generally follow the historical sequence of genetic discoveries (except that the concepts of allelism, homozygosity, and heterozygosity are introduced in a chapter preceding that in which an account of Mendel's experiments is given). Sex-linked inheritance is discussed in chapter 14, that is, after linkage and the genetic maps of chromosomes (chapters 9 and 10); this is perhaps the only feature of the book which geneticists with a zoological background may find a bit contrary to their predilections. Mutation, genic and chromosomal, is discussed in chapters 16 to 19, physiological and biochemical genetics in chapters 20 to 22, population and evolutionary genetics in chapters 23 to 25 and in chapter 27, and plant and animal breeding in chapters 28 and 29. The book closes with a discussion of "Man and the laws of heredity" (chapter 30), which in my opinion is, unfortunately, the weakest chapter in an otherwise excellent book. Among the rather numerous texts of genetics now available in English, Müntzing's book is the most thorough in its coverage of the topics of particular interest to botanists and agriculturists: this probably defines its "ecological niche," although all geneticists, irrespective of their special interests, will find the book useful and stimulating.

Genetical Mathematics for Biologist Consumers

Though expanding rapidly in diverse directions, genetics is still an integrated science and preserves its logical unity. The two subdivisions of genetics which have made enormous strides in recent years are population genetics and, most notably, biochemical genetics. Rasmuson's *Genetics on the Population Level* and Li's *Human Genetics* deal, notwithstanding their dissimilar titles, with much the same subject matter, the mathematical fundamentals of population genetics. Writing mathematics for the benefit of biologists and students of medicine is a task that poses difficulties about equally staggering to mathematicians turned biologists and to biologists turned mathematicians. Many a biologist has been annoyed to read that certain formulas or equations "evidently" lead to other formulas or equations which to him look very different, and many a mathematician has been exasperated by the obtuseness of biologists who do not find these things so evident." Now, Li has shown himself in his previous books a real wizard at conveying genetical mathematics to the biologist consumer, and *Human Genetics* proves his hand has certainly not lost its skill. Rasmuson does equally well in her slightly shorter but just as rewarding book. Both authors begin with discussions of Mendelian segregations in families and of genetic equilibria in Mendelian populations. Li illustrates the genetic equilibria with amusing allegorical models of "Game of Give and Take," "The Glove Club," and "Muller's Trucking Company." Discussions of factors altering the gene frequencies then follow—mutation, selection, and migration pressures. Phenomena of inbreeding and random genetic drift in small populations are taken up next. The genetics of polygenically determined traits and correlations between relatives are discussed. Rasmuson concludes with examples of "Practical difficulties encountered in two problems of population genetics." It is a pity that Rasmuson's book does not have a list of literature references; Li gives a short but well-chosen list. So imposing has been the growth of population genetics in recent years that much of the material presented in the books by Rasmuson and Li is not to be found in older books. Of course, rapid growth of a branch of science is a two-edged sword, as far as books are concerned; the interest of new books is accentuated, but the rate of obsolescence is just as surely speeded up!

It is really a disservice to Sager and Ryan's *Cell Heredity* that its dust jacket claims the book provides "a wholly new synthesis of the field" of genetics and treats "The science of genetics as it appears today, within the framework of past findings." The authors say explicitly in their preface: "We have limited ourselves to the discussion of genetics at the cellular level." But they must be credited with a no mean achievement—a critical review and analysis of the truly magnificent advances of biochemical (or molecular, or physiological) genetics, advances which have not only transformed this branch of genetics in the last 20 years, and even in the last 10 years, but which are influencing the whole science of biology. The need for a book such as this has been keenly felt in recent years; the only other book covering very roughly the same field is *Genetics and Metabolism* by R. P. Wagner and H. R. Mitchell (1955), and a comparison of the two books suffices to show how spectacular have been the developments between 1955 and 1961.

To write a book about a new or a newly transformed branch of science means breaking new ground; an author has no precedents to follow and no old models to improve upon. Sager and Ryan have on the whole risen to the task, although it may be questioned whether the sequence of presentation they have chosen is the best possible one. The book opens with a discussion of bacterial transformations and of the chemistry of nucleic acids; this is followed by a discussion of mutation and of mutation rates in diverse organisms, from virus to man; of gene recombination, linkage, and chromosome maps; of recombination in viruses and bacteria. Chapter 6 is an excellent synthetic discussion of "What is a gene?" Then we return to recombination and to the chemistry of mutation; a chapter dealing with "Nonchromosomal genes" is intercalated; there follow discussions of gene action, of genetic control of cell integration, of genetics of somatic cells. The book closes with a perhaps too brief "Summing up."

The books of Rasmuson, of Li, and of Sager and Ryan will be most useful to graduate students and others familiar with the fundamentals of genetics. One hopes, together with Sager and Ryan, that "The acquisition of a broader understanding about a particular branch of science may be an exhilarating intellectual experience" also "to the curious-minded of all ages from college students, to mature scholars in disciplines other than genetics." Certain it is that no geneticist of any age can afford not to read and to study their book, if he wishes to be well informed about the most exciting recent developments in his field. No less certainly, the five books here reviewed show that the "core science of biology" is at present in a period of most rapid growth.

Nucleons in Nuclei

Nuclear Sizes. L. R. B. Elton, Oxford University Press, New York, 1961. 115 pp. Illus. Paper, $2.40.

This small monograph is on the subject of nuclear sizes and density distributions. Since Rutherford first noticed deviations from the point scattering formula bearing his name, the subject of nuclear sizes has been of continuing interest. Although the question of nuclear size and composition has stimulated a great deal of research, very few reviews of the subject have been published. Thus Elton states, "The purpose of this book has been to systematize the experimental data that bear upon the density distribution of nucleons in nuclei and to correlate them, as far as possible, with current nuclear theories." He clearly succeeds in filling the gap, for the moment, in spite of the brevity of the book. He touches on virtually all the important methods of measuring nuclear sizes. Because of his own significant contributions to several aspects of the subject, Elton is able to write authoritatively about the basic methods and the quantitative results derived from them.

The important methods discussed in the order of their presentation, are electron scattering, muonic atoms, x-ray fine structure, isotope shift, mirror nuclei, semiempirical mass formula, high energy scattering of nucleons (use of the optical model), alpha scattering and alpha decay, meson scattering, absorption cross sections at high energies, and scattering of low energy neutrons. Following the discussion of methods, the author concludes with a chapter on the nuclear surface, including theory and experimental evidence.

Most subjects are covered thoroughly enough, in my opinion, in view of the incomplete or inadequate theory presently developed to account for the detailed facts of nuclear structure. A few subjects are dealt with in surprising detail for such a tiny volume. However, the method of the semiempirical mass formula for the nuclides is presented in an extremely brief way; some of the more recent work on this subject is not described, nor are recent references given. Elton does not mention a method of considerable importance, one which promises to yield much information on the mass density and neutron density distributions in nuclei, namely the method of coherent neutral pion production developed by the group at the National Bureau of Standards.

For the sake of completeness, there are a few minor points which should be mentioned. In numerous places Elton states that experimental results are based on relative cross sections rather than on absolute cross sections (pages 5, 19, and 20), whereas many of the data are in reality absolute within a somewhat larger error than indicated. Also, more recent absolute data are not given. In this respect the discussion of neutron size (page 21) is entirely out of date. Of course, this is a penalty for writing a book in a rapidly changing field. In a different context, the author sometimes gives figures and tables without mentioning the sources.

In spite of these minor imperfections, Elton has done a commendable job in collecting data and in making the subject understandable. People working in the field will find the book a necessity; others will find it interesting in many ways. It also provides a good example of how quickly a modern subject can develop in all its varied detail. I recommend the book highly.

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Mathematical Tools

Fourier Transforms and Convolutions for the Experimentalist. R. C. Jennison. Pergamon, New York, 1961. vi + 120 pp. Illus. $5.

The uninitiated can grasp the meaning of the Fourier transform by considering the behavior of a simple lens. The lens is ordinarily thought of as focusing the rays diverging from a point on an object to the corresponding point in an image, but it also focuses, at a point in the back focal plane of the lens, all rays which come from different points in the object and which are parallel to a single direction. The collection of such points in the back focal plane comprises the diffraction image of the object. In the process of focusing, rays from various points in the object (each located by the variable coordinate x) are brought together (integrated) on the diffraction image at a point located by a fixed coordinate X. Mathematically this can be expressed as $F(X) = f(x)e^{i2\pi xX}dx$. The exponential term takes care of the difference in phase of the rays arriving at the point of focus. The direction of the light can be reversed so that the roles of object plane and diffraction plane can be reversed. If this is done, a summation occurs at the object which can be expressed as $f(x) = F(X)e^{-i2\pi xX}dX$. Each of these equations represents a Fourier transformation. $F(X)$ is said to be a Fourier transform of $f(x)$, and vice versa. The relation is a beautiful one which is antisymmetrical in the phase $2\pi xX$, so that $F(X)$ and $f(x)$ are said to be conjugate and are called Fourier mates.

Jennison's book, with 110 pages of text, is short enough to be read in an afternoon. In seven chapters illustrated by 62 line drawings, it discusses the most important and useful properties of Fourier transforms.

The development of the topic includes four main features. The first is the meaning of a Fourier transform itself. A list of simple Fourier mates is included here, and the discussion is extended to two-dimensional Fourier transforms.

The next general topic is concerned with convolutions. A convolution is a kind of product of two functions. (A simple introduction to convolutions is through image theory [see M. J. Buerger, *Z. Krist.*, in press].) Its relation to Fourier transforms is given by the important theorem which may be stated as *the transform of a product is equal to the convolution of their transforms.* Jennison develops this important connection and thus provides a second stage in the discussion of Fourier transforms.

The third stage concerns the differentiation of Fourier transforms, and the author shows that the differential of a transform, $f(x)$, is its mate, $F(X)$, times the factor $i2\pi X$. This leads to the notion of a differential operator and later to an integral operator. The fourth and last facet of the discussion is the autocorrelation function.

The theoretical part of the development is interspersed, somewhat irregularly, with practical applications and is amply illustrated by line drawings. The book should be read by all who have any use for Fourier transforms. Nevertheless, it is not always easy to understand, and probably will be unintelligible to anyone who has not encountered Fourier transforms. For example, the first sentence of the book is "To the question 'what is a Fourier transform?' we may most simply reply: 'A method whereby we may obtain the variation of a quantity as a spectral function (e.g. plotted against frequency) from the variation of the quantity as a function of period (e.g. plotted against time).' " This and the following four pages are nonsense to the uninitiated. Only on the fifth page does Jennison briefly define the Fourier transform with an equation. The title informs the reader that this book is directed to the experimentalist, but it turns out that the experimentalist in mind is specifically one interested in electronics, for most of the examples come from that field. If the reader is not familiar with electronic jargon, he will not understand some of the text. While there are also