vation from Bayes' theorem, Kullback develops the logarithmic measure and related concepts into a unifying principle in testing hypotheses and in sampling theory. As he writes in the preface, "There is currently a heterogeneous development of statistical procedures scattered through the literature. In this book a unification is attained by a consistent application of the concepts and properties of information theory." Thus, the book contributes both to the teaching of mathematical statistics and to the advance of the subject.

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**Critical Problems in the History of Science.** Proceedings of the Institute for the History of Science at the University of Wisconsin, September 1–11, 1957. Marshall Clagett, Ed. University of Wisconsin Press, Madison, 1959. xiv + 555 pp. Illus. $5.

The history of science has two kinds of "critical" problems: the finding of facts and the manner of their presentation. History could thus be divided into two branches; since no distinctive word exists for the first, perhaps we should call its histories (or historiology) as the partner of historiography. Both branches are illuminated in this collection of 16 papers, accompanied by 19 commentaries containing the formal conference discussions. In many of the papers, the problems of historical facts are dominant, and the several areas in which more facts must be collected are indicated. The problems of historiography remain in the background in the first sections of the book, but they are fully and broadly brought out by Father Joseph T. Clark, who discusses "the philosophy of science and the history of science." From there on, the discussions of historiography continue.

Great emphasis is given to the Scientific Revolution—the emergence of the new scientific attitude up to the time of Galileo and Newton. More than 40 percent of the book is devoted to this topic, and it appears that the greatest recent progress in the history of science has been made here. Mainly through the efforts of A. C. Crombie, E. J. Dijksterhuis, Rupert Hall, and Giorgio de Santillana (all were participants in this symposium) the stature of such men as Grosseteste in the 13th century, and Oresme in the 14th, has become more clearly defined. Yet, as Rupert Hall wisely says, we need not "admire Galileo less, because we admire Oresme more than people did in the days when everything in the *Discorsi* was assumed to have sprung unheralded from his brain" (page 195). Our admiration for historical figures is not governed by a law of conservation which would allow only an equivalent shift in distribution of a constant quantity.

One of the highlights in this section is de Santillana's discussion of the role of art in the scientific renaissance. His hero is Filippo Brunelleschi (1337–1446), and although Brunelleschi's singular significance is doubted by Crombie, neither Crombie nor the other commentators act with the intent, or effect, of demolishing real enthusiasm.

After an interlude covering teaching of the history of science, about 70 pages are given to the topic science and the French Revolution. In particular, Charles Coulston Gillispie talks about the Jacobin leadership that regarded intellect as the enemy of freedom and "misunderstood science with a particularly damaging moral enthusiasm for nature" (page 268). All this is not a mistake that belongs only to the past; it has too much resemblance to a recurring kind of animosity that politicians direct against science even in our times. One of the interesting details in Gillispie's story is the remark on the French patent law that still retains the spirit of 1791 in favoring mechanical inventors against scientifically informed and acting judges (examiners in our language).

The next 80 pages deal with the law of conservation of energy. Here, even when compared with Thomas S. Kuhn's artful writing and I. B. Cohen's erudition, the best part is Carl B. Boyer's comment. In wit combined with wisdom, he matches the comments made by Richard H. Shryock and Conway Zirkle concerning the next two papers on biology by J. Walter Wilson and John C. Greene.

Chemistry has been allowed only the last 60 pages. This is certainly too little, particularly since Cyril Stanley Smith treats only the structure of metals, and the only really chemical topic is a paper by Marie Boas on the structure of matter and chemical theory.

In the preface, Marshall Clagett admits that science in the 19th century is not adequately presented. The reason he gives for this is weak and should certainly not be guiding when a subsequent symposium on the history of science is organized. In the meantime, we can be extremely grateful for the present volume. Its rich material is very successfully discussed in thesis and antithesis which bring the subject out in full plastic form. The words that Ernest Nagel used, "Despite my doubts about some points in Father Clark's paper, I cannot conclude these comments without once more expressing my admiration . . ." (page 150), similarly apply to other comments. The authors do not hide their enthusiasm and love for the beauty of their science, and the reader is made to share this feeling with them.

The index, although brief, deserves a special word of praise for its informative value, and so does the National Science Foundation whose grant made it possible to publish this important book at such a modest price.

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**Experimental Surgery.** Including surgical physiology. J. Markowitz, J. Archibald, and H. G. Downie. Williams and Wilkins, Baltimore, Md., ed. 4, 1959. xii + 931 pp. Illus. $12.50.

This book covers a wide range of experimental surgery, from the many procedures used in studying gastric physiology to the construction of arteriovenous fistulae, Starling heart-lung preparation, and organ and tissue transplantation. In general, the operative techniques are adequately described, so that one need not necessarily consult original references, and the book may be used as a text and guide by the surgeon making experimental preparations and as a reference source to literature on experimental surgical subjects. The writing is lucid, easy to read and follow, and it is frequently punctuated by quotations, usually appropriate and always interesting and entertaining, from the classics and from popular and current literature.

The book will be extremely helpful to those in experimental laboratories, particularly in those that concentrate predominately on work on dogs. The authors have physiological and veterinary interest and orientation and have presented material pertaining particularly to animals which is not readily available elsewhere. One or two decades ago human physiology was largely based upon such animal work. Though it is still influenced by such work, a

wealth of experimental observations on human physiology have been made available by modern techniques. Incomplete and inadequate use is made of this information in this text, and one must be cautious in applying the author's statements to clinical surgery. Anesthetists and thoracic surgeons would take exception to the statement that artificial respiration is not needed in thoracotomy on human beings unless both chests are entered, or that some cyanosis is probably better than the alkalosis that comes with overventilation. There are several uncritical statements such as the suggestion that blood transfusions can be given subcutaneously, although admittedly better intravenously, and that large volumes of plasma can be given in blood replacement. Certainly the occasion for using plasma with unburned experimental animals must be rather uncommon. A misconception is given by the statement that "the damaged gallbladder weeps cholesterol" in connection with the formation of gallstones.

Although these are only a few of the exceptions I would take to statements in the book, I believe the advantages more than adequately compensate for some inaccuracies and that the book will be helpful to the host of physicians working in experimental surgery today.

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**The Viruses.** Biochemical, biological, and biophysical properties. vol. 3, *Animal Viruses.* F. M. Burnet and W. M. Stanley, Eds. Academic Press, New York, 1959, xvii + 428 pp. Illus. $12.

This third volume continues the basic pattern of the series [*Science* **130**, 657, 724 (1960)]; the 13 chapters deal almost entirely with topics that cut across taxonomic lines within the large group of animal viruses. It is difficult to make a general characterization of the discussions, which were written by 11 different authors, but there is a common denominator in their primary concern with viral activity at the cellular level.

The volume begins with an introductory chapter by Burnet in which the main groups of animal viruses are presented and the status of their taxonomy is discussed. The following seven chapters deal with various aspects of virus-host cell interactions, and the first five of these are arranged in a logical order related to the sequence of entrance of a virus into a cell, the activities associated with intracellular virus, and the release of virus from the cell. Because of our ignorance concerning the first and third of these stages, in the case of animal viruses, the bulk of what can be said concerns the second stage. Thus, Burnet uses a relatively few pages for a discussion of the initiation of infection by animal viruses, although the mechanism of viral attachment to erythrocytes, leading to hemagglutination, may well be a closely related phenomenon and is properly inserted at this point in two chapters, "Hemagglutination by animal viruses," by Anderson, and "Chemistry of virus receptors," by Gottschalk. Studies on viruses within cells are described by Bang in "The morphologic approach," and by Isaacs in "Biological aspects of intracellular growth." The latter includes a section on the release of virus from infected cells. Important areas of virus-host cell relation are covered in Schlesinger's discussion "Interference between animal viruses," and in Horsfall's treatment "Inhibitors of multiplication."

The next three chapters deal with genetic problems. "Variation in virulence in relation to adaptation to new hosts," by Fenner and Cairns, extends the approach from the cellular level to consideration of more complex systems (tissue culture, embryonic membranes) and eventually to pathogenesis of viral infections in the whole animal. One wishes that more space had been given in this chapter or elsewhere to the topic of latency or "carrier state" of virus-infected animal cells. This represents the only major omission that I detected. In "Serologic variation," by Francis, studies on the influenza viruses are reviewed, and practical implications of their genetic changes are made apparent. Burnet's "Genetic interactions between animal viruses" analyzes the methods and results of recombination and related phenomena.

The final chapters deal with groups of viruses that are not yet readily amenable to discussion under the topics listed above. These are "Problems concerning the tumor viruses," by Andervont, and "The insect viruses," by Smith. Andervont describes the properties of representative tumor viruses as a basis for presenting the current status of the active field of virus-tumor investigation. Smith's chapter represents a general review of the insect viruses; it is apparent that significant similarities and differences between these viruses and the other large groups have not yet been defined except at the level of their chemical and physical nature.

There is a subject index, and an index of references by authors. Illustrations are confined to the chapters by Bang and Smith.

This work is outstanding in its presentation of animal virology primarily from an academic viewpoint. Viruses are approached as biologic entities, not as culprits in public health problems. The study of viruses has moved out of the descriptive phase of its development, and the three volumes of this series, in addition to providing a valuable source of expert information, represent an important stone in the building of an integrated science of virology.

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## Reprints

*Derivatives and Differentials, Definite Integrals, Expansion in Series, Applications to Geometry.* Edouard Goursat. Translated by Earle Raymond Hedrick. Dover, New York, 1959 (unabridged republication of the Hedrick translation). 556 pp. Paper, $2.25.

*Differential Equations.* Edouard Goursat. Translated by Earle Raymond Hedrick and Otto Dunkel. Dover, New York, 1959 (unabridged republication of 1917 edition). 308 pp. Paper, $1.65.

*From Magic to Science.* Essays on the scientific twilight. Charles Singer. Dover, New York, 1958 (reprint). 284 pp. Paper, $2.

*Functions of a Complex Variable.* Edouard Goursat. Translated by Earle Raymond Hedrick and Otto Dunkel. Dover, New York, 1959 (unabridged republication of 1916 edition). 269 pp. Paper, $1.65.

*Functions of a Complex Variable.* James Pierpont. Dover, New York, 1959 (reprint of ed. 1, 1914). 597 pp. Paper, $2.45.

*Lectures on the Theory of Functions of Real Variables.* vols. 1 and 2. James Pierpont. Dover, New York, 1959 (unabridged republication). Paper, $2.45 each.

*De Magnete.* William Gilbert. Translated by P. Fleury Mottelay. Dover, New York, 1958 (unabridged republication of 1893 translation). 419 pp. Paper, $2.

*A Source Book in Mathematics.* vols. 1 and 2. David Eugene Smith. Dover, New York, 1959 (unabridged republication of 1929 edition, original edition published in one volume). 701 pp. $1.85 each.