
36 Lectures in Biology

S. E. Luria

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PREFACE

The lectures in this book are the substance of a General Biology course taught at M.I.T. in the springs 1973 and 1974. Most of them are based on a transcript made in 1973. Five lectures that were presented by other teachers in 1973 are included as I presented them in 1974.

The justifications for publishing this set of lectures in book form are, first, that students seemed to enjoy them and profit by them; and second, that this course may offer a useful paradigm for biology courses of a kind suitable to good students who like to look under the surface of the subject matter.

The course is centered around one main theme, that of living organisms as possessors of a program--a set of genetic information--that underlies all vital functions and that evolves by mutation, genetic recombination, and natural selection. This theme is followed through the discussion of the chemistry of living cells, their metabolism, and their synthetic activities, which are directed essentially to the reproduction of the program. Genetics is the natural center of the presentation. Developmental biology and physiology are approached as the expression of the program.

The question is bound to be raised that many areas of biology--zoology, botany, evolution theory, ecology--are not touched upon in these lectures. My opinion has always been that these disciplines, if they are to be learned well by the science-minded student, are best approached after a general biology course in which the student learns the essentials of the life phenomena: the chemistry of the cell, the organization and function of the genetic systems, the genetic significance of life cycles, and the functioning of cells in differentiated organisms. No claim is made that the lectures collected in this book cover exhaustively even those areas of biology that are included. The lectures represent a selection of topics organized around the central theme of the biological program of organisms. Thus some of the physiological topics, for example, are described without special concern for the underlying cellular or organ structures.

The M.I.T. students are not required to take a chemistry course as a prerequisite to this biology

course, but most of them are well read in all areas of basic science. It has proved useful to provide the student with some summaries of basic facts of organic and physical chemistry needed to understand elementary biochemistry. These summaries are included in the book as background materials (pages 316B-402B). I have also included a set of suggested topics for discussion at the weekly recitations that accompany the lectures, as well as a few sample examination questions to illustrate the level of performance expected of good students in this course.

The students have used as texts two books: Watson's Molecular Biology of the Gene plus any one of several biology texts of their choice. I have listed at the end of this Preface a few books that would provide adequate supplementary readings for the eager student and have suggested desirable readings at appropriate points in the series of lectures.

In a long list of acknowledgments, the most important one goes to Carole Bertozzi, who in the fall of 1972, with financial support from the Division for Study and Research in Education of M.I.T., helped me collect materials for the course and in the spring of 1973, with the help of Eva Aufreiter, recorded and took notes of my lectures. Carole then prepared a typescript that served as a basis for my further work. The excellence of her work made my task easier and swifter. I have endeavored to preserve to some extent the flavor and casualness of the lecture room at the price of improving style and syntax. I have also tried to give the drawings in this book the quality of blackboard sketches.

I am indebted in various ways to those of my colleagues who have participated in teaching General Biology at M.I.T. in the last 10 years: Paul Gross, E. C. Holt III, Vernon Ingram, and Cyrus Levinthal. Even though there has not been a great deal of explicitly joint planning, I am grateful to John G. Nicholls and Stephen W. Kuffler for a critical reading of two lectures. I am also grateful to the numerous graduate students who assisted in the teaching of the course. Nancy Ahlquist prepared all the diagrams from blackboard or pencil sketches, besides being involved in many critically important ways in the preparation of this book as she has for 15 years been involved in

every aspect of my writings.

Finally, my gratitude goes to my students, to whom this book is dedicated. I can think of no greater pleasure for a teacher than to see a crowd of bright faces respond with understanding to his lectures. This more than anything else encouraged me to put these lectures into print.

REFERENCE BOOKS

At the end of each lecture or group of lectures reference will be made to specific chapters in one or more of the following books as well as to specific parts of the Background Section of this book, pages

J. D. Ebert and I. M. Sussex. Interacting Systems in Development, 2nd Ed. Holt Rinehart and Winston, New York, 1970. An elementary but informative presentation of development with emphasis on cellular and molecular aspects.

B. D. Katz. Nerve, Muscle, and Synapse. McGraw-Hill, New York, 1966. A stimulating discussion of the central issues of neurobiology. Not easy but rewarding.

A. L. Lehninger. Biochemistry. Worth, New York, 1970. Undoubtedly the best biochemistry textbook available today.

I. M. Klotz. Energy Changes in Biochemical Reactions, 2nd Ed. Academic Press, New York, 1967. This delightful little book is not easy reading but is an excellent introduction to the fundamental concepts of chemical energetics.

G. S. Stent. Molecular Genetics. Freeman, San Francisco, 1971. This book deals with molecular biology from a narrative point of view, explaining the experimental basis of the various landmarks.

M. W. Strickberger. Genetics. Macmillan, New York, 1968. A very complete text of genetics that covers with equal competence formal genetics and population genetics.

A. J. Vander, J. H. Sherman, and D. S. Luciano. Human Physiology--The Mechanisms of Body Function. McGraw-Hill, New York, 1970. An elementary physiology text, deficient in biochemical analysis but appealing to a modern biologist because of the emphasis on regulatory mechanisms.

J. D. Watson. Molecular Biology of the Gene, 2nd Ed. Benjamin, New York, 1970. A book that deserves its fantastic success because of its superb intellectual clarity and its insights into the central issues of present day biology.

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Part I

CELL BIOLOGY AND CELL CHEMISTRY

