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978-1-107-58643-7 - Plant Biology: An Outline of the Principles Underlying
Plant Activity and Structure

H. Godwin

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PLANT BIOLOGY

AN OUTLINE OF THE PRINCIPLES
UNDERLYING PLANT ACTIVITY
AND STRUCTURE

BY

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FELLOW OF CLARE COLLEGE, CAMBRIDGE,
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QUATERNARY RESEARCH

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NOTE ON THE THIRD EDITION

Since this book was first written the Universities of Oxford, Cambridge and London have combined, in the interests of schools, to make uniform the scope of teaching for the biology of their respective 1st M.B. examinations. A more or less common basis for this has been agreed upon, although the different universities themselves choose to spend different periods of time in teaching it. These changes have made it necessary to add to the book a consideration of the fern plant, and of reproduction by means of the flower and the formation of seeds. This has involved some mention of alternation of generations and reduction-division. *Pythium*, *Pellia* and *Sphaerella* have also been added to the lower types described, with the hope that the usefulness of the book will be increased to students taking other biology examinations, such as those for the Higher School Certificate. For suggestions for improving and correcting the text I have to thank many good friends, especially school teachers and students. In particular I am grateful to Dr C. S. Hanes who has lent his comprehensive knowledge of plant biochemistry to correcting the section on organic substances and their properties.

H. G.

October, 1938

NOTE ON THE FOURTH EDITION

This edition is substantially identical with the third edition, but recent additions to our knowledge have necessitated minor alterations. The opportunity has been taken to insert a note upon the nature of *Penicillin*, and to revise the very brief comment on the nature of meiosis.

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PREFACE

Text-books on animal biology are already fairly numerous but those devoted to plant biology are still so few that no excuse is needed in offering this new volume. Especially is this so since text-books, both of plant and animal biology, have hitherto been concerned most largely with the morphological and evolutionary aspects of the science, whilst the present volume, although not neglecting these, follows an increasing tendency of biological thought in laying greater emphasis on the physiological point of view and on consideration of the simpler characters of the physico-chemical background of plant-life. While based on elementary lectures given to first year medical students and designed primarily for their use, the book is intended to have also a wide utilisation by other biological students of similar status. It should be suitable for use in the higher forms of those schools in which biology is taught and in the introductory classes of training colleges. The experience of the writer as a member of the staff of the Cambridge Botany School confirms the opinion that too often students of botany not only come up to the University, but pass through its botanical courses with far too little appreciation of the general biological significance of the subjects with which they deal. It is hoped that this book will afford a means whereby such a deficiency may be made good.

The nature and scope of the subjects which form part of the training of the medical student are matters which for a long time have been debated by the medical and other University teachers responsible for them. It is of course desirable that the student should gain knowledge of some

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subject as a pure science, so that he may bring exact methods and exact thinking to his later work. Such would no doubt be valuable in each and every subject which he reads, but the field of medical practice and theory is so rapidly widening that there exists a natural and strong tendency to cut down preliminary introductory study to a minimum, and to excise all matter save that with direct and obvious application to later and more specialised medical work. Different universities vary in the extent to which they think such tendency should be yielded to, but as they all must find a practical solution, some kind of compromise usually follows. This takes the form of utilising in preliminary science courses matter as closely linked with later work as possible, and discarding things which may be part of the traditional teaching of the subject but which the medical student is not likely to meet with again. Such has been the background of this text-book; it has been designed largely to comprise material or principles which must later be more fully developed by the student. To this end considerable attention has been paid to the simpler aspects of physiology of the green plant and of the bacteria and fungi; the chemistry of simple organic substances and their occurrence in the plant in a colloidal state have been dealt with, thus creating a general background for later work on animal physiology, and illustrating the significance of general physiological treatment in the widest possible way. The bacteria and fungi, as organisms later subject to special study, have also received an attention which considers their biology as living organisms as well as their significance as disease producers, etc., to the rest of the world. In pursuance of such aims the study of the flowering plant has been reduced to an extent far beyond what is customary. Its

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reproduction has been omitted and all details of structure and anatomy save of such simple kind as will permit the comprehension of the outlines of the chief physiological processes in the plant, and an understanding of the specialisation and differentiation of the land plant as the end product of an evolutionary series of green plant organisms. A certain number of plant types have been considered in Chapters IX, X, XI and XII as illustrative of such evolutionary sequence, and by means of them have been expressed such wide principles as differentiation of tissues and organs, specialisation and division of labour, the origin of sex and of a mortal plant body. Mention of alternation of generations has been omitted because, unless the principle is later to be applied in detail to the most complex plant types, the gain is not worth the considerable time necessary to teach it. It is the hope of the writer that in the treatment of the subject, little matter has been employed which will really be useless once the medical student is beyond his first M.B. examination, whilst at the same time no very important principles shall have been neglected.

Whilst most of the text-book is intended to give the student direct access to biological fact and outlook, its limited size and wide scope together have made the book one which, in the author's view, is well suited to expansion and illustration by teacher or lecturer. This applies especially to the parts of the book which deal with what we may call the chemical background of plant physiology. It would have been impossible to devote space here to the closer explanation and the fuller treatment which the subject should have: at the same time it would have been unwise to omit all consideration of the chemical background of plant physiology, for this type of knowledge surely

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is basic biological fact of the widest possible value, and subject to application and development at many stages beyond the elementary examination in biology. It is difficult to develop the outlook here so briefly indicated, because traditional methods have ill prepared students for it, but it is to be hoped that this difficulty will diminish as teachers increasingly realise the importance of developing the theme, and as the theme comes to be borne in mind throughout both physico-chemical and biological teaching.

As the book has not been written for use by students of less than sixteen or seventeen years of age, it has seemed permissible to assume in the reader some elementary knowledge of physics and chemistry, but at the same time every attempt has been made to make the writing self-explanatory or to leave it in such a state that reference to a text-book of chemistry or physics will at once make clear unexplained parts. The importance to the biologist of an adequate training in chemistry and physics can hardly be over-estimated, and the medical man, whose work has well been called "applied biology," will find it, through both training and practice, to be of the greatest value.

It will be clear that although this book has been written without instructions as to possible practical work, it is intended that such work should accompany study of each part of the book as it accompanies the lecture course in Cambridge. Only by personal practical work can the student obtain the scientific habits of accuracy in observation and statement, which these courses are designed to promote.

The illustrations of the book have in most cases been redrawn and rearranged from figures in well-known botanical text-books; in such cases the source of the drawing is acknowledged in the subscription; others of the drawings

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PREFACE

are original. In the execution of all of them and in the preparation of the text, I have had the assistance of my wife, whom I should like now to thank. My gratitude is due to many others who have helped directly or indirectly in the production of this book; especially I owe much to Professor A. G. Tansley, Sherardian Professor of Botany in the University of Oxford, who, whilst lecturer in Cambridge, had much to do with framing the syllabus for the First M.B. biology, and in setting it on sound scientific lines. To him and to other members of the Botany School staff I owe sincerest thanks for the influence which, as teachers and friends, they cannot fail to have exerted on the preparation of this book. I am especially indebted to Mr F. T. Brooks, who has read through Chapter VIII, on the Fungi, and to Dr F. F. Blackman, who has beneficially criticised the biochemical and physiological parts of the book. My old friend and teacher, Mr S. Clegg, has most kindly helped in the correction of the proofs.

H. G.

December, 1929

NOTE ON THE SECOND EDITION

For the second edition some small amendments have been made. The newly observed facts of the conjugation of *Spirogyra*, of gametal release in *Fucus*, and of the hormone nature of the stimulus conduction in tropic responses have been mentioned; the section on bacterial structure and diagnosis has been altered to conform more closely to modern bacteriological practice and theory. For his kindness in giving advice on this last section I am indebted to Mr E. T. C. Spooner of the Department of Pathology, Cambridge.

H. G.

October, 1932

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