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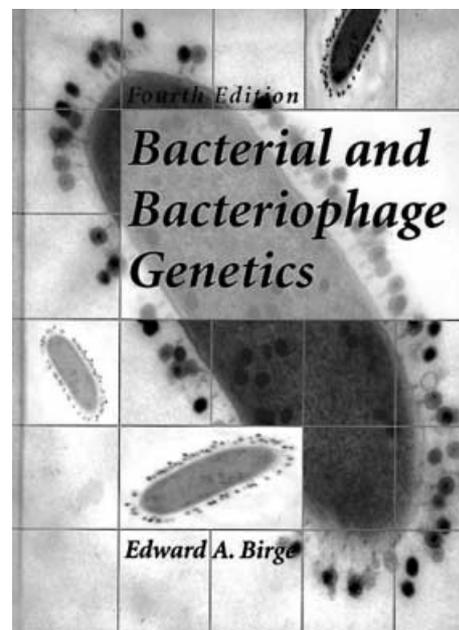
## Edward A. Birge: *Bacterial and bacteriophage genetics*, 4th edn

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Enthusiastic students interested in microbiology and genetics will be grateful for the arrival of this book, in which all of the major topics in modern bacterial and bacteriophage genetics are discussed. The first chapter (Fundamentals of bacterial and viral genetics) consists of a brief review of the fundamentals of microbial cell structure and basic viral processes; it includes a discussion of cell anatomy, genetic terminology and processes related to bacteria, yeast and viruses. This introduction also includes the study of similarities and differences between prokaryotic and eukaryotic cells, the types of genetic-transfer processes that operate in prokaryotic microorganisms, and the organization of the bacterial chromosome.

Chapter 2 (Replication and analysis of DNA) provides basic information about DNA, since the study of genetics is really the study of the properties, synthesis and inheritance of nucleic acids. This chapter focuses on DNA (although some viruses have RNA as their genetic material, which is discussed in later chapters). It describes the main structural features of DNA, its replication process, and various approaches used to study it. The section dealing with analytical techniques for DNA such as electrophoresis, detection of specific DNA sequences, polymerase chain reaction, and DNA sequence analysis will be of great interest to students of molecular biology, since the theoretical bases for those techniques are described, which allows a proper understanding of what students do in the laboratory when they follow mechanically the steps of a protocol from a manual. In Chapter 3 (Mutations and mutagenesis), the discussion proceeds from the definition of mutation to its causes, consequences and its defining role in evolution, as well as its applications in many fields of investigation. It also describes techniques available to study the appearance of mutations in populations of bacteria and how to measure mutation rates.



The study of RNA starts in Chap. 4 (Transcription and translation: processes and basic regulation), in which the processes of transcription and translation are discussed. Since these are highly energy-expensive processes, their regulation becomes very important, and this book gives detailed examples of the most widely known operons, after offering a clear and exhaustive introduction to the concept of operon as the basic regulatory unit. Since replication is not 100% effective, DNA can contain errors in its sequence after this process. Chapter 5 (DNA repair and simple recombination) describes the mechanisms of the cell to repair these imperfections, and to also repair damage produced by many other ways, lumped together under the term “extrareplicative damage”. The concept of recombination, which seems to be antithetical to that of repair, because recombination – the movement of genetic information from one molecule of nucleic acid to another – implies

that a nucleic acid molecule loses its integrity and undergoes some kind of structural alteration, is also discussed. The reason for finding together two concepts which apparently are so contradictory is, as we discover in the book, due to the close relationship between repair and recombination.

The following three chapters (6, 7 and 8), which are devoted to bacteriophages, illustrate the basic nature of genetic processes by using relatively simple genetic systems as examples. Chapter 6 focuses completely on T4 bacteriophage, an intemperate phage and a member of the T-series, whose genetic regulation has been intensively investigated. Chapter 7 discusses other intemperate phages that have also been the subject of considerable study, including the rest of the T-series phages, the descriptions of which illustrate the high degree of genetic diversity available to bacterial geneticists. Yeast viruses are not considered since they are transmitted only by cell fusion and they are never found in an independent state during their life cycle. The great diversity of strategies used by viruses to minimize their genome, replicate it and regulate all these processes are extensively described. Chapter 8 (Genetics of temperate bacteriophages) discusses problems associated with lysogeny. The varied ways in which the temperate response can be accomplished are its subject.

Chapters 9–13 deal with mechanisms of genetic information exchange between bacteria, either through viruses or not. Transduction is the subject of Chap. 9, which describes the various mechanisms for the production of transducing particles. Chapter 10 (Genetic transformation) is devoted to the basic process of transformation and some of its variations. Only a few of the many transformable genera are considered, especially *Bacillus*, *Streptococcus* and *Haemophilus*, which are currently the best studied. Conjugation, or rather, *Escherichia coli* conjugation, is presented in Chap. 11 (Conjugation and the *Escherichia coli* paradigm). An in-depth analysis of the F plasmid and its interactions with the bacterial chromosome is included. Chapter 12 (Plasmids and conjugation systems other than F) is an introduction to a variety of common plasmids. In three sections, this chapter discusses chromosome-mobilizing plasmids, colicinogenic plasmids, and R plasmids. As in Chap. 11, emphasis is placed on the classic genetics and physiology of these systems. Molecular biologic aspects are discussed in Chap. 13 (Plasmid molecular biology). To this point, the regulation presented has been of a relatively simple type: an operon, a promoter and a

repressor or activator complex. Chapter 14 (Advanced regulatory topics) introduces the complex regulatory systems the cell needs to give appropriate responses to environmental stimuli. The elements of the basic recombination pathways were discussed in Chap. 5; but site-specific recombination, which occurs in the temperate response of bacteriophages, the integration of plasmids and the movement of transposons, is not described until Chap. 15 (Site-specific recombination), which is entirely devoted to its study.

Students who, after all this reading, may wonder what they can do with the knowledge they have acquired until now will find the answer in Chap. 16 (Applied bacterial genetics). Here the applications of bacterial genetics are discussed, since this discipline is becoming a tool for developing processes that can be applied to solve industrial, ecological, and pharmaceutical problems and also to study genetic systems other than those of bacteria. The topics of this chapter should be viewed as summaries of subjects currently under investigation: a variety of cloning vectors with different functions, antibody production by bacteria, mutagenicity testing, etc. The final chapter, Chap. 17 (Bacterial evolution), applies to the bacterial world all the topics students may have learnt about evolution in eukaryotic organisms; it emphasizes the differences between eukaryotic and prokaryotic evolution due to the peculiarities of both physiology and genetics of prokaryotes.

*Bacterial and bacteriophage genetics*, which is an exhaustive introduction to this rapidly changing subject, is recommended for both advanced undergraduate and graduate students, especially for those who enjoyed genetics in their microbiology courses and/or microbiology in their genetics courses. In fact, an introductory genetics course and an introductory microbiology course would be essential to understand this book properly. This revised edition reflects recent advances in the field. The book contains a glossary of terms and also two helpful appendixes, one about the laws of probability applied to prokaryote cultures, and the other a list of World-Wide-Web sites pertaining to bacterial genetics. It is worth emphasizing the questions at the end of the chapter, and the “Thinking ahead” and “Applications” boxes. These make the book particularly didactic because they encourage the student to think and, therefore, to interact with the book. *Bacterial and bacteriophage genetics* is highly recommended for teachers of microbiology or genetics, and it should be present at any university library.