Book Reviews

Energy for Man. Windmills to nuclear power. Hans Thirring. Indiana University Press, Bloomington, 1958. 409 pp. Illus. $6.95.

Hans Thirring's book opens with several challenging statements which serve to set the theme for 16 very meaty chapters. We are reminded that our world is now adding to its population at the rate of 70,000 per day, and that this will result in a probable world population in A.D. 2000 of between 3000 and 4000 millions, or of 5000 to 8000 millions in A.D. 2050 (page 216). Food production, we are told, is decreasing rather than increasing. Birth rates are increasing, and two-thirds of the world population suffers from squalor, hunger, and deficiency diseases.

These statements should not pass without comment. As for population, Thirring is perhaps deliberately conservative in his estimates. Despite all the guesswork that enters into long-range projections, many "authorities," including the economic staff of the United Nations, predict a world population in A.D. 2000 of 4000 to 5000 millions and concur in a figure of about 100,000 per day as the present rate of population increase. This, from a broad global viewpoint, is not attributable to an increasing birth rate; the crux of the problem, with its many serious implications, is the decreasing death rate.

As for the world's food production, this is certainly not decreasing, although the per capita supplies in the world's larder are diminishing.

Thirring next points out most cogently that great increases in power production are urgently necessary if we are to solve some of the problems posed by a heavy population burden and diminishing resources of conventional sources of energy. In his inquiries into the energy sources of today and tomorrow, Thirring is very much at home. He gives us in several chapters a number of useful definitions and, by way of reader education, some helpful illustrative calculations. In his discussion of energy sources and reserves, and their utilization, he draws the necessary distinctions between the full heat value of the world's fuels and their electricity equivalent (which is about one-fifth of the full heat value). By way of contrast, it is confusing to read the papers in volume 1 of *Proceedings of the International Conference on Peaceful Uses of Atomic Energy* (Geneva, 1955), in which this distinction is not always apparent. Is it not, for example, a contradiction in terms to list energy requirements and energy values of fuels in "electricity equivalents, computed at full calorific values" when what is really meant, is "full heat value expressed in electrical units"? Including animate energy (a small part of the whole), the world is currently using over 25×10^{12} kilowatt-hours per year (full calorific value) or about 5×10^{12} kilowatt-hours per year (as electricity equivalents). Thirring does not discuss rates of increase in world energy consumption, but it is germane to point out that various authorities have placed this at 2 to 3.5 percent per annum, compounded annually.

It is quite impossible to review this book chapter by chapter, but the headings will give a fair indication of the contents: "Power, energy, and heat"; "Survey of sources and uses of power"; "Steam"; "Internal combustion engines"; "Gas turbines"; "Heat pumps"; "Electricity"; "Coal"; "Petroleum and natural gas"; "Life expectancy of fossil fuel reserves"; "Fuels from vegetation"; "Water-power"; "Solar energy and other sources"; "Atomic energy"; "Nuclear reactors"; and "Thermonuclear reactions."

The need for more efficient use of our diminishing energy reserves is stressed throughout. The reject heat of power stations should be put to proper use: "the reject heat of a moderately large power station of 100,000 kw installed capacity suffices to heat a district of about 10,000 houses." Thirring laments the waste of fuel in operating large motorcars, in which, as is pointed out by Ayres and Scarlett, only 5 percent of the potential energy of the crude petroleum is actually translated to motion of the car. The use of open fireplaces for heating is wasteful in the extreme. In fact "five-sixths of the fuel consumed for residential heating [in Britain] is wasted by allowing 85 percent of the heat to escape through the flues." Because of our diminishing fossil fuel supplies, electrification of railways is urged.

Hydroelectric power is ably considered, but it is pointed out that with the world and its population as they now are, some of the greatest undeveloped sites are just exactly where we don't need them—for example, in Tibet and remote parts of Africa. Unhappily, the transmission of electric power for more than 1000 miles is impracticable.

Solar energy has its possibilities, we are told, but only seasonally (the year around at the equator) and for rather restricted purposes. The author appears to be more sanguine about harnessing photosynthesis than the facts seem to warrant. He discusses hopefully the mass cultivation of *Chlorella* and its use, especially as fuel. He fails to mention, however, the need for vast amounts of carbon dioxide and the serious difficulties imposed by microbiological contamination of the culture and solar heating of the culture medium.

After stressing the inevitable, and possibly early, disappearance of our conventional fuels, the author turns to the great storehouse of power in the atom. Atomic fission is discussed at length, and nuclear reactors are described. The serious problems connected with the disposal of radioactive wastes are emphasized. Finally, the author discusses the elements of low atomic number and considers in great detail the possibilities of harnessing for peaceful purposes the nuclear fusion reactions. Here he tends to be conservative, if not pessimistic, and feels that many, many years will elapse before we shall succeed in building nuclear fusion reactors.

All in all, this is a fascinating book. It is heavy reading but rewarding. The author is clearly at his best in the chapters on engineering, physics, and the atom, and in these he is explicit, precise, and lucid in explanation. The book can be highly recommended to all who are seriously interested in some of the most challenging problems of the world about us.

J. Murray Luck
Department of Chemistry and Chemical Engineering, Stanford University

The Mammalian Cerebral Cortex. B. Delisle Burns. Arnold, London, England, 1958 (order from Williams & Wilkins, Baltimore). vii + 119 pp. Illus. $5.

Since neurophysiology exhibits a singular propensity for concealing simple concepts behind long names, the author has directed this volume to those for whom the pursuit of neurological problems has escaped the use of the oscilloscope and its complex trappings. He has commendably tried to avoid the terminology which is peculiar to neurophysi-

ology. Probably less is known about functions of the normal cerebral cortex than about any other organ in the body. This is mainly due to the anatomical complexity of intracortical connections and intimate associations with other parts of the nervous system.

This account of the cerebral cortex is based largely on the author's own studies, in which he has developed to an elegant perfection the technique of the isolated cortical slab with intact blood supply but devoid of neural connections with either surrounding cortex or deep structures. His use of this technique has produced a frame of reference differing basically from two others widely employed in the last decade—the one recording the action potentials of large cell populations in intact cortex, the other involving unit recording within a cell population with the assumption, often tacit, that the population is histologically and geometrically homogeneous.

Although these slabs show no spontaneous activity under light anesthesia, they respond with a prolonged "burst" discharge to single shocks. The author presents a detailed account of cellular behavior during the burst. The physiologist's interest in this, as in posttetanic potentiation, hinges on the search for neural mechanisms which might explain the observed plasticity of cerebral functions, the spontaneous activity, and the possibility that prolonged changes induced by a few stimuli may bear on the problem of memory.

The latter part of the book is devoted to problems of memory. Here, with the vast gulf that is fixed between the fields of physiological and psychic phenomena, and where only the brave may venture to bring forth even so little as a personal credo, the author maintains an admirable objectiveness without pretence to an encompassing view of the brain-mind relationship.

W. Ross Adey
Departments of Anatomy and *Physiology, School of Medicine, University of California Medical Center, Los Angeles*

Bibliography of Food. A select international bibliography of nutrition, food and beverage technology and distribution, 1936–56. E. Alan Baker and D. J. Foskett. Academic Press, New York; Butterworth, London, 1958. xii + 331 pp. $11.

Baker and Foskett have compiled a large bibliography about an extensive field in a useful way.

Literature, mostly that which has appeared since 1936 but not including individual articles in periodicals, is listed by area of information in the broad field of "food." The literature is further classified by type of publication (for example, bibliography and abstracting journal), and by informational content (for example, technology, distribution and marketing, vitamins and proteins).

An interesting and useful aspect of the bibliography is the occasional annotation of an entry by the compilers.

Paul E. Johnson
National Academy of Sciences–National Research Council

Thudichum, Chemist of the Brain. David L. Drabkin. University of Pennsylvania Press, Philadelphia, 1958. 309 pp. Illus. $5.

"There should be laboratories of research established in all large hospitals. In these, the purely chemical diseases, no less than the diseases caused by microorganisms, should be investigated." These remarkably prophetic words were delivered by Thudichum, the first professor of chemical pathology at St. Thomas', in his presidential address before the West London Medical-Chirurgical Society. That was in 1883, just after the identification of the tubercle bacillus and a decade before the discovery of the relationship of the pancreas to diabetes. The names of Koch and Minkowski are well known to every student of the medical sciences, but Johann Ludwig Wilhelm Thudichum, who somehow foresaw the future contributions of biochemistry to medicine and who developed the modern science of neurochemistry, is all but forgotten.

This book, by David Drabkin, himself a worthy successor to Thudichum in modern "chemical pathology," fulfills admirably its purpose of recognizing the achievements of this great man. It does more than that. With a charming literary style which makes it difficult to lay the book aside, the author traces the life and times of Thudichum by means of descriptions of a personal pilgrimage to Büdingen, his birthplace, or a tea with his daughters in his last home in London, whither he had immigrated in 1854 when his participation in the unsuccessful liberal revolution of 1848 had made his continued stay in Germany uncomfortable. From his daughters, his manuscripts, his letters, even his obituaries, we learn much about the sources of his creativity, his nonconformity, the intensity and precision with which he pursued his classical studies on the chemistry of the brain, the versatility he possessed in his encyclopedic knowledge of cookery and wines, his dedication to truth, and his impatience with authoritarianism. Not all of these qualities endeared him to his colleagues, as we learn from one patronizing obituary: "His scientific achievements seldom if ever realized the expectations which had been formed with regard to them. He must, nevertheless, be regarded as an original explorer . . . and it is by no means improbable that some of his investigations may yet bear important fruit." To read the bombastic attacks by Hoppe-Seyler or by Gamgee, two of the outstanding chemists of that time—attacks which, besides being hostile were utterly groundless—is an interesting lesson in humility.

As the author writes in his prologue, "This is not the biography of one man alone, nor the story of one time. It is the struggle of a creative mind for fulfillment." He has appropriately underlined the universality of Thudichum and his problems and tells the colorful story of his life in somewhat less than two hundred pages of interesting narrative. The remainder of the book consists of references, documentation, and appendices for special study.

This book should be of value not only to physicians, biochemists, and neurochemists, and to the general reader interested in the history of science, but also to those alert to, or concerned with, the problem of scientific creativity.

Seymour S. Kety
Laboratory of Clinical Science, National Institute of Mental Health, National Institutes of Health

Advances in Enzymology. And related subjects of biochemistry. vol. XIX. F. F. Nord, Ed. Interscience, New York, 1957. v + 457 pp. Illus. $9.85.

The editor has departed from usual custom in publishing two volumes instead of one during 1957. Volume 19 contains five outstanding reviews which are so detailed and extensive in their coverage of the literature that each one might be called a monograph in its own right. Unfortunately for certain American readers, two of the five chapters are in foreign languages but are well worth the trouble of translation.

In "Enzymic aspects of photosynthesis," Vishniac, Horecker, and Ochoa have done an excellent job of correlating diverse information on photosynthesis. They do especially well in their consideration of the role of carbohydrate metabolism and enzymes of carbon dioxide fixation in photosynthesis. The light-dependent reactions are covered less extensively because relatively little is known about them.

H. S. Mason, in his chapter on "Mechanisms of oxygen metabolism," contributes a remarkable achievement in his classification of oxidizing enzymes into the three categories of transferases, mixed-function oxidases, and electron-transfer oxidases. In addition, he pre-