"One can wisely doubt whether the study of mathematics is worth while and can find good authority to support him." Were it not for the fact that Kline has written a book of "kleine Mathematik" one could take much pleasure in his partially successful attempt to persuade the indifferent and opposed that the classical concepts of mathematics, including algebra, geometry (including projective), trigonometry, and calculus (described almost intuitively) have influenced and remain important in human culture.

These first six volumes in the *Popular Lectures in Mathematics* series (published by Blaisdell Publishing Company but copyrighted by Pergamon Press in 1961) are all translations from Russian originals dated 1951 and 1952 (volumes 2 and 4) or 1957 to 1959. In length they vary from 57 to 79 pages.

Each volume is attractively priced ($0.95), but for this one pays the price of an unattractive page resulting from the photographic reproduction of typescript. Worse, there are a good many places (particularly in volume 6) where superscripts and the like are badly reproduced to the extent that an inexperienced reader will be seriously inconvenienced. The mathematical public deserves to be warned that other instances of such carelessness by this printer (Pergamon) have occurred.

In striking contrast to the appeal to practical importance, as in Kline's book, or to efficiency and economy, as in the MAA study, the six Russian authors explore their subjects "for fun" and with casual disregard of time, space, and practicality. Repetition from varied points of view is deliberately used to secure clarity, and indeed it is said (volume 1, page 12) with the utmost good sense that "In order to learn to use the method of induction it is necessary to discuss a sufficient number of problems." This is not carried to the extreme of repetitive tedium, at least not for the age level addressed. The preparation assumed varies somewhat, but it is noted (typically) in the foreword to volume 1 that for chapter 1 and for part of chapter 2 the first 7 years of school mathematics is sufficient and that the mathematics course of a full secondary school suffices for the remainder. In volume 6 the elements of inequalities are assumed known, and the author notes that "the independent solution of a few difficult problems will undoubtedly be more useful to the pupil than the solving of many simple ones." He continues: "We suggest therefore that the pupil turns to the solutions only after he has found an independent solution, possibly differing (which is very good!) from the solution indicated by the author." (The current flurry of interest in this country in a simple-minded version of teaching machines comes unfavorably to mind.) The manner in which such detailed attention to pedagogical purpose is applied must of course vary with subject matter and audience, but it seems to me to be the key to successful mathematical exposition.

Volumes 1 and 6, *The Method of Mathematical Induction* and *Inequalities,* are of the most general mathematical interest, but volume 2 takes one delightfully and easily from the origin of Fibonacci numbers in the "rabbit problem" of nearly 750 years ago to continued fractions and geometric paradoxes. In volume 6 (on page 15) time has revised the statement that e and π have been calculated to 808 decimal places, since a hundred thousand have now been calculated. Also in volume 6 are interesting problems in maxima and minima, treated simply yet without benefit of the calculus.

Some Applications of Mechanics to Mathematics (note: *not* the reverse application) is fascinating and should stimulate the imagination of some students, but the volume is often so casual that the inclusion of the word "proof" in quotation marks, as on page 12, is well advised and the acknowledgment (on page 56) that "All the reasoning based on mechanical considerations can appear incorrect to fussy readers" is justified.

The two volumes on geometrical constructions are replete with many figures and the style is that of synthetic geometry, so proofs are generally imprecise by modern standards. Since the exposition is careful, this is not inappropriate for student readers. Volume 5 contains, as part 1, "Some theorems of synthetic and projective geometry," which culminate in the theorems of Brianchon and Pascal, and the book's title also serves as the title of part 2.

To summarize: the MAA study is chilled, dry wine, appropriate for a formal dinner by candlelight; the translations are a well-aged vintage from an undistinguished estate, about which one may be comfortably sentimental. Kline's book is, of course, a full case of pop. What is one to read? Forget professional advancement, and even sleep, and read them all: *e pluribus unum.*

Max-Planck-Institute

New Methods of Cell Physiology. Applied to cancer, photosynthesis, and mechanism of x-ray action. Otto Heinrich Warburg. Interscience, New York, 1962. xv + 644 pp. Illus. $34.50.

This beautifully produced volume of publications from the Max-Planck-Institute for Cell Physiology (Berlin) contains reprints of 103 papers completed between 1945 and 1961; 90 papers are written in German, and the remainder in English. About half deal with various aspects of photosynthesis; 18 are concerned with the metabolism of tumor cells, while the others are divided among investigations on the mode of action of x-rays, enzymology, and a number of miscellaneous topics, including methods for the isolation and determination of a number of substances in biological preparations.

Most of the papers reprinted here have previously been published in the literature, and they include work not only by Otto Warburg himself, but also by a number of other people who were, at some time during the period covered by the book, associates of Warburg at the Institute. These reprints encompass reports of experimental work in the various fields, as well as a number of reviews and discussions, such as the well-known paper by Warburg, "On the origin of cancer cells," which first appeared in *Science* [**123**, 309 (1956)].

The hitherto unpublished communications are divided among the various topics in roughly the same proportion as are the other papers in the book. Almost all of the new papers are very short, ranging in length from a few lines to three or four pages. Several deal with extensions and adaptations of manometric techniques: methods are described, for instance, for the determination of ascorbic acid, for the independent generation of three different gases during the course of an experiment without opening the reaction flask, and for the measurement of carbon dioxide partial pressures over bicarbonate-carbonate mixtures. Others describe investigations of the quantum requirement of photosynthesis, the influence of the partial pressure of carbon dioxide on the quantum requirement, the breakdown and resynthesis of glutamic acid in *Chlorella*, and studies on photosynthetic phosphorylation, including the inhibition of this activity by

o-phenanthroline. Two of the new papers are longer than the others: one describes the effect of x-rays on the metabolism of *Lactobacillus*, and the other discusses oxygen transport by illuminated chlorophyll.

It is indeed interesting, and in many ways helpful, to have collected in one volume a considerable number of important papers concerned with the methodology of investigation and the biochemical activities of cancerous and of photosynthetic systems. Those working in these areas certainly need to be familiar with this material. It must, however, be emphasized that much of the methodology is based on manometric techniques, and that many other means exist for investigating metabolism, which are of equal importance with manometry and which are not discussed in this book.

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Oscillating Theories

Fundamentals of Mid-Tertiary Stratigraphical Correlation. F. E. Eames, F. T. Banner, W. H. Blow, and W. J. Clarke. Cambridge University Press, New York, 1962. viii + 163 pp. Illus. Plates. $9.50.

This book, written by four paleontologists of the British Petroleum Company, is an ambitious attempt to synthesize what is known about marine Oligocene faunas, on a practically worldwide scale. According to the interpretations they adopt, discrepancies that have bothered some paleontologists are neatly resolved: discrepancies such as the absence of reticulate *Nummulites* in American deposits long accepted as of Oligocene age, the occurrence of *Pliolopidina* in the Eocene in America, and the appearance of *Miogypsina* s.s. and of some essentially Neogene and Recent molluscan genera in American deposits currently considered of late Oligocene age.

In part 1 (by the four authors), Oligocene and lower Miocene are traced from the Mediterranean region through the Middle East to East Africa and the Indo-Pacific region. The alleged Oligocene of the southeastern United States and the Caribbean region is examined. L. R. Cox, of the British Museum (Natural History), has contributed a general survey of the Oligocene and Aquitanian (early lower Miocene) marine molluscan faunas of parts of Europe. In an appendix the generic name *Palaeonummulites* is resuscitated for nummulitids that have been referred to *Operculinella* and *Operculinoides*. In another appendix *Pliolepidina*, in a restricted sense, is given an exclusive early Miocene age.

In part 2, Blow and Banner discuss late Eocene to Aquitanian planktonic Foraminifera and zones based on those fossils. Trinidad and the Lindi area on the coast of southern Tanganyika are taken as standards. Two late Eocene zones in the Lindi area are substituted for Bolli's one zone of the same age in Trinidad, and the overlying Oligocene *Globigerina oligocaenica* zone of the Lindi area, missing in Trinidad, is added to Bolli's succession of zones. Some 50 species and subspecies, almost half of which are new, and a new genus are described. Seven lineages are traced in a final discussion of the evolution of some late Eocene to early Miocene species.

Discrepancies are resolved at a price that is likely to be unacceptable to American paleontologists. This price is the almost complete wiping out of marine Oligocene and the great expansion of Aquitanian in America. Oligocene, based on the occurrence of *Globigerina oligocaenica*, is recognized, however, at three American localities: the lower part of the Alazan shale of the Tampico area in Mexico, an unspecified locality in Cuba, and an unspecified locality in the Dominican Republic. The Cuban and Dominican specimens were identified by Bolli and Bermúdez.

It is difficult to reconcile an Aquitanian age with the Eogene stamp of the extensive molluscan fauna of the Vicksburg group of the southeastern United States—an Eogene stamp as marked as that of Oligocene European molluscan faunas. Wherever the American species *Pliolepidina tobleri* is associated with larger Eocene Foraminifera—and it is generally so associated—the Eocene fossils are claimed to be reworked. The implication that all of the Gatuncillo formation of Panama is Aquitanian, with reworked Eocene fossils on an extensive scale, surely is not intended.

At the turn of the century, Dall claimed that all the Miocene of the Caribbean region and of southeastern United States, except the very latest, as well as a little Eocene, were Oligocene. The pendulum has now swung to the other end of the arc. The Oligocene of the southeastern United States and almost the entire Caribbean region is Miocene and some Eocene is thrown in for good measure. Time will tell whether the pendulum will stay there.

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Yesteryear in Nigeria

Barth's Travels in Nigeria. A. H. M. Kirk-Greene. Oxford University Press, New York, 1962. xii + 300 pp. Illus. Maps. $6.10.

Quite apart from its unique value as the only biography of Barth in English, this book is a godsend to everyone interested in the history and geography of the central and western Sudan. It will be appreciated especially by those who have been unable to procure the increasingly rare original editions of Barth's journal or who hesitate to wade through five ponderous volumes.

The author opens with a brief but full biography, followed by a critique of the *Travels and Discoveries*, an evaluation of Barth's work in the light of present knowledge, and an impressive essay in critical bibliography. Then come a series of extracts, from the original English text, covering the most important phases of Barth's travels, trials, and adventures in the region that extends from Lake Chad to Sokoto; this is all smoothly connected by seemingly effortless résumés of the intervening material. One does not need to be interested particularly in Barth, or even in Nigeria, to be charmed by the many vivid word-pictures of landscapes and of native life; the photographic reproductions of Barth's colorplates (in black-and-white) are equally fascinating and informative.

Kirk-Greene's delightful, easy-flowing style and his extraordinary mastery of a very complex subject give the deceptive impression of a skillful novelist, so experienced that he can write effortlessly and almost without thought. And yet no one who is familiar with Barth's work at first hand can help being impressed profoundly by, and appalled at, the amount of labor that must have gone into such an admirable summary.

I am writing this review in the heart