Soviet Brain Science

The Physiological Mechanisms of Cerebral Blood Circulation. A. I. NAUMENKO and N. N. BENUA. Translated from the Russian and edited by Josef Brožek and Ernst Simonson, with the assistance of Margaret Maria Brožek. Thomas, Springfield, Ill., 1970. xviii, 126 pp., illus. $8.75.

Blood circulation in the brain and the mechanisms of its regulation have long been a subject of intense interest and investigation in physiology and medicine. Activity in this field received additional impetus about 25 years ago with the advent of reliable quantitative methods for measuring cerebral blood flow in man. These methods were developed and first exploited mainly in the United States. More recently they have been modified, refined, and extended largely through the efforts of Scandinavian workers, and Western Europe has seen a boom in research activities in this field. Major centers for research on the cerebral circulation now exist not only in the United States but also in Denmark, Sweden, Great Britain, Italy, and France, and also in Japan. The combined activities of these various groups have led to the publication of vast amounts of information which, though often confirmatory of results obtained many years ago with less quantitative methods, describe and explain in great detail the properties of the normal cerebral circulation, its regulation, and its behavior in pathological states and in response to drugs. Numerous reviews of various aspects of the field have appeared in the American, the European, and the Japanese literature.

A striking feature of these reviews is the relative dearth of references to Soviet literature. In view of the known predilection of Soviet science for the central nervous system, this could hardly mean that Soviet scientists have done little work on the cerebral circulation. It is generally assumed that the neglect of the Soviet literature is the result of language barriers, inaccessibility of Soviet publications, and the infrequency of interchange between Soviet and Western scientists. Brožek and Simonson's translation of the monograph by Naumenko and Benua confirms this assumption and proves that Soviet science has not been idle in the field of the cerebral circulation. Indeed, the bibliography is the major contribution of the book. Documentation is not limited to the Soviet literature; citations are from all sources and are thoroughly interspersed and integrated so that all information, regardless of national origin, is brought to bear in the analysis of any given problem. Even if allowance is made for prejudicial reliance on Soviet work, it is clear that Soviet scientists have made significant contributions to the physiology of the cerebral circulation which have gone largely unrecognized in the West.

Several features of the book greatly enhance its bibliographic value. All references include titles, and the Russian titles are accompanied by English translations. A mere scan of these titles attests to the breadth of Soviet study of the subject. The text reflects an intent to encompass as much of the relevant literature as possible, and its style is to a large extent that of an annotated bibliography. This is generally disadvantageous to the readability of the text; it often leads to disjointed and incomplete treatment of the points under consideration and obscures the authors' critical evaluation of the cited work. It serves, however, to identify the workers with their work and thereby prepares the reader for more intensive reading of the source literature.

The monograph covers the conventional subjects relating to the control of the cerebral circulation. There are chapters on anatomy; chemical, neurohumoral, and neural control; the relationships between cerebral blood flow, metabolism, and functional activity; the action of drugs; and one on autoregulation. The treatment of autoregulation is unique in that it attempts to relate all variables and parameters which bear on this phenomenon in a single, unifying mathematical expression. The mathematical treatment, however, contributes merely a symbolic statement of what is already known and offers no greater understanding of the mechanisms of autoregulation. Not unexpectedly, there is a chapter on conditioned reflex control of the cerebral circulation; the treatment is very brief and unconvincing and is probably intended as little more than the traditional Soviet obeisance to Pavlovian concepts.

The monograph reveals no remarkable new insights into the physiology of the cerebral circulation. It confirms that Soviet scientists are preoccupied with the same problems as are workers elsewhere and are proceeding along similar lines. Their methodological approaches are different, however, and they have not yet adopted radioisotopic and inert-gas methods and studies in human subjects, which are very popular in Europe and the United States.

Perhaps because it is the authors' own method of choice, the monograph suggests that there is extensive use of electroplethysmographic techniques; these techniques are generally considered in the West to be of dubious value in the quantitative measurement of perfusion rates. There is a noticeable reluctance to downgrade the role of the nervous system and to accept the concept of chemical control of the cerebral circulation; even the classic effects of CO_2 on the cerebral vasculature are interpreted in terms of chemoreceptor mechanisms rather than direct chemical effects.

It is unlikely that the reader can gain a coherent and comprehensive picture of the physiology of the cerebral circulation from this book. Its value lies in the breadth and representation of the references, and the inclusion and integration of the Soviet literature with that of the Western world. It is recommended mainly as a bibliographic source.

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Constituents of Marine Life

The Chemical Biology of Fishes. With a Key to the Chemical Literature. R. MALCOLM LOVE. Academic Press, New York, 1970. xvi, 550 pp., illus. $21.

The purpose of this book is to provide "a biology of fish seen through chemical analysis." It is divided into three parts: the text proper and two bibliographical indexes, one based on chemical substances and the other on the names of fish. Fortunately, the author does not allow himself to be limited by the stated objective. Had he done so, this book would have been severely circumscribed and of less interest to students of oceanic science.

Chemical analytical data, per se, are sometimes provocative but are justifiably overshadowed by studies in biochemistry and physiology that relate more directly to the economy of the whole organism. Regrettably, very little chemical work of any nature has been done specifically to contribute to deeper and broader horizons in biology. The author was obliged to compile and interpret data from a vast literature of

fishery technology, much of which consists of compositional studies of commercial fish and fishery products. The task required a shrewd, discerning, and incredulous approach. Love, rising above infatuation with mere chemical analyses, has ably put together a book that is interesting, informative, and at times fascinating. The reader, depending upon his fancy, will find well-balanced discussions on such subjects as the life cycle, differences between and within species, the influence of environment, and phylogeny.

It is said that fish have a phylogenic history at least three times greater then birds and mammals. The chemistry of aquatic forms, on this basis alone, would be expected to offer new and refreshing perspectives in biology. The discussions in this book support such a conclusion. Students of comparative science may well recognize the wealth of provocative data afforded by oceanic species. Indeed, the relevance of marine biochemistry to humans is well documented by discussions of matters such as hormonal controls in spawning and the fate of various foods. Nutritionists may well enjoy dissecting a discussion of the question "Is it possible to acquire a different composition through a change of diet?" Furthermore, accounts of such phenomena as the fascinating ability of *Salmo gairdnerii* to undergo extensive vascular degeneration during spawning, followed by a *reversal* of this process, should stimulate the student of human diseases to take another look at ocean life.

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Tracing Mathematical Concepts

The Nature and Growth of Modern Mathematics. EDNA E. KRAMER. Hawthorn, New York, 1970. xxvi, 758 pp., illus. $24.95.

The Nature and Growth of Modern Mathematics is a monumental volume of 30 chapters written for the purpose of surveying the entire field of mathematics with particular emphasis upon those ideas that have become popular during the 20th century. An "oscillatory-type" spiral approach is used in which the author moves forward historically but also steps backward frequently as the book develops in order to capture the essence of key mathematical concepts. In this way the concepts are traced from their origins in antiquity to their more modern formulations. The writing is richly interlaced with mathematical lore and interspersed with biographical sketches of prominent mathematicians in an attempt to provide insight into the humanistic motivations for the birth of particular mathematical ideas.

A review of the treatment of game theory and probability will illustrate this approach. Early in chapter 9, the stage is set for contrasting the nature of probability theory with that of scientific determinism by discussing 17th-century Newtonian mechanics with its emphasis upon precisely defined relations between present and future conditions of physical events. In the following chapter, "The elements of strategy in war and peace," chance-dominated game theory is discussed, with emphasis upon the contributions of John von Neumann (a brain as superb as von Neumann's provoked Hans Bethe to fancy the possibility of a species superior to man!). At this point, a detour is taken through probability theory, beginning with the classical, 17th-century, Bernoulli-Laplace definition of probability, giving an axiomatic treatment of a few of the fundamental theorems of probability, and concluding with a mention of the need for measure theory due largely to Emile Borel. Pascal's definition of mathematical expectation is utilized in discussing the solution of certain matrix games. This is followed by a treatment of general games and statistical decision theory as advanced by Abraham Wald. One of the concluding chapters of this sequence, "From dice to quantum theory and quality control," begins with an analysis of games of chance as proposed by the 17th-century gambler Chevalier de Méré, leading to a discussion of conditional probability and the modern use of quality control. In this series of chapters, extensive sections are devoted to biographies of earlier mathematicians, such as Euler, Newton, and Laplace, as well as of more modern ones such as Borel, von Neumann, and Wald, in addition to an enlightening description of the highlights of the mathematical ideas. In a similar manner concepts important to algebra, analysis, geometry, logic and foundations, and topology (angelic geometry) are developed.

This volume was written for an audience of well-educated, highly interested laymen and not primarily for mathematical specialists, although it does seem clear that a specialist will enjoy reading this book, particularly those sections that are beyond his specialty. The author has certainly achieved her purpose of writing a stimulating volume for the general reader, but in so doing she has made some sacrifice of precision and mathematical rigor, which some may feel is a shortcoming.

The Nature and Growth of Modern Mathematics richly deserves a place on any mathematical bookshelf. It appears that it will rank very favorably with the popular and successful classic *What Is Mathematics?* written in 1941 for a similar audience by the mathematical scholars Richard Courant and Herbert Robbins.

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Omnipresent Phenomena

Separation of Flow. PAUL K. CHANG. Pergamon, New York, 1970. xviii, 778 pp., illus. $40. International Series of Monographs in Interdisciplinary and Advanced Topics in Science and Engineering, vol. 3.

As he breathes and moves man generates separated flows. Around him wind and water currents give rise to separated flows with vastly varied scales and shapes which have long intrigued him practically and esthetically (witness Leonardo da Vinci's journal). Man was unable to fly until he learned how to streamline his flows, that is, how to minimize separation effects, but on landing and deceleration he promotes flow separation to achieve his ends. Yet his understanding of the omnipresent separation phenomena remains essentially fragmented and empirical. In the presence of largely unavoidable flow instabilities and turbulence, the well-established governing field equations—the Navier-Stokes equations generalized for compressibility—defy even his most powerful computing machines. The problem of flow separation is a highly nonlinear, multidimensional, singular-perturbation problem in partial differential equations, often with only stochastically defined initial conditions—a problem unlike most others scientists have faced.

The author of *Separation of Flow* undertook "an attempt to compile references . . . in basic physical processes, analyses, and experiments covering the