograph and report series No. 18. Institute of Metals, London, 1956. 346 pp. Illus. + plates. $7.50.

The Mechanism of Phase Transformations in Metals contains all of the papers that were included in the symposium of the same title which was held in London, 9 Nov. 1955, as well as the discussions which were presented there. The symposium was divided into two parts. The first part was devoted to transformations which involve nucleation-and-growth processes; the second, to martensitic transformations.

The first paper of the first group, "Nucleation-and-growth processes in metals and alloys," by H. K. Hardy and T. J. Heal, provides an excellent review of the subject as a whole; the next seven papers are concerned with special aspects of it. Of particular interest in this group is the paper "A resistometric study of the kinetics of precipitation in lead-tin alloys," by G. Borelius and L. E. Larsson. These authors show that precipitation in alloys that contain approximately 20 percent tin occurs in two stages. They conclude that the first stage consists of a homogeneous clustering of the tin atoms,