portant on this planet hundreds of million of years ago, and they are not at all likely to go out of fashion. Another omission is a satisfactory treatment of the subject of hormones. That we are considerably in the dark about exactly how these substances act biochemically does not, in my opinion, justify so much neglect, even in a short book.

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On the Nature of Mathematics

Mathematics in Your World. K. W. Menninger. Translated from the German by P. S. Morrell and J. E. Blamey. Viking Press, New York, 1962. viii + 291 pp. Illus. $5.

Some have called our times the Aspirin Age, but to many it has long been clear that ours is the Age of Mathematics-Made-Easy. Whereas the 18th century had its Newtonianism for the Ladies, our more democratic age has its Mathematics for the Millions. *Mathematics in Your World* is a new title, but it is in the familiar genre. Like its forebears, it opens with pejorative comments on "aspects so often neglected in school" and with the expressed desire to keep the reader from thinking "he has fallen among pedants." The author then follows precedent by assuring us that "Only the pure essence of mathematics is presented." The miracle is accomplished, of course, by avoiding "traditional nomenclature, which means nothing to the uninitiated." The theme of this recent addition to the lighter mathematical literature is a familiar one, although names and locale may be novel. This time the man-on-the-street is called John Smith, and the curves used for illustrations are those of the Rhine River, the Nürburg race track, and the Müngsten railway bridge across the Wupper River. (The work was first published in 1954 for a German audience.)

A listing of the topics in the book would be gratuitous for all except the one in a million who somehow has missed the ubiquitous popularization of his generation. The Moebius band, the bees' honeycomb, the multiplication of rabbits, the Wheel of Aristotle, the cycloid, the cardioid, the barber paradox, continuous compounding of interest, the fourth dimension—these, and many more, predictably find a place in the book. That these old chestnuts are presented with sprightliness could have been foretold from the fact that this American version was preceded by two editions at Göttingen and one at London. The script and translation are attractive and accurate, despite the misprint (page 39) of 1822 for 1882 as the date of the proof of the impossibility of squaring the circle and the occasional failure (for example, on pages 43 and 55) to distinguish clearly between exact and approximate values.

Menninger's book resembles its many close relatives in the folksiness of its examples and exposition and in the sometimes hasty abandonment of a topic when the going gets rough. It differs from its cousins perhaps chiefly in respect to the ample space devoted to themes from probability and statistics: chapter 7 is entitled "The realm of lady luck"; chapter 8 is "A tip on the football pools"; much of chapter 6 is on "Normal and not normal"; chapter 9 opens with Monte Carlo methods; and chapter 11 deals largely with the mathematical analysis of life and death.

It is well to bear in mind that the book is intended to be read for enjoyment rather than to be analyzed. If one looks too closely, one may be disturbed by touches of flamboyant showmanship. In the epilogue we are told: "Man has a natural talent for detecting order in his world and this helps us to understand why mathematics is independent of both people and time. . . . It is the sublime spirit in man, from which mathematics arose, that makes it as impossible to deny a mathematical truth, as it is to deny a dictate of the conscience. It is completely unassailable, and from its very truth issues forth its beauty." Such Platonic views shield the reader from an uneasy contemplation of the internecine strife concerning the nature of mathematics and its antinomies. One is reminded in this connection of another contemporary book title, *Mathematics in Fun and in Earnest*. Menninger has indeed given us a very readable account of mathematics in fun; but our generation needs to be warned again and again that this is no substitute for mathematics in earnest. We are living in the Golden Age of Mathematics, but we have not yet found a Royal Road.

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Green Function

The Green Function Method in Statistical Mechanics. V. L. Bonch-Bruevich and S. V. Tyablikov. North-Holland, Amsterdam; Interscience (Wiley), New York, 1962. xii + 251 pp. Illus. $9.75.

Quantum Statistical Mechanics. L. P. Kadanoff and G. Baym. Benjamin, New York, 1962. 203 pp. Illus. Paper, $4.95; cloth, $6.95.

The outstanding postwar development in theoretical physics has been in the improved ability to handle quantum mechanical perturbation theory. With the aid of new techniques the triumphs of quantum electrodynamics in the late 1940's were followed by the successful explanation of superconductivity of metals and of superfluidity in liquid helium and by improved descriptions of the binding energy of nuclei, of electric interactions in plasma, and of ferromagnetism. Not only have specific problems been solved but the theory of both equilibrium and nonequilibrium statistical mechanics has become more complete. These developments are associated with the names of Bogolyubov, Feynman, Yang, Landau, Lee, Brueckner, Bardeen, and many others.

Very few books have been written on these new techniques, and each new contribution is most welcome. The present volumes are not comprehensive surveys of the entire field but rather detailed descriptions of one technique, the Green function as it is applied to quantum statistical mechanics. A Green function is defined as the ensemble average of the product of two operators evaluated at different points of space time. If one is to work with Green functions, the implication is that one has gone over from the differential to the integral equation form of mechanics. This transition emphasizes instead of the instantaneous coordinates of a particle or system, its correlation functions in space and time and its propagation. In the integral formulation it becomes much easier to sum certain parts of the perturbation series. For example, an atom in liquid helium is in more or less violent interaction with its neighbors, but a collective view such as that afforded by the Green functions shows that weak excitations are possible with the long relaxation times characteristic of almost free particles.

Bonch-Bruevich and Tyablikov go into the mathematical structure of the theory in considerable detail, but they