

**A LABORATORY  
COURSE IN PLANT  
PHYSIOLOGY**

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A laboratory course in plant physiology by William F. Ganong

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**WILLIAM F. GANONG**

**A LABORATORY  
COURSE IN PLANT  
PHYSIOLOGY**





VIEW IN AN EXPERIMENT HOUSE FOR PLANT PHYSIOLOGY.

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A LABORATORY COURSE  
IN  
PLANT PHYSIOLOGY

*1911*  
SECOND EDITION

EXTENDED TO FORM A HANDBOOK OF EXPERIMENTATION  
FOR EDUCATIONAL USE

*Francis*  
BY  
WILLIAM F. GANONG, PH.D.  
*III*  
*Professor of Botany in Smith College*



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1908

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## PREFACE.

THIS book has a threefold purpose. First, it aims to lead students through a good laboratory course in Plant Physiology. Second, it seeks to provide a handbook of information upon all phases of Plant Physiology having any educational interest. Third, I venture to hope that it may find service as a guide to self-education by ambitious teachers or students, who, unable to obtain regular instruction, yet wish to advance themselves in this attractive and important subject. To meet these ends I have tried to bring together the best of that which is already known in its field, and to add thereto some materials derived from new studies. The book is not a compendium of physiological knowledge, nor yet, except incidentally, a handbook of investigation; but it is a guide to the acquisition of a physiological education. It is designed as a contribution to educational economy, and as such I wish it to be judged.

If the book is found to have any special merit in its particular field, this will no doubt consist in its practicability, for, with but few and mostly obvious exceptions, everything in it has been tested repeatedly by my students and myself. In this, as in some other respects, however, the work is uneven, and some parts have been worked out far more carefully than others. The faults I hope in the future to correct and the deficiencies to supply. Nobody can be more conscious than I of its imperfections, and of how much remains to be done to put our physiological education upon a satisfactory basis. But at least we may feel assured that we are on the right road, and have made a goodly start.

Although the general aim, and therefore the principal title, of this book remain the same as in the first edition, it has been entirely rewritten and much extended. The chief differences, aside from improvement in details, consist in two things: First, there is much greater insistence upon mechanical neatness in experimentation, upon effective exposition, and upon scientific logic. Second, the emphasis is thrown, for advanced or college work, not upon qualitative results obtained by students from apparatus of their own making, but upon quantitative results obtained from practically accurate, or normal, apparatus manufactured expressly for its particular work. The reasons for this change will be made plain a few pages later. I wish here simply to emphasize its presence and its importance.

The first edition of the book had the advantage of criticism in manuscript by Professor C. R. BARNES, and much that he suggested is retained in this edition. I have had, as before, the constant co-operation of Mr. E. J. CANNING, the skilled Head Gardener of Smith College, in the effort to find the best materials for educational work. I have received, also, much aid from many of my loyal students, some of whom are mentioned by name in the following pages; but I am especially indebted to Miss SOPHIA ECKERSON, whose aid and criticism have been constant and valuable. To the BAUSCH and LOMB Optical Company I owe the use of the cuts illustrating my normal apparatus made by them, and they have permitted me also to copy freely from their copyrighted descriptive catalogue of this apparatus. To those who have thus co-operated in making this work more serviceable, I wish to express the grateful thanks not only of myself, but of all who may find the book of use.

WILLIAM F. GANONG.

SMITH COLLEGE, June, 1908.



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PART I.

ON THE EDUCATIONAL PLACE, METHODS  
OF STUDY, AND NECESSARY EQUIP-  
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