# BAILEY'S

# TEXTBOOK OF HISTOLOGY

REVISED BY

PHILIP E. SMITH, PH.D.

Professor of Anatomy,
College of Physicians and Surgeons,
Columbia University

AND

WILFRED M. COPENHAVER, PH.D.

Associate Professor of Anatomy,
College of Physicians and Surgeons,
Columbia University

THIRTEENTH EDITION

LONDON
BAILLIÈRE, TINDALL AND COX
1953

First edition, 1904
Second edition, 1906
Third edition, 1910
Fourth edition, 1913
Fifth edition, 1916
Sixth edition, 1920
Seventh edition, 1925
Eighth edition, 1932
Ninth edition, 1936
Tenth edition, 1940

*Reprinted 1941*
*Reprinted 1942*
*Reprinted 1943*

Eleventh edition, 1944

*Reprinted 1945*
*Reprinted 1946*
*Reprinted 1947*
*Reprinted 1948*

Twelfth edition, 1948

*Reprinted 1949*
*Reprinted 1951*

Thirteenth edition, 1953

Spanish Translation published by Aniceto Lopez
Buenos Aires, 1948



*Made in the United States of America*

BAILEY'S TEXT-BOOK OF HISTOLOGY

## Preface to Thirteenth Edition

In this (XIII) edition of Bailey's Histology, we have adhered to the purpose of presenting a text primarily for the use of first year students in medicine and dentistry. In presenting controversial subjects we have emphasized points of agreement rather than of disagreement and have excluded a considerable body of facts which should be included if this were a source book for teachers and research workers. We have listed a limited number of bibliographic references at the end of each chapter. Besides being selected for their excellence *per se*, these references have been chosen, not primarily from the point of view of priority of discovery, but because they contain many other important references.

Since structure assumes its full significance only when correlated with function, we have endeavored to discuss the physiological significance of the structures wherever it seemed desirable. We have attempted, to an increased degree, to bridge the gap which often exists in the student's perspective between gross and microscopic anatomy.

Six new color plates, most of which contain several individual illustrations, and eighty-eight half tone and line figures have been added. Electron micrographs have been reproduced in several instances. Some of the halftone and line figures replace ones in previous editions and others illustrate structures not previously illustrated. The figures are from carefully selected material and depict typical structural features. Cellular proportions and structural relations have been shown with fidelity.

Since the previous edition of the text was written, there have been marked advances in the field of histology, particularly in histochemistry, electron microscopy, and in the elucidation of structural-functional relationships. We have made no attempt to include all of the new research material but have selected the results which seem pertinent for a textbook written primarily for first year medical and dental students. In order to incorporate these findings, changes in the text have been made throughout most of the book. Certain rather extensive sections have been entirely rewritten.

In this edition we have had the able assistance of Doctor Dorothy D. Johnson. Although her primary responsibility has been the revision of Chapters XV and XVI, she has given valuable aid in the revision of other parts of the text. We wish again to recall that Professors Strong and Elwyn revised the VII and, in part, the VIII editions. Doctors Carpenter, Goss and Severinghaus participated with us in the revision

of the VIII, IX and X editions. The text still contains valuable contributions made by them for those editions.

As in the IX, X, XI, and XII editions, all of the new drawings have been made by Mr. Carl Kellner to whom we are greatly indebted. We wish, also, to express our appreciation for the splendid cooperation of the publishers.

PHILIP E. SMITH
WILFRED M. COPENHAVER

# INTRODUCTION

All living organisms consist of minute elements which are called cells. These cells are the smallest structural units possessing those properties which we commonly associate with life. They are able to nourish themselves, to grow, to respond to stimuli, and to reproduce. Some organisms, the protozoa, consist of one cell only; the higher types, metazoa, may consist of infinite numbers of cells varying greatly in structural characteristics. Each of these multicellular organisms starts its existence as a single cell, the fertilized ovum, which by a process of proliferation gives rise to the adult body. At first the cells of the developing embryo are similar in shape and structure. As growth continues, differentiation takes place leading to the formation of groups of specialized cells, each group differing in structure from the others, each group adapted to subserve one or more specific functions. These specialized groups form the *tissues* of the adult body. At a very early period the cells of the embryo become separated from each other by the formation of intercellular substance, which may be the result of cellular secretion or may represent actual modifications of cellular substance. In some of the tissues this intercellular material assumes enormous proportions. Thus the adult body is composed of cells and intercellular material, all elements so interrelated as to form a normally functioning machine.

Histology in a restricted sense is the study of the tissues of the body, but since the tissues are composed of cells and their products, a knowledge of the structure and activities of the cell must necessarily form the basis of histology. The first two chapters of the book are therefore given to a discussion of the cell, the first of these dealing with the cell after fixation and the second with the living cell. Each of these chapters obviously supplements the other. Physiology is stressed in both. Succeeding these, the structure of the tissues is presented. This is followed by the microscopic anatomy of the various organs.

While histology is a structural science and serves to complete the anatomical knowledge gained from dissection, its intimate relation to physiology and pathology must be emphasized. The cell is not only a unit of structure but also of physiological activity. The formation of the specialized tissues is the structural expression of a physiological division of labor. The structures seen under the microscope assume a

meaning only in the light of their functional significance. Thus the structure of muscles and glands can only be studied by constant reference to contraction and secretion. Normal physiological processes are associated with normal structure, abnormal processes are usually expressed in the altered structure and relationship of the cells and intercellular substance. A thorough knowledge of normal histology is essential for the understanding of the altered structure seen in the various conditions of disease.

# CONTENTS

## CHAPTER IV



## CHAPTER V



## CHAPTER VI

## CHAPTER VII

## CHAPTER VIII



## CHAPTER IX



## CHAPTER X

## CHAPTER XI



## CHAPTER XII

## CHAPTER XIII



## CHAPTER XIV



## CHAPTER XV

## CHAPTER XVI



## CHAPTER XVII

## CHAPTER XVIII



## CHAPTER XIX

## CHAPTER XX



## CHAPTER XXI