

**THE MICROSCOPE AND HISTOLOGY:
FOR THE USE OF LABORATORY STUDENTS
IN THE ANATOMICAL
DEPARTMENT OF CORNELL UNIVERSITY.
PART I. THE MICROSCOPE AND
MICROSCOPICAL METHODS**

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The Microscope and Histology: For the Use of Laboratory Students in the Anatomical Department of Cornell University. Part I. The Microscope and Microscopical Methods by Simon Henry Gage

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SIMON HENRY GAGE

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MICROSCOPE AND HISTOLOGY

FOR THE USE OF LABORATORY STUDENTS IN THE ANATOMICAL
DEPARTMENT OF CORNELL UNIVERSITY,

BY

SIMON HENRY GAGE,
Associate Professor of Physiology.

THIRD EDITION, ENTIRELY RE-WRITTEN.

PART I.

THE MICROSCOPE
AND
MICROSCOPICAL METHODS.

ILLUSTRATED.

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1891.

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PREFACE TO PART I.

This, the third edition of "Notes on Microscopical Methods for the Use of Students in the Anatomical Department of Cornell University," has been entirely rewritten, enlarged, and more fully illustrated; and while elementary matters have received fuller treatment than in previous editions, in this, an especial effort has been made to give a more adequate account of Homogeneous Immersion Objectives, the Sub-Stage Illuminator, Camera Lucidas, the Micro-Spectroscope and Micro-Polariscope, that is to apparatus which is coming to be used more and more in the higher fields of investigation in pure science and in practical medicine.

It is thoroughly believed by the writer that simply reading a work on the microscope, and looking a few times into an instrument completely adjusted by another, is of very little value in giving real knowledge. In order that the knowledge shall be made alive, it must be made a part of the student's experience by actual experiments carried out by the student himself. Consequently exercises illustrating the principles of the microscope and the methods of its employment have been made an integral part of the work.

In considering the real greatness of the microscope, and the truly splendid service it has rendered, the fact has not been lost sight of that the microscope is, after all, only an aid to the eye of the observer, only a means of getting a larger image on the retina than would be possible without it; but the appreciation of this retinal image, whether it is made with or without the aid of a microscope, must always depend upon the character and training of the seeing and appreciating brain behind the eye. The microscope simply aids the eye in furnishing raw material, so to speak, for the brain to work upon.

The necessity for doing a vast deal of drudgery or "dead work," as it has been happily styled by Prof. Leslie, before one has the training necessary for the appreciation and the production of original results, has been well stated by Beale: "The number of original observers emanating from our schools will vary as practical work is favored or discouraged. It is certain that they who are most fully conversant with elementary details and most clever at demonstration, will be most successful in the consideration of the higher and more abstruse problems, and will feel a real love for their work which no mere superficial inquirer will experience. It is only by being thoroughly grounded in first principles, and well practised in mechanical operations, that any one can hope to achieve real success in the higher branches of scientific enquiry, or to detect the fallacy of certain so-called experiments."

In preparing this manual it has been taken for granted that the student is already familiar with elementary physics, especially the subject of optics.

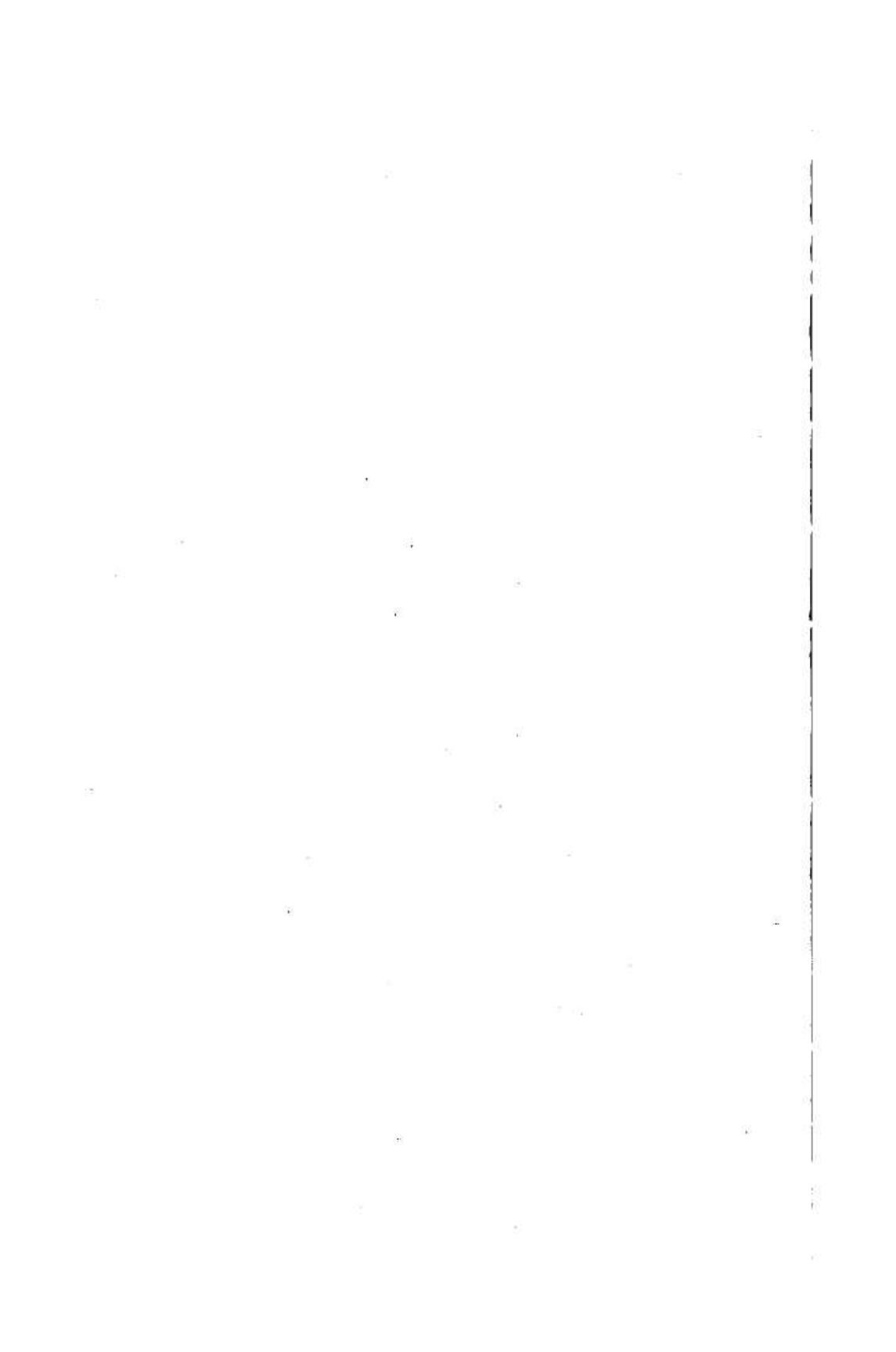
The experiments in micro-chemistry (Ch. V.) are given for the sake of practice for the junior chemical students who take the course in order to gain a knowledge of the microscope as an aid to chemistry.

In Part II will be given the application of the microscope to study and investigation in Vertebrate Histology.

SIMON HENRY GAGE,
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October 1, 1891.

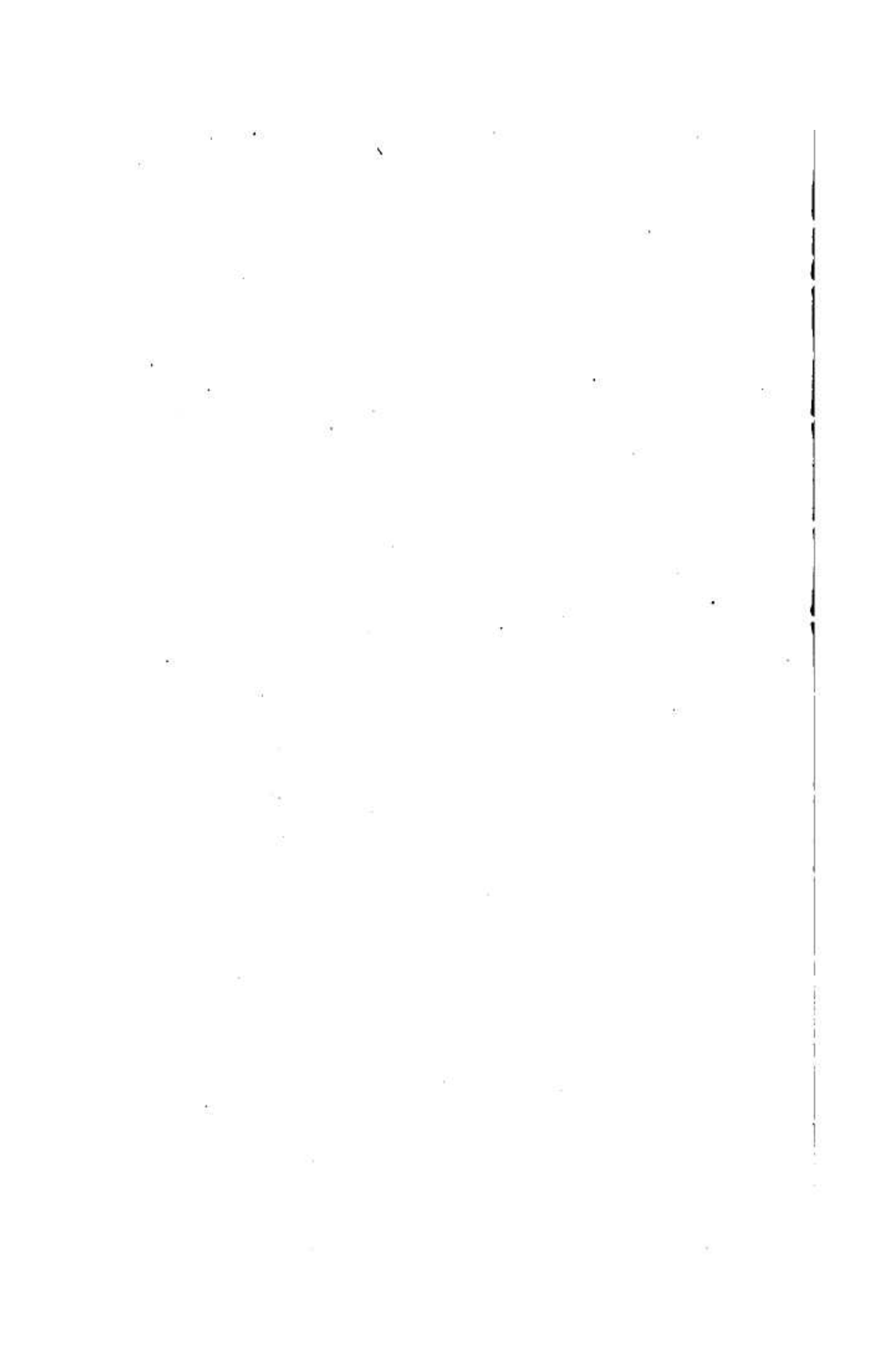
Microscopical Methods
1891-1892



THE MICROSCOPE AND HISTOLOGY.

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All of the Figures, except when otherwise indicated, are original, and were drawn by Mrs. Gage.

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PLATE I.

FIG.

1. Double convex lens showing the principal plane, the principal focus, and the focal distance.
2. Converging lens showing formation of a virtual image.
3. Converging lens showing formation of a real image.
4. Simple microscope with retinal image, and its projection as a virtual image.
5. Compound microscope, tracing the rays from the object to the final, virtual image.
6. Huygenian ocular or eye-piece, showing action of field-lens (Ross).
7. Huygenian ocular showing the eye-point.

PLATE II.

9. Tripod magnifier.
10. Stand of a compound microscope with names of parts.
11. Section of stage of compound microscope showing proper position of diaphragms.
12. Section of a low, dry objective and reflected light.
13. Section of an adjustable, immersion objective, transmitted axial and oblique light.
14. Diagram showing how to put on a cover-glass.
15. Slides showing how to enclose the lines of a micrometer or of some part of a preparation by a small ring.
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PLATE III.

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23. Letters mounted in stairs to show order of coming into focus.
24. Glass rod in air and in glycerin.
25. Glass rod coated with collodion to show double contour.
26. Blood corpuscles on edge, to show surface and optical sections.
27. Wollaston's camera lucida in section, showing the overlapping fields.
28. Position of the microscope for determining magnification with Wollaston's camera lucida; also the necessity of a standard distance at which to measure the image.
29. Figures of the image of the stage and ocular micrometers, showing correct mutual arrangement of lines in determining the ocular micrometer valuation.