form of student guidance must be an integral part of our educational system in the foreseeable future; it will remain an important element in our social services for young people so long as adolescence remains a time of increasing strain and difficult decisions. The value of such an appointment is fully demonstrated, on the grounds of its contribution to student welfare, to improving their intellectual efficiency, and thus adding to the amount of the talent available to the nation as a whole—and to minimizing the diversion of ability into anti-social channels. In the long run, it offers a saving in time and emotional strain to other members of the staff which it affects, improving teaching and making education in these colleges more efficient, which, in the terms of results achieved, more than repays the financial outlay. *Student Guidance* provides an example of exactly the kind of innovation desiderated by Dr. Young, but Mr. Palmer also pleads for a great expansion of research in all fields of education with as much freedom as possible for the research workers. Likewise, he emphasizes the importance of some independent sources of finance. Some of Mr. Palmer's observations are provocative, and he reminds us that teachers and administrators and many employers can all be a source of frustration. Emphasizing the importance of the teaching of English—failure to master which he regards as an integral part of the overall failure of the student to cope with his or her environment—he observes that we are wasting the talents of thousands of our bright boys and girls, young men and women, for just this neglect. Here he comes near to echoing Dr. Young's own remark that teachers need to concentrate on their proper function of encouraging the desire to learn. In his open-mindedness, he also comes near to reaffirming Dr. Young's further remark that research on the raising of the school-leaving age and what is involved is unlikely to go far if the investigators are already firmly convinced that the extra year is in itself a good thing, or at the least can do no harm. For such open-mindedness, as is shown by these remarks alone, both books are timely and stimulating.

R. BRIGHTMAN

MOLECULAR GENETICS

The Evolution of Genetics

By Arnold W. Ravin. (Academic Paperbacks.) Pp. x+216. (New York: Academic Press, Inc.; London: Academic Press, Inc. (London), Ltd., 1965.) 22*s*. 9*d*.; 2.95 dollars.

IN one way *The Evolution of Genetics* is an excellent book, in another it is depressing. The trouble arises from its title, which leads one to expect some cogent illustration of the way in which contemporary genetics has evolved, an expectation to which the author adds when he complains in his preface that "the debt of modern genetics to the past is easily overlooked".

Yet with what are we presented? 32 pages on the legacy of classical genetics, 147 pages on modern molecular genetics, and 23 pages on the future of genetics. In these first 32 pages we have as the main legacy of classical genetics the concept of a unit of inheritance—the gene (Mendel); the concept of relation between genes and metabolic blocks (Garrod); the concept that genes are chromosomal (Sutton); linkage (Morgan); proof of chromosome exchange in crossing-over (Stern); the origin of theoretical population genetics (Hardy–Weinberg; Fisher, Haldane, Wright); and proof that the cytoplasm counts too (anon).

In the rest of the book we find that, prior to 1940, Griffith had discovered transformation and Muller and Stadler had discovered the mutagenic effects of radiation. Furthermore, and here we come to the crux, we are told (p. 87) that "The very power of the microbial system led to a breakdown of one of the tacit assumptions of classical genetics. The gene, it had been presumed, was a unit of the genetical material that functioned as a single entity in controlling some phenotypic character and responded as a whole to mutation and to recombination". "It was Seymour Benzer who brought this conclusion emphatically home" using phage.

Opinions of which were the key points that led to the opening up of molecular genetics may vary; but none could omit any of the following. The introduction of micro-organisms to genetics by Dodge and Lindegren and to biochemical genetics by Beadle and Tatum; the demonstration by Avery that the transforming factor is DNA; the production of a genetically intelligible structure for DNA by Watson and Crick; and—the point which the author rightly describes as basic—the discovery that genes defined as segregational units, as recombinational units, as mutational units and as physiological units are not necessarily coextensive. But this discovery did not depend on micro-organisms. Well before Benzer's work began, Fisher, Goldschmidt, Darlington, and Mather, among others, were aware that different definitions of the gene were not synonymous, and the demonstration that physiological units were complexes that could be broken down by recombination was made primarily with *Drosophila* (Lewis, Pontecorvo). To say this is not to minimize Benzer's contribution. It is merely to contradict the central point in this account of the evolution of genetics.

As an account of contemporary molecular genetics, the book is simple, straightforward, well written, and has much to recommend it, and the concluding section is a thoughtful account of the views of the author of the problems geneticists must face in the future. It is a pity the author, in his title and preface, should have suggested he was trying to show how molecular genetics arose, a task which, had it been well done, would have been very well worth doing.

J. M. THODAY

A MOLECULAR BASIS OF EVOLUTION

Evolving Genes and Proteins

Edited by Vernon Bryson and Henry J. Vogel. (A Symposium held at the Institute of Microbiology of Rutgers, The State University, with support from the National Science Foundation.) Pp. xxi+629. (New York: Academic Press, Inc.; London: Academic Press, Inc. (London), Ltd., 1965.) 156*s*.

THIS well-presented though expensive volume makes available a detailed account of the proceedings of a symposium held at Rutgers University in September 1964. An impressive array of scientists delivered papers which are collected into nine parts, eight of which begin with a chairman's introductory remarks and which end with open discussion. There are two parts dealing with the evolution of biochemical pathways and three each with the evolution of proteins and genes.

Dedicated to the late D. M. Bonner, *Evolving Genes and Proteins* starts with a list of participants, a short preface by the editors, and a welcome by J. O. Lampen. At the end of the book there is a complete author index and a sensible subject index.

An opening address was delivered by E. L. Tatum, who attempted to place the present knowledge about the molecular basis of evolution in perspective within the framework of the rapidly developing discipline of molecular biology.

In the first section, N. H. Horowitz surveyed the evolution of biochemical syntheses. He proposed a process of retro-evolution whereby evolution started with an end-product of a biosynthetic pathway and worked backward stepwise towards the beginning of the reaction