was showing his paintings to a scientist. He said, "This work I painted for other artists, but this one I painted for people like you scientists." In other words, some of his work was extreme specialization (artists' art). A few of the articles in this symposium appear to be so extreme in their specialization that they go even beyond the level of "artists' art." Most speakers, however, treat their audience well and put their subjects in perspective.

Most of the authors conscientiously attempt to answer most of the questions listed above. I did note that an attempt to define or explain the term "dormancy" does not appear until page 219. Many of the articles introduce stimulating new terms such as "germination inhibitors," "seasonal tokens," "capacity adaptation," "resistance adaptation," or offer explanations of the differences between "winter rest," "diapause," and simple "cold resistance." However, a few articles do not even mention the terms "dormancy," "survival," "environment," or "evolution" and consider only, for example, if a block in protein synthesis is removed, or the exact composition of a cyst wall. The good teachers of the symposium make up for the few superspecialists, however. Because of the carefully designed papers of Fogg, Williams, Andjus, Lyman and O'Brien, Wimsatt, and others, biologists who are not scientists in this field will be pleased to have the volume at hand. These authors pay particular attention to explaining how dormancy assists the survival of the individual animal or plant in a hostile environment. They answer the frequent questions that come to mind concerning the exact differences between dormancy, hypothermia, and hibernation. This symposium will be of timely assistance to the lecturer and investigator on topics of environmental biology.

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Algal Model

Acetabularia and Cell Biology. S. PUISEUX-DAO. Translated from the French by P. Malpoix-Higgins. Logos, London, and Springer-Verlag, New York, 1970. xii, 162 pp. + plates. $9.80.

We are experiencing a third awakening of interest in the algal cell *Acetabularia*. The first, beginning in the 1930's, resulted from Joachim Hammerling's discovery that the morphogenesis of this giant cell could be manipulated experimentally. Thus *Acetabularia* promised a model system for differentiation at the cell level without the problems inherent in embryonic fields, competence or even induction.

Jean Brachet was responsible for a revival of interest that occurred in the early days of cell and molecular biology. He exploited the unique geometry of this cell to characterize the instructions passing from nucleus to cytoplasm. Hammerling's group also entered into this work, and considerable early evidence for the role of RNA in transferring nuclear information was obtained. *Acetabularia* as a model system lost out to *Escherichia coli*, but some of the findings from it have served to indicate the difficulty in direct extrapolation of prokaryotic results to eukaryotes.

The current revival of interest results from the high degree of cytoplasmic autonomy already demonstrated in this alga and the discovery of DNA in chloroplasts and mitochondria. This revival has carried *Acetabularia* to a number of new laboratories. *Acetabularia* chloroplasts contain large amounts of DNA and have extensive biosynthetic capacity, both in isolation and after long periods of enucleation, again providing a model system, this time for studying the genetic capabilities of organelles. Thus, given the role that this alga has played in cell biology, the title of the book is appropriate. The role of *Acetabularia* in cell biology is treated only in the preface by Brachet and the author's introduction, however.

The book provides a review of *Acetabularia* literature in French, German, and English, covering 250 references, mostly from the last ten years. A large number of tables and graphs from this literature are reproduced. Other illustrations range from lovely line drawings and light micrographs of *Acetabularia* to electron micrographs of its nucleus and plastids. The emphasis, though, is on the author's own work and that of several of Brachet's coworkers.

Perhaps the greatest strength of the book lies in original contributions of Puiseux-Dao and her co-workers in two areas: the biology of *Acetabularia* and the development of a concept of "plastidal units." The biology chapter provides information that is difficult to find elsewhere on growth, morphogenesis, life cycles, and culture of several *Acetabularia* species. Plastidal units are minimal plastids consisting of lamellae, a single starch grain, and a DNA area. Most chloroplasts consist of several such units in tandem, separated, according to the author, by specialized lamellae representing a potential division plane. Workers who are interested in plastid biogenesis and DNA content will find this concept useful.

One cannot read the book without recognizing the lack of concrete information on some important aspects of *Acetabularia* biology, particularly the nuclear events during its life cycle. In effect no genetic control of these algae is possible at present. (The author does not discuss this impediment to experimental work.)

The book is often flawed by attempts to incorporate experimental observations that should be considered preliminary or inconclusive into comprehensive theories concerning the roles of nuclear and plastid genes and RNA's in such processes as morphogenesis or circadian rhythms. The results are less than convincing.

That the book was translated from a French manuscript is often noticeable, but seldom interferes with comprehension.

This book will be most useful to those contemplating work with *Acetabularia*, but anyone dealing with chloroplast autonomy, circadian rhythms, or nucleo-cytoplasmic interactions is likely to find accounts of interesting phenomena readily observed only in this alga, but almost certainly not unique to it.

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Applying Solid Mechanics

Physical Processes in Geology. A Method for Interpretation of Natural Phenomena —Intrusions in Igneous Rocks, Fractures and Folds, Flow of Debris and Ice. ARVID M. JOHNSON. Freeman, Cooper, San Francisco, 1970. xiv, 578 pp., illus. $14.75.

The geology graduate student or professional who wants to learn solid mechanics in order to apply it to geological problems is faced with a difficult and frustrating task. He has to learn a great deal of new mathematics and physics with no guarantee that any specific part of it is relevant to geologic problems. Even if he is able to absorb the new material and to develop the ability to use it to solve specific problems, there is the final hurdle of translating geological observations into solvable physical problems. It is doubtful that any textbook or course can make the task an easy one, but *Physical Processes in Geology* is a remarkably successful attempt to make it less frustrating.

Let me illustrate the style and organization of the book by considering its treatment of sheet structure in granites. The author starts with a review of observations of the sheeting phenomenon and proceeds to a discussion of the details of sheeting fractures, including quantitative data on the length, number, and spacing of fractures as a function of depth. This section, which contains a considerable number of new observations by the author, is an excellent introduction to the phenomenon. It is followed by a theoretical interlude in which the concepts of strain energy, initial stress, and Griffith crack theory are developed in a clear, self-contained treatment, building on earlier theoretical portions of the book. These concepts are then used to develop a theory that explains quantitatively many of the observed relations. Finally, the concepts are used to discuss the problem of brittle fracture of rocks in general.

By applying this technique to an imaginative choice of geological topics Johnson is able to interweave a remarkably complete introduction to solid mechanics with discussion of specific mechanical processes in geology. Bending of layers is dealt with in the context of laccolith formation, buckling of layers in terms of Bailey Willis's experiments on the formation of Appalachian folds, use of polar coordinates in terms of the Spanish Peaks dike swarm, plastic flow in terms of the flow of debris in channels, and slip lines and plastic indentation problems in terms of the transport of large boulders by debris flows. The mathematical background required is differential and integral calculus and a smattering of differential equations. The reader who has the perseverance to read the whole book carefully and work the numerous problems in the text will be introduced to more advanced topics such as differential equations, both ordinary and partial, separation of variables, Fourier series, and the use of characteristics in hyperbolic partial differential equations. With respect to solid mechanics, the persevering reader will find a sound introduction to the strength-of-materials approach, two-dimensional elasticity including polar coordinates, slow viscous flow and the elastic-viscous analogy, perfectly plastic, power-law, and Bingham materials, the Mohr circle, the Coulomb fracture criterion, strain energy, and Griffith crack theory. The only important topics in static and quasistatic solid mechanics that are not treated are variational and numerical methods.

More important than the breadth of material covered, however, is that for each topic the reader will see the method developed to the point of solving nontrivial problems. In addition, he will see numerous examples of the process of formulating a solvable physical problem from a set of geologic observations. Continually stressed by precept and example is the point that the physical model of a geologic process should be simple enough that it can be solved and its predictions tested against the real world and complicated enough that it explains the principal features of the natural situation. For example, in discussing debris flows Johnson considers models that use perfectly plastic, Newtonian viscous, Bingham, and power-law rheologies. He points out that the main selection criterion is that the rheology should be adequate to model the particular aspect of the phenomenon under consideration, and that different models may be equally valid—neither perfect plasticity nor viscosity is adequate to explain the main features of the flow of debris in channels, but the Bingham and power-law models fit the observed data equally well.

A number of the geologic problems discussed are based on work by Johnson and his students, appearing in print for the first time. Although this work is both interesting and significant, I think the principal value of the book is as a teaching tool. It is a truism today that research and education in geology should become more quantitative and process-oriented; *Physical Processes in Geology* is both an example of how this reorientation can be carried out and a demonstration of the increased understanding of geological phenomena that will be gained.

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Books Received

Advances in Experimental Social Psychology. Vol. 5. Leonard Berkowitz, Ed. Academic Press, New York, 1971. xvi, 392 pp. $14.

Angiography of the Mesencephalon. Normal and Pathological Findings. A. Wackenheim and J. P. Braun. Springer-Verlag, New York, 1970. xii, 154 pp., illus. $22.50.

Animal Aggression. Selected Readings. Charles H. Southwick, Ed. Van Nostrand Reinhold, New York, 1970. xii, 230 pp., illus. Cloth, $5.95; paper, $3.95.

Animal Cell Culture Methods. G. D. Wasley and John W. May. Blackwell, Oxford, 1970 (U.S. distributor, Davis, Philadelphia). vi, 194 pp., illus. $9.

Animal Experiments in Pharmacological Analysis. Floyd R. Domer. Thomas, Springfield, Ill., 1971. xii, 670 pp., illus. $26.50.

Annotated Bibliography of Quaternary Shorelines. Supplement 1965–1969. Horace G. Richards, with the collaboration of Rhodes W. Fairbridge and others. Academy of Natural Sciences, Philadelphia, 1970. viii, 240 pp. Cloth, $11; paper, $9.

Annual Review of Psychology. Vol. 22. Paul H. Mussen and Mark R. Rosenzweig, Eds. Annual Reviews, Palo Alto, Calif., 1971. xii, 646 pp. $10.

Arithmetic Functions. K. Chandrasekharan. Springer-Verlag, New York, 1970. xii, 236 pp. $16.

Astronomy for Beginners. Henry Brinton. Pelham, London, 1970 (U.S. distributor, Transatlantic Arts, New York). 176 pp. + plates. $7.50.

Atlas of Arthroscopy. Masaki Watanabe, Sakae Takeda, and Hiroshi Ikeuchi. Igaku Shoin, Tokyo, and Springer-Verlag, New York, ed. 2, 1970. x, 176 pp., illus. $26.50.

Atlas of Cerebral Angiography. Takayoshi Nomura. Igaku Shoin, Tokyo, and Springer-Verlag, New York, 1970. xii, 322 pp. + plates. $22.50.

Atlas of Mammography. J. Gershon-Cohen. Springer-Verlag, New York, 1970. viii, 264 pp., illus. $26.

Atmospheric Transport Processes. Part 2, Chemical Tracers. Elmar R. Reiter. U.S. Atomic Energy Commission, Oak Ridge, Tenn., 1971 (available as TID-25314 from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va.). vi, 382 pp., illus. Paper, $6.

Automation Management. The Social Perspective. Proceedings of the second Georgia-Reliance symposium, Athens, Ga., 1970. Ellis L. Scott and Roger W. Bolz, Eds. Center for the Study of Automation and Society, Athens, Ga., 1970. x, 286 pp. Paper, $5.75.

Beiträge zur Verhaltensforschung. Investigations of Behaviour. R. Bilz and N. Petrilowitsch, Eds. Karger, Basel, 1971 (U.S. distributor, Phiebig, White Plains, N.Y.). viii, 280 pp., illus. Paper, $16.55. Bibliotheca Psychiatrica, No. 147; Aktuelle Fragen der Psychiatrie und Neurologie, vol. 11.

The Biology of Large RNA Viruses. Based on a symposium, Cambridge, England, July 1969. Richard D. Barry and Brian W. J. Mahy, Eds. Academic Press, New York, 1970. xvi, 736 pp., illus. $29.