onomy and the interior of Saturn? If not, why put them in one book? Perhaps the reader should take advantage of Annual Reviews' reprint service rather than spend his money at an efficiency of 1/14 or 2/14. (In fairness, the price of the collection *is* attractive, and the book is a vast improvement over most conference proceedings.)

The reminiscence by Jeffreys, one of the fathers of the field, is stimulating, though one might prefer that such personal reminiscences be collected from a dozen of the eminent fathers of planetary science into one separate volume where attitudes and accounts could be compared (but perhaps such a volume would have a short half-life against spontaneous explosion).

I was struck by the range of problems that we *ought* to be working on, but often can't for lack of adequate funding. Vonnegut, for example, tells us that unintentional artificial weather modifications are going on right now and that we haven't adequately evaluated them! With respect to the subject of my own recent work, Mars, a number of problems were suggested by these papers—for example, red bed formation, possible analogies between isostatic, nonrebound uplifts on Earth and the Tharsis and Elysium volcanic domes on Mars, and the reptile-to-mammal transition (was it due to the same solar-induced climatic shift suggested from Mariner 9 data to have occurred several hundred million years ago on Mars?). Yet while thinking about these matters I learned of the complete inadequacy of the funding available through NASA to follow up the Mariner 9 discoveries. Well, let us hope there is material for volumes 2, 3. . . .

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Atmospheric Processes

Turbulent Diffusion in the Environment. G. T. CSANADY. Reidel, Boston, 1973. x, 248 pp., illus. Paper, $13. Geophysics and Astrophysics Monographs, vol. 3.

The dispersal of pollutants in the environment by turbulent atmospheric or oceanic flow is a matter of great public concern and practical importance; at the same time the theory of turbulent dispersion in even idealized situations is a difficult problem in statistical mechanics. This book steers a middle course between the cookbook approaches that may not be reliable even to within an order of magnitude or two and the more rigorous mathematical approaches that may not be able to give any "answer" at all. The main concern of the book is to develop the simple properties of a dispersing cloud or plume to situations in which a mean shear is present and where buoyancy effects are significant. These, together with questions of relative diffusion and the fluctuation problem, are described in such a manner as to be accessible to a beginning graduate student who knows some fluid mechanics and differential equations; the successes and shortcomings of the theory are illustrated by frequent reference to laboratory and field data.

Not a book for one who wants a quick and easy answer or for one who wishes to understand the latest statistical mechanical analysis, it will, with proper caution, enable the meteorologist or oceanographer to know at least what must be measured and what to do with it in order to estimate dispersion rates in the many and varied situations that he is being called upon to examine.

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Systems under Pressure

Electronic Transitions and the High Pressure Chemistry and Physics of Solids. H. G. DRICKAMER and C. W. FRANK. Chapman and Hall, London, and Halsted (Wiley), New York, 1973. x, 220 pp., illus. $16.50. Studies in Chemical Physics.

Electronic transitions under pressure are a topic of much current interest and include metal-nonmetal transitions of all kinds and transitions involving spin state, valence state, and charge transfer state. Drickamer and his colleagues at the University of Illinois have carried out pioneering studies in recent years in the latter field, using mainly Mössbauer and optical spectroscopy under pressure, and have published a wealth of data on shifts in energy level with pressure and their consequence in a large number of organic and inorganic systems of varying complexity. They developed techniques necessary for extension of such studies to very high pressures, and have established the occurrence of a change of spin state and oxidation state of Fe under pressure in a number of materials. From their results certain generalizations seem apparent, namely: that under pressure a new electronic ground state is established; that, depending on the position of the crystal-field-split levels of the metal ion relative to the ligand levels of the organic molecule, electrons can flow from the former to the latter, or vice versa, causing reversal in the spin or oxidation state; that the equilibrium between these states follows the laws of equilibrium familiar in chemistry; and that the chemical reactivity can be strikingly altered in the new ground state. The book under review is a research monograph embodying mainly this work.

The presentation is slanted toward a chemical physics audience. The theoretical ideas used in the interpretation of the results are dealt with in the first four chapters, which include a brief discussion of the molecular orbital theory, configuration coordinate state diagrams, and the energy of thermal versus optical transitions, as well as a description of continuous electronic transitions modeled on regular solution theory. The experimental techniques are dealt with briefly in chapter 5. The six remaining chapters cover the experimental data and their interpretation. Chapter 7 is a brief discussion of electronic transitions in metals and metal-insulator transitions.

The book should be of interest to both chemists and physicists engaged in theoretical as well as experimental research.

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Drawings and Ideas

An Illustrated History of Brain Function. EDWIN CLARKE and KENNETH DEWHURST. University of California Press, Berkeley, 1973. xiv, 154 pp., illus. $14.

The history of medical illustration is a field that one expects to cut across disciplinary boundaries. Intersecting the history of art and of culture, as well as that of medicine, it should open up resources for interpretation and expansion beyond the traditional view of medical development as a self-contained, progressive accumulation of knowledge. With an acknowledgment of the influence of Robert Herrlinger's masterly work on the history of medical illustration, Clarke and Dewhurst also subscribe to this thesis.

The authors intend their study to be a pictorial history of an idea—the localization of functions in the brain, detailed by the illustrations themselves. They contrast their approach with one in which pictures are merely used to clarify a written exposition. Their 158 illustrations, selected from a wide range of sources and thematically organized, are accompanied by brief commentaries and supplemented by a thorough bibliography. Although some of the drawings have been published previously, for the most part they have appeared in diverse periodicals and seldom with analyses in English.

The brain is a worthy subject for such a study. Along with the heart and the liver, it has been one of a trio of organs which have been central to medical theory since antiquity. From the time of Erasistratos to the present, it has retained (with some dissent) its dignified position as the seat of intelligence or of the soul. The changing ideas about the nature of mentality and its localization in the brain have left their traces in the drawings collected by Clarke and Dewhurst. The drawings show the ancient notion of soul as an ethereal substance contained within the ventricles and the rigid adherence to this notion in the "cell doctrine" of the Middle Ages. In the 17th and 18th centuries, attention began to shift gradually to the cortex. But only in the 19th century, partly through the influence of phrenology, were functions localized in the cerebral convolutions.

Glancing over the illustrations, especially the medieval drawings of cells or chambers in the brain, one cannot help asking what they were used for. Surely they were usually not portrayals of observed structures but conceptual representations of medical or philosophical ideas. Each of the cells, for example, was simply the place of a faculty of the soul, and the concept of cells had more to do with the division of mentality into units than it did with anatomy. Yet one need only read Vesalius's account of the ventricles to discover that naturalistic depiction of observed structure was a weapon in the overthrow of the cell doctrine in the Renaissance. Indeed, the relationship between the interest in structure and the interest in function is a continually emerging theme in this book. The accurate representation of a structure (with the consequent neglect of another) reflected sometimes the attention focused upon it by a theory of function, but sometimes the freedom to portray without preconceived notions. Medieval and early modern ideas discouraged interest in the convolutions, say the authors, but anatomists of the early 19th century, not "approaching function by way of morphology," concentrated upon the accurate representation of structure.

Once these issues have been raised, however, the authors give them scant attention. We do not learn how Galen could have forced the docile submission of medieval writers, or why anatomists began to examine the cortices in the 17th and 18th centuries, or how the anatomists of the early 19th century so easily escaped the oppression of functional theories. At one point, Gall's phrenology earns its place in history by focusing attention upon the convolutions through its doctrine of functional localization; at another, it secures itself by Gall's solid neuroanatomy in spite of flights into phrenological fantasy. However, structural and functional concern could not be separated in Gall, nor for that matter in Sir Charles Bell, the leading English anatomist of the early 19th century.

Part of the difficulty lies in pictorial history itself. As the authors concede with respect to modern ideas of localization, theoretical undertones are often beyond the reach of graphical portrayal. I think the problem goes deeper. The presumption that the theory underlying earlier drawings is simple and well understood, and that it is the detailed complexity of modern thought which eludes our graphical abilities, is misleading. It would be a mistake to equate the pictorial primitiveness of medieval illustrations with conceptual simplicity.

Pictures, like words, derive their complete meaning only from their use. They lend themselves to a variety of purposes and take on new significance in new contexts. A text written in pictures is commonly seen as a value-neutral exposition, assembled by the author yet standing independent and free of his bias. But the adaptability of illustrations can in fact obscure their proper interpretation and conceal an author's historiographical inclinations.

Clarke and Dewhurst have a definite historiographical commitment. From the frequency of expressions like "regression," "the next step," "inaccuracy," "crudity," and "advanced," it is clear that they view medical history as a progressive movement toward standards set in the present. In this case, the standard is a photographic portrayal of a living brain. But the drawings judged crude or transitional by the authors might be more profitably interpreted in terms of their intended use and contemporary technics. The sources for such an evaluation lie as much in the history of art and of culture as they do in the history of science and medicine. (One might begin with a look at the works of Herrlinger, E. H. Gombrich, and M. W. Evans.) It is unfortunate that the authors, in spite of their indebtedness to Herrlinger, fall back upon a more restricted view of the history of medicine.

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Antiviral Agents

Interferons and Interferon Inducers. N. B. FINTER, Ed. Second edition. North-Holland, Amsterdam, and Elsevier, New York, 1973. xx, 598 pp. $31. Frontiers of Biology, vol. 2.

This completely revised edition of the 1966 publication *Interferons* is an impressive compendium of information about the subject through 1971 (over 1500 references are included). Of particular use to researchers working directly with these antiviral substances, the volume also provides a valuable reference for researchers in related fields. The organization of the book is well thought out. The cross-indexing of subjects and authors is comprehensive, and the literature references are compiled in a single list.

Several recent developments are discussed in detail, and outdated concepts are revised. The point is well made that the term "species specificity" with regard to interferons is somewhat misleading and in need of qualification, since certain interferons have been found to be active in cells from heterologous species. It is suggested that this term be replaced by "characteristic species specificity," to indicate that most interferons do have specificities for the cells of particular animals and that when an interferon is active in cells of two different species it seldom has the same degree of activity in the two. Increased emphasis is also given in this book to the remarkable diversity of molecular size and electric charge among interferons, as a result of which progress in the study of their physicochemical nature will probably be slower