mathematical chair at Cambridge. During the ensuing years Newton continued his sheltered life at Trinity College, leaving Cambridge only a few times. He worked assiduously on his researches in mathematics, chemistry, and optics. From these years dates his construction of the reflecting telescope. He corresponded with John Collins in London, a man of wide scientific connections, eager to assist him in making his discoveries known, and with Henry Oldenburg, secretary of the Royal Society. Oldenburg, a man of even wider scientific connections, sponsored Newton's entry into the Royal Society after Newton had presented a communication on his telescope. Shortly after having become a Fellow of the Society, in 1672, Newton published in its *Philosophical Transactions* the "New theory about light and colours," his first printed paper.

Most of Newton's mathematical work in the period 1670–1673 dealt with the preparation of his Lucasian lectures on optics and with the casting of his discoveries in the theory of infinite series and fluxions into publishable form. The manuscripts on these subjects form the bulk of this third volume, and the greater part consists in the majestic tract "De methodis serierum et fluxionum," on the methods of series and fluxions, the first ample exposition of what we now call the calculus. The market for a book on such an abstruse subject being severely limited, Newton first expected it to be published as an appendix to a Latin version of an "Algebra" written by the Dutchman Kinckhuysen. Nothing came of this or of any modified plan of publication, and the manuscript rarely left Newton's files until it was published in 1736, after his death, by John Colson in an English translation from a copy made by William Jones. The original Latin text appeared only in 1773. If this manuscript, a labor of reworking and amplifying older notes, composed in the winter of 1670–71, had been published at the time, the history of the calculus would have run a different course. As it was, the calculus came to published light only in 1684 by means of a small paper by Leibniz (who did not mention Newton), and Leibniz's version won the day, but only after a bitter fight of gigantic pettiness.

Perhaps the most interesting sections of the remaining part of this third volume are the extant texts of Newton's optical lectures. They can now also be compared with the published text, in this case the posthumous *Lectiones opticae* of 1729. Another interesting paper, unpublished so far, is a study on the harmonic motion of a point in a cycloidal arc under gravity. Here Newton finds its tautochronic character, and this independently of Huygens, who published his famous results on the pendulum in 1673. Here, happily, there was no priority fight.

We can only have the greatest admiration for the patient, painstaking, and dedicated scholarship which the editor and his colleagues have bestowed on their task. Studying, understanding, dating, and collating the Newton manuscripts is an arduous task. An added task was the English translation and the preparation of the introduction and the generous notes, which by themselves almost constitute an introduction into late-17th-century mathematics. Beautifully presented by the publisher, this is a work which will be eagerly consulted for many years to come, a veritable (we blush for the cliché) *momentum aere perennius.*

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NMR in Organic Chemistry

Nuclear Magnetic Resonance Spectroscopy. FRANK A. BOVEY. Academic Press, New York, 1969. x + 398 pp., illus. $16.50.

The book under review is a brief introduction to nuclear magnetic resonance spectroscopy in the tradition of the now classic monograph by Pople, Bernstein, and Schneider (1959). Since the book is actually an introduction to applications of high-resolution NMR to organic chemistry, the title is somewhat too broad.

The sections the reviewer found best are those that reflect the research of the author: the part dealing with various aspects of molecular shielding, the chapter on coupling of nuclear spins and their dependence on molecular structure and geometry, and the section dealing with symmetry and polymer configuration. Polymer chemists in particular will benefit from the treatment of problems related to molecular symmetry and polymer configuration, because coverage of NMR applications to the study of polymers is usually missing in comparable monographs. The actual text is only 242 pages long (the rest are various appendices), and many important topics are treated only briefly. But even the sketchy outline of some recent developments is helpful; on the basis of a few key references the reader can choose several literature sources from which to learn in detail about the subject in question.

For a chemist dealing with organic structural problems acquaintance at least with some of the rules and approaches used in the analysis of high-resolution NMR spectra of strongly coupled spin systems has become a necessity. The author introduces in an empirical way the analysis of simple spin systems such as *AB*, *ABX*, and AB_2. The reader who attempts to recognize a typical spectral pattern of a simple, strongly coupled spin system often occurring in organic compounds is also aided by a rather extensive appendix in which about 300 computer-generated line spectra are given.

In the section dealing with chemical exchange processes a more extended discussion of complete line-shape analysis and of the relative merits of various approximative methods still often used by organic chemists might have been helpful.

As the author points out, the book is an extension of a review article on NMR which he published in *Chemical and Engineering News* in 1965. Owing to its nonmathematical, empirical approach and condensed size, the monograph would be useful to chemists and workers in other fields who want to be introduced to the basic ideas of high-resolution NMR spectroscopy and who also are trying to develop some working knowledge in solving problems related to organic chemistry.

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Antibodies, DNA, and RNA

Nucleic Acids in Immunology. Proceedings of a symposium, New Brunswick, N.J., Oct. 1967. OTTO J. PLESCIA and WERNER BRAUN, Eds. Springer-Verlag, New York, 1968. xviii + 726 pp., illus. $22.

This book begins with a discussion of methods for obtaining antibodies to nucleic acids. Antigens can be obtained either by complexing oligo- or polynucleotides with methylated serum albumin or by the covalent bonding of

nucleotides to proteins. Some antiserums can distinguish single-, double-, or triple-stranded helical polyribonucleotides. Some differentiate between native and denatured DNA and are useful in elucidating structural changes in DNA. Antiserums to oligo- and polydeoxynucleotides have been used to examine the mechanism of bacterial transformation.

Antibodies to nucleic acids are also produced in some human diseases. Serums from patients with systemic lupus erythematosus may combine only with denatured DNA, only with native DNA, with both forms of DNA, or with nucleoprotein. Antibodies from patients with collagen diseases, labeled with fluorescein, react with various nuclear components of human white cells.

Antiserums to bacterial ribosomes are specific for the polyphosphate backbone, not for the bases. They have been used to study the number of strands in synthetic polynucleotides and to measure the proportion of the RNA that lies on the surface of each ribosomal subunit.

A session on nucleic acids as nonspecific stimulators of immune responses precedes the discussion of the role of nucleic acids in specific antibody formation. This fascinating problem, the genetic control of the means by which an animal can synthesize antibodies to an almost infinite variety of antigens, has not yet been solved, but the numerous skillful approaches described at this symposium give the impression that, as of 1967, the answer lurked just around some corner. The topics include the roles of macrophages and lymphocytes, transfer of information by isolated RNA's or RNA-peptide complexes, immunoglobulin synthesis and assembly, and theories, deduced from amino acid sequences, of the genetic control and evolution of antibody polypeptide chains.

Each group of papers is followed by a general discussion of experimental techniques and interpretation of results; these discussions are one of the most valuable parts of the book.

The final chapter is an address by Melvin Cohn entitled "The molecular biology of expectation," in which he discusses "the mechanism by which an individual can react in an adaptive way to an unexpected stimulus." Theories of somatic versus germline mutation are discussed at length for the immune system and considered briefly in regard to control of the detoxifying and learning mechanisms.

The book is highly recommended to all those who are interested in either nucleic acid structure or immunoglobulin synthesis.

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Flagellates

The Biology of Euglena. DENNIS E. BUETOW, Ed. Vol. 1, General Biology and Ultrastructure. Academic Press, New York, 1968. xii + 364 pp., illus. $19.

This volume on *Euglena* and the forthcoming second volume summarize what is known about the genus. Volume 1 ranges from taxonomy, ecology, and locomotion through morphology and cytology to growth in axenic cultures and some general aspects of biosynthesis. The chapter on cultivation and growth (J. R. Cook) is a comprehensive survey of methods for maintaining cultures (small to large volumes, conventional methods to continuous-culture techniques). Recent work on specific nutritional requirements is covered thoroughly. Following a summary of changes which *Euglena* undergoes as the culture grows older, the chapter concludes with a section on environmental influences on growth of *Euglena* in cultures, stressing effects of such factors on morphological features as well as biochemical activities. The chapter on morphology and ultrastructure (D. R. Buetow) begins with a brief description of active and flagellated stages, continues with a compact review of the pellicular complex in *Euglena*, and then proceeds to flagella, cytoplasmic inclusions, and various internal organelles. The chapter contains more than 40 excellent micrographs and several good diagrams. The nucleus is covered in a chapter which correlates revelations of electron microscopy with observations made with light and phase-contrast microscopes (G. L. Leedale). This treatment, highlighted with a beautiful series of anoptral contrast photomicrographs of living *E. gracilis* undergoing fission, yields a very informative account of mitosis. Correlated photomicrographs of stained preparations are exceptionally clear, as are a number of electron micrographs showing particularly the microtubules ("spindle elements") in dividing nuclei. Locomotion and other movements (T. L. Jahn and E. C. Bovee) are related, as far as possible, to the structure of *Euglena* (and closely related flagellates). Responses to physicochemical stimuli are critically reviewed, and phototaxis is related to structural features of the stigma and the light-sensitive paraflagellar swelling (specific function still uncertain). Swimming is discussed in detail, metaboly is considered in relation to structure of the pellicular complex, and mechanisms for gliding (still considered a mystery) are discussed. Rates of biosynthesis (carbohydrate, protein, DNA and RNA, cell number, dry weight) are compared for *E. gracilis* (supplied with different substrates) and with cultures of mammalian tissue cells (B. W. Wilson and B. H. Levedahl). For those who sometimes meet their flagellates outside labeled culture tubes, there is an excellent chapter on ecology (J. B. Lackey) and also a well-illustrated section on taxonomy of *Euglena* (L. P. Johnson). A potentially valuable feature of this volume is the consistent emphasis on major and minor gaps in the available information on *Euglena*. If these signposts awaken the curiosity of at least a few industrious investigators, *The Biology of Euglena* will be more than worthwhile on this basis alone.

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Responses to Environment

The Climatic Physiology of the Pig. L. E. MOUNT. Williams and Wilkins, Baltimore, 1968. x + 274 pp., illus. $14.50. Monographs of the Physiological Society, No. 18.

The pig is being used increasingly in biomedical research. The author here indicates that the physiological analogies between pig and man are more apparent than real. Especially is this true in regard to the skin of the animal, the subject of research carried out in the belief that it is similar to that of man. Mount points out the patent fallacies of such an approach, and does it well. There are purposes for which the pig can be the animal of choice, such as in artificial heart studies, where both anatomical and physiological similarities to man are observable. This book, however, does not treat aspects of the pig which would make it a useful work of reference for such purposes, dealing rather with the physiological responses of pigs to climatic variables with a comprehen-