A course of practical instruction in elementary biology

Martin H Newell
A COURSE OF ELEMENTARY INSTRUCTION IN
PRACTICAL BIOLOGY

BY
T. H. HUXLEY, LL.D., F.R.S.,
ASSISTED BY
H. N. MARTIN, M.A., M.D., D.Sc., F.R.S.

REVISED EDITION
EXTENDED AND EDITED

BY
G. B. HOWES,
ASSISTANT PROFESSOR OF ZOOLOGY, NORMAL SCHOOL OF SCIENCE AND ROYAL SCHOOL OF MINES,

AND
D. H. SCOTT, M.A., Ph.D.,
ASSISTANT PROFESSOR OF BOTANY, NORMAL SCHOOL OF SCIENCE AND ROYAL SCHOOL OF MINES.

WITH A PREFACE BY
PROFESSOR HUXLEY, F.R.S.

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PREFACE TO THE REVISED EDITION.

The first edition of the Course of Practical Instruction in Elementary Biology appeared twelve years ago, and the motives which led to its publication are fully explained in the original preface, which is subjoined. The present edition has been carefully revised and, where necessary, enlarged by my colleagues Mr Howes and Dr Scott, assistant Professors in Zoology and Botany in the Normal School of Science and Royal School of Mines, and such additions and improvements are entirely their work. But besides these changes, the reader who compares the two editions will observe that the order in which the subjects are presented is completely changed. In the first edition the lowest forms of life were first dealt with; the series of plants followed in ascending order; and then the series of animals, from the Bell animalcule upwards to the Frog.

No doubt there is much to be said for the principle of this arrangement, which leads the student from the study of simple to that of complex phenomena; but the experience of the Lecture-room and the Laboratory taught me that
philosophical as it might be in theory, it had defects in practice.

All the simplest forms of life, which are easily accessible, are of very minute size and their study involves the use of high microscopic powers. The student who begins with them is therefore not merely introduced suddenly into a region in which everything is new and strange, but he has to familiarize himself with the use of unwonted means of exploration. By taking this road, the teacher (to whom the world of the microscope is so familiar that he is apt to forget its strangeness to students) sets himself against one of the soondest canons of instruction, which is to proceed from the known to the unknown, and from familiar methods of learning to those which are strange.

After two or three years' trial of the road from the simple to the complex, I became so thoroughly convinced that the way from the known to the unknown was easier for students, that I reversed my course, and began with such animals as a Rabbit or a Frog, about which everybody knows something, while their anatomy and physiology is illustrated by innumerable analogies with those of our own bodies. From this starting point we proceeded further and further into the unfamiliar regions of invertebrate organisation until we reached the border region between animals and plants, whence there was a natural and easy ascent to the most complicated vegetable organisms.

This order is followed in the present edition; which is greatly improved by the addition of the Earthworm and the Snail in the series of animal, and of Spirogyra in the series of vegetable, types.
I have every reason to believe that our course of instruction in Elementary Biology has been found useful by many learners and teachers. But whatever the value of our attempt to carry out a certain method of instruction, I am more than ever convinced that the method itself is one which will eventually be universally adopted, not only by teachers of the biological sciences as such, but by the teachers of so much of those sciences as constitute the foundation of medicine.

No man can be competent to deal with the greater problems of biology as they are now presented to us, unless he has made a survey, at once comprehensive and thorough, of the whole field of biological investigation. The animal and the vegetable worlds are only two aspects of the same fundamental series of phenomena, and each is capable of throwing a flood of light upon the other. I know of no way by which such a broad, but not superficial, survey can be effected except the method adopted in this work.

Again, while to my mind, nothing is more to be deprecated than the compulsory waste of the invaluable time of students of medicine, upon topics so remote from the serious business of their lives as are systematic Zoology and Botany, there is no preparatory discipline so well calculated to serve as a practical introduction to the study of Human Anatomy and Physiology, as that afforded by a proper laboratory course of Elementary Biology.

Sundry experiments have left no doubt upon my mind that, by following such a course of three or four months’ duration, the medical neophyte is enabled to enter upon his proper studies, provided with a practical knowledge of
Anatomy, of Histology, and of the Elements of Embryology and of Physiology, such as under the present system is either not acquired at all, or is gained at the expense of time and labour which can be ill spared from practical subjects.

T. H. HUXLEY.

November, 1887.
PREFACE TO THE FIRST EDITION.

Very soon after I began to teach Natural History, or what we now call Biology, at the Royal School of Mines, some twenty years ago, I arrived at the conviction that the study of living bodies is really one discipline, which is divided into Zoology and Botany simply as a matter of convenience; and that the scientific Zoologist should no more be ignorant of the fundamental phenomena of vegetable life, than the scientific Botanist of those of animal existence.

Moreover, it was obvious that the road to a sound and thorough knowledge of Zoology and Botany lay through Morphology and Physiology; and that, as in the case of all other physical sciences, so in these, sound and thorough knowledge was only to be obtained by practical work in the laboratory.

The thing to be done, therefore, was to organize a course of practical instruction in Elementary Biology, as a first step towards the special work of the Zoologist and Botanist. But this was forbidden, so far as I was concerned, by the limitations of space in the building in Jermyn Street, which possessed no room applicable to the purpose of a labora-
tory; and I was obliged to content myself, for many years, with what seemed the next best thing, namely, as full an exposition as I could give of the characters of certain plants and animals, selected as types of vegetable and animal organization, by way of introduction to systematic Zoology and Palæontology.

In 1870, my friend Professor Rolleston, of Oxford, published his "Forms of Animal Life." It appears to me that this exact and thorough book, in conjunction with the splendid appliances of the University Museum, leaves the Oxford student of the fundamental facts of Zoology little to desire. But the Linacre Professor wrote for the student of Animal life only, and, naturally, with an especial eye to the conditions which obtain in his own University; so that there was still room left for a Manual of wider scope, for the use of learners less happily situated.

In 1872 I was, for the first time, enabled to carry my own notions on this subject into practice, in the excellent rooms provided for biological instruction in the New Buildings at South Kensington. In the short course of Lectures given to Science Teachers on this occasion, I had the great advantage of being aided by my friends Dr Foster, F.R.S., Prof. Rutherford, F.R.S., and Prof. Lankester, F.R.S., whose assistance in getting the laboratory work into practical shape was invaluable.

Since that time, the biological teaching of the Royal School of Mines having been transferred to South Kensington, I have been enabled to model my ordinary course of instruction upon substantially the same plan.

The object of the present book is to serve as a laboratory
guide to those who are inclined to follow upon the same road. A number of common and readily obtainable plants and animals have been selected in such a manner as to exemplify the leading modifications of structure which are met with in the vegetable and animal worlds. A brief description of each is given; and the description is followed by such detailed instructions as, it is hoped, will enable the student to know, of his own knowledge, the chief facts mentioned in the account of the animal or plant. The terms used in Biology will thus be represented by clear and definite images of the things to which they apply; a comprehensive, and yet not vague, conception of the phenomena of Life will be obtained; and a firm foundation upon which to build up special knowledge will be laid.

The chief labour in drawing up these instructions has fallen upon Dr Martin. For the general plan used, and the descriptions of the several plants and animals, I am responsible; but I am indebted for many valuable suggestions and criticisms from the botanical side to my friend Prof. Thiselton Dyer.

T. H. H.

London,

September, 1875.