by coordinated travel and mutual defense into bands, which meet at sleeping cliffs and there form troops, and the abundant numerical, sociogrammatic, and descriptive data illustrating each statement should be the delight of the system theorist wishing to apply his models to factual material, as well as enlightening material for the serious student of animal behavior. The indications that females within a one-male unit show breeding synchrony whereas females from different units are asynchronous offer a potential rich source of problems for collaborators from the physiological and behavioral sciences.

The study of primate social behavior has been marked in the past by much intuition and little technique. Kummer's book describes a number of ingenious yet simple techniques, such as the nearest-neighbor sample, which could be of great value to other workers on various species. This study could be used as a guidebook on how to study a primate society. In clarity of description and in the precision with which each statement is supported by factual material the book must also stand as a model of scientific reporting.

DONALD STONE SADE
Department of Anthropology, Northwestern University, Evanston, Illinois

Properties of Materials

Ferroelectricity. ENNIO FATUZZO and WALTER J. MERZ. North-Holland, Amsterdam; Interscience (Wiley), New York, 1967. x + 289 pp., illus. $11.25. Selected Topics in Solid State Physics.

So few books or extended review articles have been devoted to the subject of ferroelectricity that any such contribution is welcome in one way or another. The present volume purports to give a picture of ferroelectric phenomena with special emphasis on the most recent developments such as those related to switching properties, microwave and far infrared properties, and lattice dynamics theory. After a brief introduction describing the plan of the book, the authors discuss various properties of different ferroelectric materials in chapter 2. The emphasis in this chapter is descriptive, and the discussion should be useful to the uninitiated in the field by providing an idea of the properties of ferroelectric materials and the kinds of materials that exhibit these properties. The final part of chapter 2 briefly describes the results of certain microwave and infrared studies and the implications of the infrared studies with respect to recent lattice dynamical theories of ferroelectricity. It is unfortunate that these more recent developments have not been treated in a more complete manner, with inclusion and discussion of certain interesting and pertinent work omitted from the present volume. Chapter 3 is devoted to the thermodynamic description of a number of the ferroelectric properties illustrated in the previous chapter. The treatment is kept simple and direct, and as a result one can appreciate the unification that thermodynamic theory provides by explaining and relating a number of the measured quantities. Chapters 4 and 5 are devoted to Cochran's lattice dynamical theory, the Slater theories of KH_2PO_4 and $BaTiO_3$, and the inelastic neutron scattering results of Cowley. Most of this work has been taken more or less directly from the original papers. In the few places where the authors have supplied their own discussion and interpretation they are guilty of certain inaccuracies· for example, in the first paragraph of chapter 4, they state, "if, for one particular mode of vibration, these long range forces have the same magnitude but opposite sign as the short range forces, the crystal becomes unstable for this mode." As might be expected from the authors' previous contributions to the field, chapters 6, 7, and 8 are devoted to a thorough and up-to-date description of ferroelectric domains and domain switching. The remainder of the book includes brief statements on miscellaneous topics such as radiation damage, second harmonic generation, semiconducting properties, thermal conductivity, and applications of ferroelectrics. Chapter 10 includes a short, interesting discussion of the measurement of a true coercive field and mentions two materials which possibly exhibit this property.

Although this book can in no sense be considered comprehensive or definitive, its length, general organization, and style of writing make it a useful introduction to the subject of ferroelectric phenomena. It can also be used as a reference supplement to existing literature.

B. D. SILVERMAN
Electronics Research Laboratory, National Aeronautics and Space Administration, Cambridge, Massachusetts

Vapors

The Characterization of High-Temperature Vapors. JOHN L. MARGRAVE, Ed. Wiley, New York, 1967. x + 555 pp., illus. $24.95.

Vaporization and sublimation, the processes in which liquids and solids, respectively, are converted into vapor, are important concepts in science and technology. The long-term trend has been toward use and control of higher and higher temperatures. In many cases the practical upper limit of temperature is set by the rate at which the condensed phase is converted into vapor. A classical example of such a limiting case is the tungsten filament in the incandescent light bulb. It is also important to have information about the structure of the particles comprising the vapor. Such information can, by the use of statistical mechanics, be made to yield knowledge of the thermodynamic properties of the vapor. This information is necessary in the understanding of the stability of refractories at high temperatures, of the combustion process, and of the properties of extremely high-temperature plasmas.

The characterization of high-temperature vapors is currently a subject of active research. However, there is a need for a better and more widespread understanding of vaporization and of the properties of vapors. This book appears to be a step toward this goal. The editor has put together the contributions from 28 authors, each a noted specialist in a particular aspect of the vaporization process, into a well-integrated and readable text.

The techniques used in the measurement of the vapor pressure and in the characterization of these vapors are covered from both theoretical and experimental viewpoints. The applicability and limitations of the several experimental methods are discussed. This is particularly helpful to the researcher in the selection of experimental methods for the solution of a research problem. The discussions of the experimental techniques are in general complemented by drawings of sufficient detail to guide the experimentalist in the construction of the apparatus. Just as important, the theoretical discussions offer guidance in the treatment of data.

The book also contains chapters on the kinetics and mechanism of the vaporization process and appendices giving vapor-pressure data for the ele-

ments and many common inorganic compounds. It is particularly useful as a source of reference to the many papers in the literature on this subject.

The Characterization of High-Temperature Vapors is appropriately dedicated to the new generation of high-temperature scientists and engineers. It also has much to offer to persons currently in the field. It will undoubtedly serve as a guidepost to physicists, chemists, metallurgists, engineers, ceramists, and others doing research at high temperatures.

A. J. DARNELL
Atomics International, A Division of North American Rockwell Corporation, Canoga Park, California

Regulators of Development

The Evolution of Differentiation. WILLIAM S. BULLOUGH. Academic Press, New York, 1967. viii + 206 pp., illus. $8.

This unusual and interesting treatment of differentiation emphasizes the importance of the role played by chemical messengers such as nutrient materials, metabolites, inducing substances, and hormones. With data from a broad spectrum of organisms ranging from bacteria to the most complex systems, the theme is carefully developed that differentiation has evolved from the more-or-less reversible, labile state found in microbes and plants to the inflexible, stable state seen in mammals. At all stages of complexity, differentiation is viewed as the outcome of a progressive and selective closure of an originally totipotent genome, through the action of specific chemical messengers which travel within and between cells, activating and repressing genes according to the theory of Jacob and Monod. The thesis is advanced that closure of the genome has become progressively tighter with the progress of evolution, the ultimate stability being represented by systems in which genetic activity has ceased completely and control is exercised at the RNA level. An unconventional approach (and a somewhat awkward terminology) is used in one of the most thought-provoking sections of the book, dealing with tissue homeostasis. A new look at the incompatibility of mitosis and tissue function is offered as the view is developed that cells may differentiate to synthesize either only those enzymes required for mitosis or those which determine a composite program for aging and function. At this level also, the action of tissue-specific chemical messages (on the relative inhibition of mitotic activity) is considered to be primarily responsible for the balance between the rival forces of cell duplication, function and death.

It is more a comment on the state of the field than a criticism of the presentation to say that this book provides a fascinating example of the consequences of current tendencies to force all explanations in terms of gene regulation. In view of the (laudable) emphasis on chemical messengers which are not made of DNA or from DNA, and do not usually act on DNA, it is somewhat confusing to assume that such messengers exist only for the purpose of regulating genetic activity. This is particularly so in view of the fact that, mechanistically, more is known about their mode of action at nongenic levels, for example, in the activation and inhibition of existing enzymes and as a source of energy and precursor material for synthetic pathways. Thus some very pertinent questions (and conflicting conclusions) are automatically eliminated from consideration. The assumption is made that differentiation essentially involves nothing more than the elaboration of an ancient theme of gene control in bacteria. Although this is very probable as applied to the genetic level of control in differentiation, it hardly does justice to the equally important role of other levels of control. Unlike bacteria, which are susceptible to influence by various exogenous inducers, a differentiating system must furnish its own chemical messengers. The nature and source of the messengers, the control of their synthesis and utilization, and the mechanism of their action at nongenic as well as genic levels must be considered in understanding the evolution of differentiating systems. Soon we must also ask whether the catalytic products of genetic activity are produced in limiting (that is, controlling) amounts, or in excess compared to the other cellular components (such as metabolites) essential to the expression of their activity.

On the whole, this book condenses an impressive amount of information and a variety of viewpoints in a stimulating and interesting manner.

BARBARA E. WRIGHT
Retina Foundation, Boston, Massachusetts

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