in the third. Accounts of the first probings and fingerings of elementary particles, neutrons, are given in the next two papers by Havens, Rabi, and Rainwater, and by Fermi and Marshall. From this point the story proceeds apace as blind men excitedly feel and describe (in measured terms) what they find inside the "elementary" particles called nucleons. Theoreticians (fingerless men with great imaginations) quickly join the expedition into these vast infinitesimal regions. Fitch and Rainwater build new fingers from muons, while Hofstadter and his colleagues steadily make their electronic fingers more sensitive and finally in 1955, feel inside the proton.

Through some 83 papers, the story is told by the men who led the expedition and cheered it on. The last in the sequence is a paper by Frati and Rainwater written in 1962. Taken together in this unified set, these 83 papers, with comments on each by the man who led the assault on the summit where storms of pion resonances rage and electric and magnetic fields swirl about one's ears, form a fascinating story that will live in the annals of science as long as those annals are kept by men.

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Bacterial Viruses

Molecular Biology of Bacterial Viruses. Gunther S. Stent. Freeman, San Francisco, 1963. xvi + 474 pp. Illus. $9.50.

This brilliantly written book is by Gunther Stent, one of the few people who could conceivably have done the job. Stent combines the qualities of an outstanding scientist with those of an outstanding teacher, and he has put into some 470 pages a distilled essence of molecular biology as it is approached through bacterial viruses. Any undergraduate, graduate, or postdoctoral student with even a sketchy background in biochemistry and cellular biology can use this book to tremendous advantage.

To me, the term *molecular biology* denotes a branch of science that seeks to explain biological phenomena in terms of the structure and properties of molecules, particularly of the macromolecules. Not everything that Stent has to say about bacterial viruses is molecular biology, by this or any other definition, but then not everyone takes the term that seriously. What Stent does present is a series of chapters that cover the following topics: the discovery of bacterial viruses (bacteriophages) by Twort and d'Herelle; the bacterial host cell; the nature of the infective virus particle; the various stages in viral infection, replication, and maturation; viral genetics, both with respect to mutation and recombination; and the radiobiology of bacteriophage. All of these topics, with the exception of the bacterial host cell, are covered with enough detail to give the student a good idea of the experimental basis for each and every significant conclusion.

The only weak chapter is the one in which the bacterial host is described. The 14 pages alloted to this subject do not provide an adequate background; a student who, for example, enters the field of molecular biology from a background in pure physics and mathematics will simply have to go elsewhere to learn about the fundamental architecture and function of bacterial cells.

I have only one other criticism, and that has to do with the author's treatment of the complementation test. To perform this test, two mutant genomes are brought together in a common cytoplasm; if the wild phenotype is produced, the genomes have complemented each other and are inferred to be deficient in different functions; if the mutant phenotype is produced, the genomes are unable to complement each other and are inferred to be deficient in the same function. Benzer adapted the complementation test to the identification of functional units in viral DNA. He coined the term *cistron* for such a unit, since the test, if properly carried out, demands that the same phenotype be produced when two defective *cistrons* are in the *trans* position as in the *cis* position.

The foregoing account is similar to the one that Stent presents in an expanded form. Unfortunately, he does not tell the reader that recent work with *Escherichia coli* and *Neurospora* systems has greatly weakened the complementation test as a means of identifying the functional unit. Work by Giles, Fincham, Levinthal, Garen, and others shows that complementation occurs extensively at the protein level: two genomes, each producing the same polypeptide in defective form, will complement each other if the defects are suitably spaced. The defective polypeptides associate to form functional polymeric enzymes. Thus, the rigorous identification of a functional unit requires direct knowledge of the polypeptide produced. Strictly genetic data that utilize gross phenotype as a test of complementation can only provide a tentative identification, and then only if very large numbers of mutants are studied. Groups of noncomplementing mutants can safely be inferred to be affected in the same functional unit; a positive complementation test, on the other hand, does not necessarily mean that two different functional units are involved. A book that is as thorough as this one owes the reader a discussion of this important development.

These criticisms should not be allowed to detract from the overall impression of excellence which I wish to convey. As a final item of praise, I must record the fact that the book is handsomely composed and illustrated and that the bibliography is handled in a manner which every author would do well to imitate. The 700 references are grouped alphabetically by author at the end of the book, and are also numbered serially. References are made in the text by number, but any author's work can be located in the bibliography directly. Finally, after each entry there is a list of numbers that denotes the pages on which the reference is cited. This last courtesy is one of the many touches that make this book a pleasure to read.

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Cryogenics

Cryogenic Technology. Robert W. Vance, Ed. Wiley, New York, 1963. xviii + 585 pp. Illus. $19.50.

This book is a collection of lectures given in a graduate course on cryogenic engineering at the University of California. Each of the 15 chapters was prepared by a prominent engineer or scientist. The stated goal of the treatise is to provide a reference source for those engaged in the application of, or in basic, theoretical cryogenic studies. If we consider the diversity of the disciplines involved in cryogenic studies and the wide range of technological applications, the book must be considered a success.