given geographical region of relatively uniform climatic conditions one can recognize a certain floristic spectrum of species, for example, central hardwoods predominating in southern New England and northern hardwoods in northern New England. Within each of these vegetation zones there are a variety of site or habitat types: lower slopes, mid slopes, upper slopes, crests, talus slopes, sand plains, river terraces, and so on. Each of these sites within a given zone can display a distinctive and relatively stable vegetation. For each site one can discuss future trends, incorporating all environmental factors, including historical, catastrophic, edaphic, and biotic influences and the role of fire and of measures to protect against it. An extremely lucid interpretation of the vegetation, free of climax terminology, can result. My plea to students using this text is constantly to look at vegetation with an open mind, rather than with preconceived ideas of what it is *supposed* to be doing. Arrowed successional diagrams may be real, or they may merely represent relatively stable belts not really headed toward any one so-called end stage. The succession and climax concepts have had tremendous appeal, for they tend to simplify complex phenomena, but they also have the inherent danger of stymieing thinking. I remember a book editor's comment to a colleague when discussing this question—"you may be right but this approach [succession-climax] is more teachable." As our problems of maintaining a high level of environmental quality intensify, we will need more and better ecologists to analyze and interpret ecosystem dynamics constructively. A basic understanding of vegetational change is essential, not in preconceived terms, but by a holistic analysis of all the factors, past and present, that are modifying process and change.

The book is clearly written and well illustrated. The nearly 500 references keyed by numbers in the text give the reader a good insight into the literature of plant ecology. Although vegetation as a continuum is discussed, papers concerned with this subject are poorly represented in the bibliography. This may well reflect the author's skepticism of the concept. To the student with an open mind, Daubenmire's book can provide a considerable background of information on the methods of study and the dynamics of plant communities.

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Sleep

The Biology of Dreaming. ERNEST HARTMANN. Thomas, Springfield, Ill., 1967. xiv + 206 pp., illus. $9.75. American Lecture Series, No. 686.

Few working sleep researchers recently have attempted single authorship of books or monographs intended to review in detail the physiology, let alone the "biology," of dreaming sleep. The many recent publications have all been conference proceedings or collections of papers. This is understandable, for the prospective author is faced with examining not merely the advances of a particular scientific discipline but the progressive unfolding of knowledge in the physiology, chemistry, pharmacology, endocrinology, neurophysiology, psychology, phylogeny, ontogeny, and pathology of an entire state of existence. Sleep research in the last decade and a half has simply extended all our biological and psychological curiosities about man to a round-the-clock concern. What perils, for example, might we expect for the author who announced that he was embarking on a review of *awake* research?

Under these difficulties, Ernest Hartmann has singly authored an extensive, pertinent, and always readable monograph in *The Biology of Dreaming*. The advantage of single authorship in this instance is that we have been provided with a well-integrated account of the manifold properties and phenomena—drawn from extensive research with animals as well as with humans—of rapid-eye-movement (REM) sleep.

To a considerable degree Hartmann has formulated an enviably clear statement of what might be termed the "dominant" (though encrusted) view in the field during the last several years. Though he is careful in his assessment of the data and alerts us with a *caveat lector* as to the limits of current knowledge, he nevertheless presses the beliefs, first, that dreaming represents a unique biological condition, and second, that during dreaming the operations of the brain may be regarded as analogous to those of the awake brain. However, this view, which sees REM-state activation as equivalent to the mechanisms at work in a hypothetical "awake dreamer," now seems overdrawn.

Most workers agree that vivid dreaming occurs in the REM stage. However, it is unfortunate that Hartmann has added yet another to the many extant designations for REM sleep, the *D-state*, " 'state,' to emphasize the qualitative differences from waking and from ordinary sleep; 'D,' to emphasize the important psychological experience of dreaming." That this state *within* sleep has amazing properties is well known, but to circumscribe its significance prematurely with a label is a mistake, especially since there is virtually no information available as to whether animals actually "dream." Also, there is a current disagreement as to whether man's dreaming is confined to the REM stage.

The author argues hard for a now more than ever questionable tie-in between variations in psychological drive pressure and variations in REM sleep time. He also suggests that stress and "psychic pain" may cause an increased "need for D." Psychological drive intensity is doubtless expressed in dream content, but most recent evidence would dispute a connection with the *amount* of dreaming. There is also some tendentiousness and excessive speculation in Hartmann's handling of the relationship of REM sleep to mental illness and to other pathological conditions. This is revealed in his approach to the reasons for death in central pontine myelinolysis, for delirium following cardiotomy procedures, and for the psychological symptoms in the premenstrual period.

One problem with a book such as this is that, in spite of the author's obviously careful attention to cogent synthesis of the material, it quickly becomes substantially out of date. Though written in 1965–66 and published last year, some of Hartmann's covering concepts now read as shopworn or oversimplified. More unfortunate, in the areas where Hartmann has stressed an individual point of view (the association of depression and high REM time, serotonin as a possible neurochemical mediator of REM sleep, and hormonal influences on the sleep stages), information has become available since the writing of this book which either reverses these hypotheses or complicates the questions.

Hartmann's book is recommended for those to whom it seems addressed—interested lay readers and scientific workers in other fields who want a short but extensive introduction to the status of physiobiological studies of dreaming sleep. Nevertheless, the book has some new facts and interesting points for everybody's attention. Certain chapters, such as that on neurophysiology of the "D-state," are detailed and excellent in light of the time at which they were written. For workers in the field, how-

ever, some important areas of investigation are treated too cursorily.

The author should be commended for an admirable biblography and for the ambitious scope of the book's contents. The chapter and subsection organization of the volume obviously aims at an exhaustive examination of the biological underpinnings of dreaming and its extraordinary significance for mind, brain, and body. Hartmann need not change the framework of the book at all in order to provide a fuller treatment of the data in a later edition.

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Origins of Some Nuclides

High-Energy Nuclear Reactions in Astrophysics. A Collection of Articles. B. S. P. SHEN, Ed. Benjamin, New York, 1967. x + 281 pp., illus. $9.75.

Relative abundances of the light elements deuterium, lithium, beryllium, and boron in nature, although very low, are still too high by many orders of magnitude to have resulted from thermonuclear reactions in stellar interiors. Excess abundances of other rare elements, both radioactive and stable, ranging from tritium to xenon, have been detected in the terrestrial atmosphere or in meteoritic, cosmic ray, and solar flare materials intercepted by the earth. The origins—some well understood, others not—of these nuclides in nonthermal high-energy nuclear reactions in various astrophysical environments are examined by the authors of the ten review articles which make up this volume.

The emphasis of *High-Energy Nuclear Reactions in Astrophysics* is somewhat more specific than the rather general title might suggest. Six of the nine chapters following Shen's excellent introduction and a lead-off "state of the art" discussion of the physics of high-energy nuclear reactions by Miller focus entirely or in major part on the rare light nuclides H^2, He^3, Li, Be, and B. Light-element production by fragmentation of cosmic rays is examined by Shapiro and Silberberg, with particular emphasis on the Be/B ratio in the primary radiation and the confinement age of galactic cosmic rays. In a closely related chapter Reames discusses the urgent need for extensive spallation cross-section measurements in the interpretation of cosmic ray data. Danziger's review of stellar observations of light elements is largely devoted to a comprehensive, up-to-date discussion of Li and Be abundances as indices of stellar age and evolution. Mitler, in a significant and well-written chapter on the origin of the rare light nuclides, evaluates earlier theories on H^2, Li, Be, and B production in solar system matter, using current abundance and cross-section data, and sketches the tentative outlines of a two-source hypothesis for these elements: H^2 and Li^7 surviving from the primordial fireball, with Li^6, Be, and B produced by spallation during a solar T-Tauri phase. Here, as elsewhere in these discussions, cosmological interpretations of the abundances of these nuclides require precise information on production cross-sections in spallation reactions. In this context there are two chapters of key importance from Bernas's Orsay group, presented by Gradsztajn and by Audouze, Epherre, and Reeves, on the laboratory measurement of cross-sections for the production of Li, Be, and B isotopes and other nuclides from a variety of targets. The impact of the Orsay experiments is considerable, particularly in casting doubt on the feasibility, at least with present techniques, of determining cosmic ray "age" by measurement of Be/B, and—if the experimental results are confirmed—in ruling out any significant modification of the spallogenic B^{11}/B^{10} ratio (and consequently of H^2/H^1 and Li^7/Li^6 as well) by neutron irradiation of primitive matter in the early history of the solar system.

Three papers on high-energy nuclear reactions in solar flares and on the interaction of cosmic rays with the terrestrial atmosphere and with meteorites round out the book. Lingenfelter and Ramaty present a detailed and quantitative analysis of solar flare interactions leading to the production of secondary particles, gamma radiation, and the heavier isotopes H^2, H^3, and He^3. Korff and Mendell's short discussion of neutrons in the earth's atmosphere ranges pleasantly and rather lightly over the neutron spectrum, the usefulness of Be^{10} as a chronological tool, and cosmic ray acceleration mechanisms. Finally, the great wealth of experimental data on nuclide production by cosmic rays in meteorites and by accelerator proton beams in various thick targets is beautifully systematized and interrelated in an important and useful paper by Kohman and Bender.

This is an interesting collection, and certainly a useful one for workers and students in astrophysical disciplines. Credit is due to Shen both for skillful editing and for a comprehensive introduction which smoothly bridges inevitable discontinuities in the subject matter of the separate papers. Its value as a ready reference work is somewhat diminished by lack of any but the most rudimentary subject index. The photographically reproduced typescripts are uniform and remarkably free of errors. Bibliographies are generally excellent. The fields of study discussed here under the unifying theme of high-energy nuclear reactions are for the most part clearly in a state of rapid development. The volume is essentially a valuable review of the status of these fields as of September 1967.

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Topic in Developmental Biology

The Cell Surface. A. S. G. CURTIS. Logos Press, London; Academic Press, New York, 1967. x + 405 pp., illus. $18.

A. S. G. Curtis's book reminds me of an apocryphal story about Linnaeus, the great systematist, who implicitly believed in the theory of special creation as opposed to the theory of evolution. One day he saw a bug which his expert eye immediately told him strongly supported the evolutionist viewpoint. Linnaeus stepped on the bug and buried it deeply in the sand; thus he missed the chance of being Darwin. The stakes in Curtis's book are, of course, infinitely smaller, but the opportunity that it misses is nevertheless important and the loss is equally regrettable; a good text on the cell surface would have been timely and welcome.

There are at present three or four "schools of thought" on the nature of the mechanisms of cell contact in developing multicellular systems. Objectively, the differences between the various viewpoints are less significant than the similarities; in fact, it is becoming apparent that, as the semantic and methodological discrepancies become ironed out, a common ground and productive general concepts are emerging. It would have been timely and constructive for a book on this topic to present the problems, accomplishments, and prospects of studies on the cell surface and its role in differentiation, placing them in a wider biological context.