originated that stimulated the development of integration theory." Isn't that much of what history is all about?

Classical and Modern Integration Theories starts with Cauchy and goes on through Riemann to the early stages of measure theory. Here there is an outstanding formulation of the differences and connections between the several measure theories. After a good presentation of Lebesgue's integral measure theory, Pesin continues on to outline the theories of Denjoy, Perron, and Daniell.

The English edition of *Classical and Modern Integration Theory* sets four aims for itself. It succeeds in only two. As a book for a student already knowledgeable in Lebesgue's theory who wishes to see where and how it connects up with Riemann integration it is excellent; it would also be useful as a refresher for a former student who has not looked at the topic for a long time. Unfortunately, it does not succeed as a text for a novice; there are too many barriers. The book has some crucial misprints; the notation is often special and nonintuitive. True, there is a glossary of terms, but not all necessary items are included. In fact, the selection of terms is baffling; for example, continuity is defined, but absolute continuity is not. Finally, the two indexes specially prepared for the English edition are, admittedly, only partial. In sum, we have a right to expect a better job both of bookmaking and of history.

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Operations on the Heart

The History of Cardiac Surgery, 1896–1955. STEPHEN L. JOHNSON. Johns Hopkins Press, Baltimore, Md., 1970. xviii, 202 pp., illus. $9.50.

The Scalpel and the Heart. ROBERT G. RICHARDSON. Scribner, New York, 1970. x, 326 pp. + plates. $8.95.

Since the time of the ancients the heart has been accorded a place of predominance as well as mystery. At one time or another it was thought to be the seat of life, the source of vital spirits, the site of heat production in the body, and the repository of sentiments such as love. As recently as the presidential campaign of 1964 Americans were urged to vote with their hearts, not their minds. No wonder then that when heart transplantation became a reality in South Africa in late 1967 the world's imagination was immediately captured. These two books will explain much of the work that led up to our current phase of cardiac surgery, and they complement one another nicely.

Johnson, a member of the biomedical engineering faculty at the Johns Hopkins Medical School, has carefully shown the slow progress of the story, beginning with the successful suture of cardiac wounds in the 1890's, to the open-heart surgery of the 1950's. The value of his book lies in his approach to the story and in the superb illustrations so necessary to a nonsurgical reader. Much of this all too brief book is devoted to the necessary developments in physiology that were prerequisites to successful thoracic and cardiac surgery. The sections on electrocardiography, cardiac resuscitation, and cardiac catheterization, and the final chapter devoted to the heart-lung machine are particularly noteworthy. The inclusion of numerous drawings and diagrams makes for much easier comprehension of both problems and solutions. Johnson, moreover, brings to life a few of the contributors to the story, although he makes no attempt to assess their general work.

Robert Richardson, a London surgeon who is now a writer and editor, has the pleasing facility for making the complex technical and scientific problems more understandable to the nonspecialist. In this, his second book in the history of surgery, he describes the events surrounding the surgery of the heart and major thoracic blood vessels, as well as some of the physiological developments in anesthesia, hypothermia, and open-heart surgery also discussed by Johnson. Richardson's is the more elegantly written book, and it has a wider audience in mind. For all its information, however, it is less broad in historical perspective than *The History of Cardiac Surgery*. Richardson supplies a wealth of detail for the many advances made since 1955, when Johnson ends his story. Richardson's book supplies only a few references at the end whereas Johnson's book is fully documented. It is to Richardson's credit that he utilizes the important, but generally neglected, book by V. P. Demikhov, *Experimental Transplantation of Vital Organs*, published in Russia in 1960 and translated into English in 1962. The Russian contributions to cardiac surgery are extensive, and they must be taken into consideration.

Richardson's book is exciting reading, yet it suffers from severe defects. It is inadequately illustrated (especially when compared to Johnson's book), and it really is an extensive review of the literature without bringing to life the principal characters.

Surgery, especially cardiac surgery, has so captured public interest that these books should find a ready audience. Yet the question remains why the quality of the history of surgery as a whole has not improved much since the time of Gurlt, Fischer, and Billings, all writing more than 70 years ago. One problem has been, as Richard Meade noted recently in his *Introduction to the History of General Surgery*, that we have focused too much attention on the surgeons, to the neglect of the operations they performed. These two books do much to swing the balance the other way. Still, we are left with a feeling, especially from Richardson's book, that we are reading a catalog of operations, their dates, successes, complications, and failures, all piled on one after another. Do we not have to look for the development of cardiac surgery within the history of general surgery and within the history of 20th-century medicine as a whole? Do surgeons only operate or devise ingenious equipment to enable them to operate more safely or in more complicated situations? Do they not have some guiding principles, some philosophy, some thoughts about solving scientific and technical problems? Stereotypes aside, I think the answer is an unqualified yes; yet no one seems able to come to grips with these aspects of the history and development of surgery. Perhaps it is foolish to expect either a surgeon or a historian working alone to accomplish the difficult task of synthesis. A joint effort may be the solution.

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Food in the Sea

Marine Food Chains. Proceedings of a symposium, Aarhus, Denmark, July 1968. J. H. STEELE, Ed. University of California Press, Berkeley, 1970. viii, 552 pp., illus. $13.50.

The advent of the computer has begun to make the prediction of events taking place in our biosphere a practical reality. Yet simulation of the environment cannot proceed without basic

biological input, and so the experimentalist and the modeler must be brought together. This was clearly an important end result of the Marine Food Chain Symposium.

The scope of the papers is wide, covering marine organisms from bacteria to whales and the environment from the pelagic zone to the bottom and right into the spaces between the sand grains. The volume is not a comprehensive review of trophic ecology but rather a series of insights into current ecological thinking regarding the food web. As in most volumes of its type, the papers are somewhat variable in quality and idea content, but on the average they are topical and make important contributions to marine ecology.

The book is divided into six convenient sections each of which is introduced by a symposium participant and which are followed at the end by an overall summary by L. B. Slobodkin. A very valuable feature is the contribution made by a number of Russian scientists, whose work may be unfamiliar to many.

Part 1, Recycling of Organic Matter, gives considerable insight into some of the feedback processes whereby the whole production cycle would seem to be made more efficient. For instance, here Khailov and Finenko show how large surface-active organic compounds become adsorbed on detritus particles which provide a substrate for the bacteria which, at the same time, utilize these compounds for energy and increase the nutritive value of the detritus for other animals by their own presence.

The section Pelagic Food Chains includes papers by Mullin and Brooks and Reeve, who have used cultured organisms to yield important new knowledge about the biology of zooplankton. Here also Petipa and her colleagues combine field and laboratory observations to describe in considerable detail the food web of a Black Sea planktonic community. Other papers included under this heading discuss such diverse topics as the relationship between temperature and growth efficiency, the consequences of submergence in zooplankton, and the fitting of older population growth data to newer population models.

Under Feeding Mechanisms are papers discussing the functional morphology and nutritional physiology of bivalve mollusks, the striped mullet, and the baleen whales. Also included here is a discussion of the relationship between feeding types in the benthic community and their geographical distribution in northern European waters by V. I. Zatsepin.

In the section Food Requirements for Fish Production, Trevallion *et al.* nicely illustrate an example of biological feedback in which the depredations of young plaice feeding on *Tellina* siphons ultimately lower the fecundity of the bivalve to the point where different food sources must be sought by the predator. Under this same heading, Gulland relates the output of commercial fisheries to food chain studies, concluding that previous estimates of food chain efficiency may be too low.

The section Food Abundance and Availability in Relation to Production includes papers concerned with the detailed description of feeding niches in fish, the relationship between feeding behavior and survival in young herring, the consequences of different-lengthed food chains for the same species of fish, and the significance of food size in determining availability for different trophic levels in food chains.

The final grouping, Theoretical Problems, tends to be a catchall but includes important models on phytoplankton-zooplankton relationships by McAllister and on utilization of the environment by fishes by Paloheimo and Dickie. Both models actually are considered to some degree elsewhere in the literature but are not so well documented as in this volume.

So this book answers few important ecological questions, but goes a long way toward disposing of some ancient ecological dogma. It is rather a composite progress report and as such should be a source of stimulation to workers in the field.

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Immunology

Biochemistry of Antibodies. ROAL'D S. NEZLIN. Translated from the Russian edition (Moscow, 1966) by Michael C. Vale. Fred Karush, Transl. Ed. Plenum, New York, 1970, xiv, 382 pp., illus. $25.

Within the last decade, intensive studies of the structure of antibodies (or immunoglobulins) have had an enormous impact on our understanding of the immune response. Not only have fundamental concepts been brought into sharp focus, but most of the major problems have been reduced to the molecular level and are proving amenable to attack by the tools of modern molecular biology. The demonstration of marked heterogeneity in the amino acid sequences of antibody molecules has provided strong support for the view that the role of the antigen in the assembly of antibodies is selective, rather than instructive. Detailed analyses of the primary structure of immunoglobulins coupled with analysis of the biosynthesis of antibodies have confirmed the previous view that the immune response is the result of a very special biological system. Variations in the amino acid sequences of different antibody molecules are confined to the amino terminal portions of the constituent light and heavy polypeptide chains, and it is these portions of the molecule that are undoubtedly involved in antigen binding. The patterns of variation that have been observed suggest the possibility that unusual genetic mechanisms are required to provide this diversity, and there is probably a special process responsible for linking these variable regions with the remainder of each chain.

This overall picture of the biochemistry of antibodies does not emerge clearly from the translation of Nezlin's book. The account is presented in the style of a review of the literature and thereby lacks the necessary central theme and organization to make it useful as an introductory text. In considering theoretical aspects or controversial points, the author attempts to represent nearly every concept or argument —including some known to be incorrect. This attempt to be comprehensive seriously breaks up the flow of ideas. As a result the book lacks focus and appears as a collection of distinct chapters, rather than as a cohesive unit.

In addition, the book is outdated—undoubtedly a result of the time required for translation from the Russian and the tremendous speed with which the field is advancing. The major portion summarizes the studies of the biochemistry of antibodies to 1966. For this edition the book has been corrected and partially updated to about 1968. However, many important advances have been made since this time. For example, since this book was written the complete covalent structure of one entire immunoglobulin and the partial sequence of many others have been reported. It is now known that the variable regions of light and heavy chains are approximately equal in length, show