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.