

REVIEW OF MEDICAL HISTOLOGY

POIRIER AND RIBADEAU DUMAS

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ADAPTED BY PETER S. AMENTA

REVIEW OF MEDICAL HISTOLOGY

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Review of Medical Histology

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Foreword

Medical students no longer have enough curriculum time for detailed study of comparative vertebrate microscopic anatomy of tissues and organs. Although it is desirable, there is really no need for this. They must, however, have fundamental knowledge of the cells and tissues that function in the principal systems of the human body. A basic knowledge of the cellular and histophysiological processes is mandatory for comprehending the pathophysiology of most diseases.

The basis of our textbook is to present, in less than 250 pages, the essential histological information needed by a prospective physician. It seemed quite appropriate to present purely morphological data in tables or diagrams, and we preferred explaining, in text format, certain histophysiological information that was difficult to dissociate from pathological information. Texts, drawings, or diagrams are intended to complement, not duplicate, information.

Items of information which failed to point up significant physiological or pathophysiological facts were omitted. We have deliberately deleted technical details, esoteric discussions, and most authorities' names.

Part One, devoted to the cell, is considered solely to present basic information, not to be a review of the immense field of cellular biology.

Part Two is concerned with general histology, or the study of tissues. Those chapters dealing with blood cells and cells associated with immune responses or defense processes are more detailed because of their current significance in medicine.

Part Three treats of special histology, or that of systems. The nervous system is not included, since neurohistology, at least as it interests physicians, cannot be separated from neuroanatomy and neurophysiology.

We wish to express our gratitude to Mme. Isabelle Cohen, Chief of Histology-Embryology studies on the Medical Faculty of Créteil, who wrote the chapter on the female reproductive system, and who extended valuable advice.

We are deeply indebted to Professor J. Baudet as well as to Dr. J. M. Pelisse and Dr. J. P. Veron for their contributions in the preparation of this book.

Last but not least, we thank Mme. A. Feyfant for typing the manuscript.

J. POIRIER

J.-L. RIBADEAU DUMAS

Preface

It is rarely an easy task to condense any subject matter, particularly when one must consider all component topics. Doctors Poirier and Ribadeau Dumas have been successful with the present text, which is geared to students of medicine and biology. They have abstracted the essential elements in the vast field of modern histology.

This text satisfies several needs: (1) it provides a valuable introduction to histology for medical and graduate students, and (2) during subsequent studies, it will provide a concise review of cellular and tissue structure. The complexity of modern medicine requires the student to constantly review basic material.

In addition to satisfying the needs of the student, this well-prepared review of current histological knowledge is invaluable for continuing education. Physicians and biologists who have found difficulty in keeping abreast of recent developments in histology will find this presentation extremely helpful.

Because of very strict requirements imposed in preparing any core text, it was necessary to be highly selective of material considered significant and relevant. In addition, since this book was intended primarily for medical students and those in allied fields, information that would provide a strong foundation for studies in pathology was emphasized.

Doctors Poirier and Ribadeau Dumas brought to this endeavor their valuable expertise gained from experiences as basic scientists and as clinicians. They surely deserve our gratitude for providing this well-written and valuable text, with its excellent diagrams and tables, which no doubt will render a great service in the study of histology.

RÉNÉ COUTEAUX
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Preface to the English Edition

The pleasant task of editing this first English edition was accepted on the conviction that it fills student needs in most Medical Histology courses. The concept of a core curriculum necessitates that material presented be critically selective and not merely reduced. The "core" should contain the "seeds" which, if properly planted, will grow to fruition in a well coordinated curriculum. All students should understand clearly that a core or review textbook, by its very nature, cannot take the place of the larger, more complete established texts. The core or review text serves to provide a busy student with an overview, and to stimulate interest in reading larger texts and, it is hoped, the literature cited in those texts.

Grateful acknowledgment is conveyed to Ms. Ursula Traube, who provided the initial translation. To Mr. Jack Hanley, Vice President and Health Sciences Editor of the W. B. Saunders Company, go my thanks for his patience, guidance and courtesies.

Special gratitude is offered to Ms. Mary V. Amenta for her many dedicated hours in typing, proofing, copy editing and preparing figures for the manuscript.

My faculty colleagues in the Department of Anatomy were particularly helpful. For their generous assistance in carrying on Departmental duties while this work was being completed, I am particularly grateful.

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PART ONE

THE CELL

The cell is the smallest unit of living matter capable of independent existence and reproduction.

All cells that constitute tissues and organs are derived from a single cell: the fertilized ovum. Regardless of their degree of differentiation, they all possess certain fundamental characteristics which permit an independent existence. The specific characteristics of differentiation producing the many varieties of cellular specialization are discussed in Part Two (*The Tissues*). In Part One, only those histophysiologic characteristics inherent in all cells are considered.

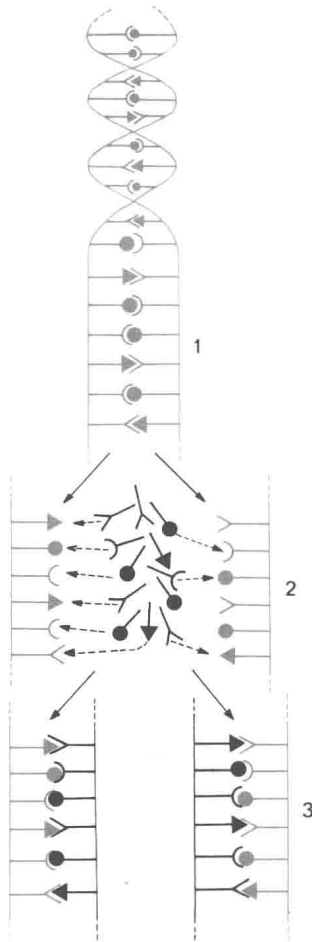
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Cell Division

The majority of body cells (except nerve cells, which are not known to divide) have a limited life span, and can "survive" only by reproducing (cell division). This is an essential event leading to the formation of two cells from a single one. Each daughter cell receives all the genetic information encoded in the DNA molecules of the original cell's 46 chromosomes. This necessitates the duplication of the DNA of the "mother" cell and its equal distribution to the two daughter cells, so that each contains genetic material identical to that of the mother cell. Cell division, therefore, requires two successive stages: (1) *Biochemical*—duplication of DNA in the mother cell, and (2) *morphological* (or mitosis)—formation of two distinct daughter cells, each containing 46 chromosomes identical to those of the mother cell.

A. REPLICATION OF DNA

The coded genetic information is confined to the DNA molecules contained in the cell nucleus. The DNA molecule is composed of two chains wound helically around the same axis, and linked to each other via four complementary bases. Adenine links to thymine and cytosine links to guanine. As a result of this complementarity principle, if one of the two chains has the four bases in a certain sequence then the sequence of bases in the second chain will be determined as follows: Adenine will occur opposite thymine, cytosine opposite guanine, thymine opposite adenine, and guanine opposite cytosine. DNA synthesis, which can occur only by



SYMBOLS

→ Adenine
← Thymine
● Guanine
⌋ Cytosine

腺嘌呤
胸腺嘧啶
鸟嘌呤
胞嘧啶

Figure 1. Duplication of the DNA molecule. 1, A portion of the DNA molecule. 2, The molecule splits into two parts, each possessing all the information required to reconstitute an entire molecule. 3, Reconstitution of two molecules of DNA.

duplication of preexisting DNA molecules, produces an exact replica of DNA.

In effect the two chains of the molecule separate progressively and as their separation proceeds, each of the strands assembles the constituent bases in exact conformity to the principle of complementarity. The product is two molecules of DNA, each identical to the initial DNA molecule. In each of the two DNA molecules obtained, one strand originated from the initial DNA molecule, and the other is newly synthesized. This process requires the presence of an indispensable enzyme, DNA-polymerase, which carries out the course of DNA duplication before the morphological events of cell division become observable.

不可少的 必须 (indispensable)
DNA聚合酶 (DNA polymerase)
n-聚合酶

B. MITOSIS

Mitosis, a major upheaval within the cell, concerns mainly two types of structures: chromatin (which condenses into the chromosomes) and the centrosome.

I. CHROMATIN AND CHROMOSOMES

During the periods preceding mitosis, the essential genetic information is confined to the nucleus, where it exists in the form of tangled filaments of chromatin.

Each long and tortuous chromatin filament may be thought of as a single molecule of helical DNA encased in a protein sheath. Sequential duplication of DNA precedes the mitotic stages; the chromatin filaments

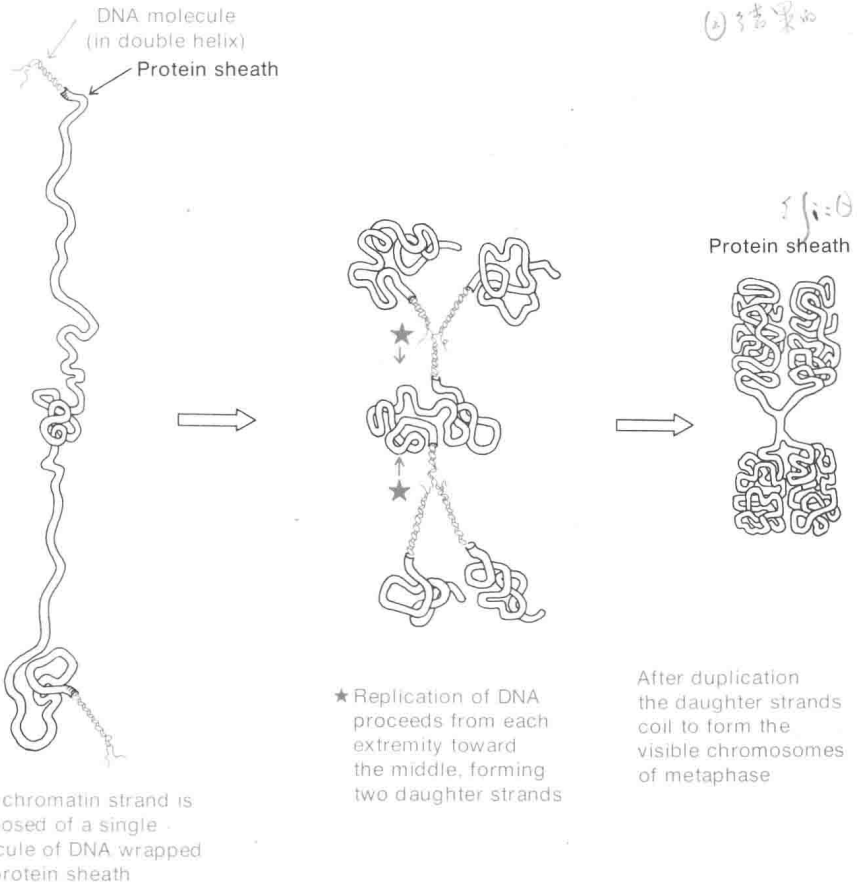


Figure 2. Model of the structure of chromosomes. (After E. J. Du Praw.)