

**OUTLINES  
AND REVIEW  
OF**

# **PATHOLOGY**

**SECOND EDITION**

*Including 1,000  
Medical Board type  
pretest questions  
and answers*

**HERBERT BRAUNSTEIN**

**OUTLINES  
AND REVIEW  
OF  
PATHOLOGY**

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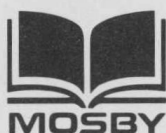
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To Sheila, John, and Anne,  
who read, used and criticized  
the first edition of this book,  
and Frances and Mary,  
whose support and encouragement  
sustained its preparation.



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# Preface

For the second edition of this volume, the outline format of the first edition has been retained. As in the first edition, we have maintained and updated the two Appendices to permit the reader to obtain additional, more specific information in two areas (Infectious Disease and Pediatric Disease) that are covered generally in the text or widely scattered in the text. We hope that the student will find these sections useful not only as references, in pathology instruction, but also in clinical clerkships for quick review. Some students have even indicated to me that the Appendices have been useful in reviewing for examinations in Microbiology.

As before, the material is presented in outline form. In the Systemic Pathology section the text follows, where feasible, the sequence of disease processes outlined in Table 2 of the first chapter. This sequence is also that generally adopted in various systems of disease nomenclature. Headings and sequential lettering have been retained to permit the student to find material or annotate it for future review. In general, the space devoted to discussion of a topic is a reflection of the editor's opinion of its importance, either as a pathologic entity or as a model for the understanding of a fundamental process. Certain editorial features have been restructured to enhance readability: use of a larger page, with two columns; use of bold type in subheadings to facilitate location of material; and elimination of the spiral binding.

Perhaps the most significant change is the addition of more than 1000 Medical Board-type pretest ques-

tions, almost all of which have been used previously in a similar or identical form to examine second-year Pathology students. For each question, the answer and an appropriate text reference are given, so that the reader can test his or her knowledge. We believe that this feature will enhance the value of this book as a vehicle for studying for both class and Medical Board examinations.

The purpose of this book remains unchanged from that of the first edition: coverage of the field of instruction that is as complete as possible, presented in a concise fashion. Also unchanged are the author's opinions that (1) the book should be used in conjunction with a major illustrated Pathology textbook with references; (2) it should be supplemented by classroom instruction, including the use of audiovisual or illustrated material; and (3) it should be used as a review for examination, or as an outline to revitalize or refresh knowledge by students or physicians who have already been exposed to Pathology.

With the departure from the area of a number of contributors to the first edition, the editor has assumed the responsibility for their contributions. It is hoped that this will not prevent the attainment of comparable standards. The excellent indexing by the publisher of the first edition has been expanded and improved. As before, the editor bears the responsibility for the entire text, having read and edited each word. If the reader finds the book useful, it should be credited to the section authors; any shortcomings are the fault of the editor.

HERBERT BRAUNSTEIN

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## Preface to the first edition

When called on to organize “from scratch” a course in pathology for a new biomedical program, I decided to employ a very traditional and conventional approach to teaching. However, it became apparent early that standard textbooks of pathology were poorly adapted to the core curriculum currently in vogue in medical education. Although necessary for reading, reference, and illustration, these standard textbooks were excessively lengthy for students to use for repetitive study and review for certification examinations. Most medical schools accommodate these deficiencies by providing students with a lecture series, emphasizing important information and serving as a study guide.

Lectures have significant deficiencies, including the following:

1. The amount of time available for instruction in different schools varies widely. In many, the time allotted for pathology instruction is grossly inadequate to cover the field.
2. The combination of misstatements by the lecturer and frequent misunderstanding and transcription errors by the student makes lecture notes taken by the student, even with the systematic organization carried out by many student groups, gold mines of misinformation.
3. The usual alternative, handouts issued by the instructor, has a number of undesirable features. These include lack of consistency, frequent overemphasis on areas of special interest to the instructor, and a tendency for the notes to remain immutable for many years.

Textbooks likewise suffer from the deficiency of rapid obsolescence. The long lead time required for preparation of a textbook and the great interval between editions make the information contained in textbooks often 5 to 7 years out-of-date late in the life span of each edition.

The present outline evolved out of the need to pro-

vide students with a vehicle to compensate for the deficiencies of the conventional system. Since our curriculum had a separate course in general pathology, this area is discussed in a separate section. The section on systemic pathology was written when we were presenting an integrated course in pathology and introductory medicine. Accordingly, it is organized along medical subspecialty lines, rendering it easily adaptable for use in integrated courses. Nonetheless, despite having abandoned integration in most areas, we have not found it necessary to change its arrangement. Since most schools teach hematology as an integrated block, including anatomical and clinical pathology as well as clinical hematology, that section contains all the information required for that approach to instruction, most of which is not covered in traditional pathology textbooks.

The chapter on infectious diseases is extremely compact by comparison with that of most pathology textbooks but covers the general features of infectious disease pathology in a fashion similar to that used in infectious disease blocks in integrated courses. Specific details of the pathology and laboratory diagnosis of infectious disease are covered in tabular form in an appendix. Similarly, in recognition of the fact that in the systemic approach diseases of children are frequently given short shrift, the peculiarities of disease processes as they occur in different pediatric age-groups are outlined in an appendix.

In the interest of spatial economy, illustrations are limited and there is no bibliography. Since it is recommended that this outline be used in conjunction with a conventional textbook, both pertinent references and visual material should be obtained from the textbook and provided by instructors.

Early experience with this teaching method indicates that it has been successful if the scores of our students in National Board Examinations and feedback from clinical sources are valid criteria. We believe that it is

adaptable to almost any curriculum organization and, accordingly, have decided to publish it. Its continued success will be contingent on timeliness, which will require frequent revision at intervals far shorter than those between editions of conventional textbooks. Achieving this will require wide initial acceptance by medical students and others interested in studying pathology. We trust that the reader will find it useful.

I have personally read every word and edited every section. I ask that the reader, if satisfied, credit this to the authors and, if dissatisfied, blame the editor, who assumes sole responsibility for any errors or misstatements.

HERBERT BRAUNSTEIN



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# Contents

## CHAPTER

### **1 Introduction to Pathology, 1**

Herbert Braunstein

---

## Section ONE

### **General Pathology**

### **2 Pathology of the Cell, 7**

Herbert Braunstein

### **3 Inflammation, 21**

Herbert Braunstein

### **4 Repair, 38**

Herbert Braunstein

### **5 Diseases Caused by Physical and Chemical Agents, 45**

Robert A. Stewart

### **6 Environmental Diseases, 52**

Robert A. Stewart

### **7 Radiation Pathology, 61**

Herbert Braunstein

### **8 Nutritional Diseases, 67**

Herbert Braunstein

### **9 Degenerative Processes, 77**

Theodore A. Friedman

### **10 Diseases of Aging, 83**

Theodore A. Friedman

### **11 Disorders of Homeostasis, Shock, and Heart Failure, 89**

Herbert Braunstein

### **12 Necrosis, Infarction, Thrombosis, and Embolism, 98**

Herbert Braunstein

### **13 Neoplasia, 106**

Herbert Braunstein

### **14 Congenital and Genetic Disorders, 120**

Theodore A. Friedman

### **15 Immunopathology, 133**

Herbert Braunstein

### **16 Infectious Disease, 144**

Herbert Braunstein

---

## Section TWO

### **Systemic Pathology**

### **17 Respiratory Pathology, 157**

Robert A. Stewart

### **18 Cardiovascular Pathology, 186**

Herbert Braunstein

- 
- 19 Renal and Male Genitourinary Pathology, 212**  
Herbert Braunstein
- 20 Endocrine Pathology, 248**  
Herbert Braunstein
- 21 Skin Pathology, 271**  
Theodore A. Friedman
- 22 Breast Pathology, 283**  
Theodore A. Friedman
- 23 Pathology of Special Senses (Eye, Ear), 288**  
Robert A. Stewart
- 24 Diseases of Mediastinum and Pineal Gland, 295**  
Robert A. Stewart
- 25 Alimentary Pathology, 298**  
Herbert Braunstein
- 26 Hepatobiliary Pathology, 322**  
Herbert Braunstein
- 27 Pathology of Female Genital System and Pregnancy, 347**  
Theodore A. Friedman
- 28 Diseases of Soft Tissue and Muscle, 364**  
Herbert Braunstein
- 29 Diseases of Bone and Joints, 371**  
Herbert Braunstein
- 30 Hematology, 387**  
Theodore A. Friedman
- 31 Neuropathology, 436**  
M. Anthony Verity
- 
- Appendices**
- 1 Pathology and Diagnosis of Infectious Disease, 453**
- 2 Disease of Childhood, 485**

# 1

## Introduction to Pathology

Herbert Braunstein



Pathology is the study of disease. Disease may be defined as any abnormality in structure and/or function within an organism. In pathology, for the first time in a systematic fashion, the student will study disease under field conditions.

There has been increasing criticism of the medical profession for its "disease orientation" in both medical education and medical practice. Some have even claimed that this attitude is deliberately fostered by physicians for nonaltruistic reasons. Such individuals have urged that physicians devote their attention to promoting and maintaining health rather than treating ill health. Young, idealistic physicians-to-be, not yet rendered cynical by the passing parade of unhappy humanity through health care facilities, often share these opinions.

These beliefs have encouraged the development of a variety of health care, euphemistically designated "health maintenance organization" (HMO). This appellation is designed to suggest that such a group practice has as its purpose the promotion of good health rather than the management of ill health. In fact there is no evidence to suggest that such an organization can achieve this aim, given the inability of the physician to control the poor health habits and the environmental and social problems that cause most disease.

Improvement in life expectancy and reduction in mortality are, to a considerable extent, a result of better sanitation and diet (public health) as well as a reflection

of the development and application of advanced therapeutic measures, especially for management of infectious diseases. Public health is a relatively small branch of medicine. Accordingly, most physicians will devote their careers to detecting and managing disease as well as to advising individual patients concerning good health habits and methods of disease detection.

The argument that the individual physician or the medical profession as a whole can "maintain health" is specious. In the first place, "health" is a phenomenon that defies delineation, unless it is defined as the absence of disease. Secondly, all parameters that have been proposed to measure it are inexact. Additionally, in a democratic society, no patient need follow the physician's advice concerning sound health habits, even if there were unanimity in identifying them. Finally, there is no reason to believe that the physician, in the relatively brief contact time with the patient, can effect the substantial modification in life-style usually necessary to "maintain health." The incidence of recidivism from reformed bad health habits that cause disease is extremely high.

Although initiation of good health habits may have the short-term effects of prolonging and improving the quality of life, the mortality of man mandates that there will be only postponement, not elimination of breakdown. Ultimately, a diseased state will develop in all individuals, requiring diagnosis and management. At best, therefore, "health maintenance" may serve to

postpone and modify rather than eliminate the disease states physicians presently encounter.

The minimum influence that the physician can exert in maintaining health is illustrated by the following: two thirds of the population of the United States do not use automobile safety belts, one half still smoke tobacco, and most still consume alcohol, many very heavily. No doubt, a totalitarian state could effect a great reduction in morbidity and mortality by banning industrial pollution, eliminating automobiles, fluoridating drinking water, prohibiting the manufacture and consumption of candy, alcoholic beverages, and tobacco products, and slaughtering all cattle—if these procedures could be enforced. The evidence is convincing that these measures cannot be carried out successfully, even in an all-pervasive despotism and even if they were feasible without serious disruption of modern society. Indeed, alcoholism is an enormous problem in the Soviet Union, and per capita consumption of cigarettes in the People's Republic of China and of cigars in Cuba is the highest in the world.

It appears probable, therefore, that the medical profession will continue to devote most of its energies to the diagnosis and treatment of disease, which today in the United States is largely an attempt to repair the damage wrought on the individual by self and environment. Such emphasis does not preclude the possibility that individual physicians and the medical profession as a group will exert whatever influence they may possess on behalf of sound health habits for individuals and improvement of public health through appropriate group and governmental action. Beyond this, the physician's efforts at "health maintenance" are largely devoted to early detection of disease.

Pathology is a bridge between basic science and clinical medicine. In common with basic science, it strives, insofar as possible, to offer explanations and establish principles. In common with clinical medicine, to a considerable extent it consists of isolated bits and pieces of information which, although valid, are as yet unexplained. Also in common with clinical medicine, pathology often deals with medical problems on the basis of relatively inaccurate and incomplete information. Although extremely sophisticated and complex methods have simplified and made more exact the diagnosis of disease, these are often time-consuming and expensive. As was Hippocrates, on initial contact with the patient the physician is still confronted with the necessity of viewing the patient through a wall of only partially penetrable skin and flesh. The physician now faces the dilemma of deciding whether the manifesta-

**Table 1-1** Examples of disease produced by various mechanisms

Mechanisms	Disease
Lethal cellular damage (agent kills cells)	Myocardial and other infarction Staphylococcal disease Viral hepatitis Mercury poisoning
Sublethal cellular damage (agent damages but does not kill cell)	Glycogenosis Tay-Sachs disease Fatty liver Neoplasia Tetanus Cholera
Extracellular damage (agent acts on or damages extracellular compartment)	Amyloidosis Glomerulonephritis (in part) Atherosclerosis Alveolar proteinosis Diabetic vascular disease (in part)
Response to foreign stimuli (disease results from response of individual to introduction of agent that is essentially inert)	Tuberculosis Pneumococcal pneumonia Traumatic shock

tions described by the patient justify the expenditure of time and money as well as the risk to the patient that complex diagnostic studies often entail. With the frequent necessity for rapid response to changing situations in medical management, a data base of information, not derivable from conceptual comprehension, is essential. It is the purpose of pathology to provide the student with the understanding of principle and the factual or observational data base essential to medical practice.

Disease in humans is rarely simple, for many reasons. These reflect the heterogeneity of the human species, the great variability in environment, customs, and dietary as well as health habits, and the extreme complexity of the organism. Added to this is relative longevity associated with the inevitable wear and tear on organs and tissues and the increasing ability of modern medicine to palliate this deterioration and keep the patient alive. Apparently simple disease mechanisms may be complicated by underlying chronic diseases, extremely complicated organ or cell interactions, heter-



**Table 1-2** A classification of disease

Nature of process	Location												
	Body as a whole	Alimentary	Hepatobiliary	Cardiovascular	Endocrine	Kidney-urinary: male genitalia	Kidney-urinary: female genitalia	Hemopoietic	Integumentary	Musculoskeletal	Nervous system	Respiratory	Special senses
Congenital, genetic	3												
Inflammatory, acute				2					12			1	
Inflammatory, chronic			13	2		11							
Mechanical obstructive, etc.			6							5			
Chemical: Toxic													20
Circulatory: Occlusive; thrombotic				17								7	
Circulatory: Hemorrhagic											18		
Growth disturbances				9	10								
Neoplastic		14					15	16	8				
Metabolic disturbances	4				19								

**Examples of classification**

- |                            |                                       |                         |                         |
|----------------------------|---------------------------------------|-------------------------|-------------------------|
| 1. Pneumonia, lobar        | 6. Gallstone obstruction to bile duct | 11. Kidney tuberculosis | 16. Leukemia            |
| 2. Rheumatic heart valve   | 7. Pulmonary embolism                 | 12. Skin boil           | 17. Heart attack        |
| 3. Down's syndrome         | 8. Cancer of breast                   | 13. Cirrhosis of liver  | 18. Hemorrhage of brain |
| 4. Generalized amyloidosis | 9. Enlarged heart                     | 14. Cancer of stomach   | 19. Diabetes mellitus   |
| 5. Fractured rib           | 10. Parathyroid overactivity          | 15. Fibroid of uterus   | 20. Smog eye irritation |

ogeneity of possible causes, or therapeutic modalities (iatrogenic factors). Nonetheless, although disease is usually complex, it is produced by a relatively small number of fundamental mechanisms. These are summarized in Table 1-1.

*Classification of disease* is important in medical communication and in comprehending both pathogenesis and pathologic alterations. There are many complex and sophisticated methods of classifying disease, but all in some fashion use two parameters: *location* and *nature of process*. A generic term applied to an area of diseased tissue, whatever its nature, is *lesion*.

A method of classification that is relatively simple and convenient for purposes of instruction is outlined

in Table 1-2. All diseases can be classified as belonging in one of the boxes making up the grid. It should be noted that pathology is divided into two parts according to the same parameters mentioned before in the classification of disease:

1. General pathology: A discussion of disease fundamentals oriented *horizontally* (nature of process)
2. Systemic pathology: A more detailed discussion of diseases oriented *vertically* (by area or location)

This outline will follow the aforementioned time-honored division in its presentation of pathology.



## Questions

A new feature of the second edition of this book is the provision of review questions at the end of each chapter. Questions are followed by a list of answers with relevant text references.

The questions are of the three types most frequently appearing on national board and other medical certification examinations. The format of each and an example of each are noted below.

### A. SINGLE MULTIPLE CHOICE

**Principle:** Select the single most correct answer.

**Example:** Who is buried in Grant's tomb?

- a. Lee
- b. Lincoln
- c. Sheridan
- d. Grant
- e. McClellan

**Answer:** d

### B. MULTIPLE MULTIPLE CHOICE

**Principle:** Select the correct combination as follows:

- A. Only answers 1, 2 and 3 are correct.
- B. Only answers 1 and 3 are correct.
- C. Only answers 2 and 4 are correct.
- D. Only answer 4 is correct.
- E. All 4 answers are correct.

**Example:** Among the generals who fought on the Union side in the Civil War is/are:

- 1. Sherman
- 2. Grant
- 3. Sheridan
- 4. Lee

**Answer:** A

### C. MATCHING

**Principle:** Match the statement on the left with the most appropriate statement on the right by placing the letter of that statement in the space to the left.

**Example:**

Achievement	Person
<u>C</u> President of U.S.	A. Lincoln
<u>B</u> Union general in Civil War	B. Grant
<u>D</u> Buried in the Lincoln Memorial	C. Both
<u>B</u> Buried in Grant's tomb	D. Neither
<u>D</u> Born in Virginia	

**Answers:** Listed

# ONE

## General Pathology

Harriet E. Blumberg

Cell



# 2

## Pathology of the Cell

Herbert Braunstein

### CELLULAR ECOLOGY

#### Review of cellular components

- A** Cell membrane: Structure is that of double membrane enclosing a space. Outer layer is coated with mucopolysaccharide. Probably lipoprotein bilayer with embedded traversing globular proteins; microvilli at absorptive surface. Function is selective transport.
- B** Nuclear membrane: Structure is that of double membrane interrupted by pores surrounded by annuli. Outer layer covered with ribosomes. Function is ribonucleic acid (RNA) transport.
- C** Cytoplasmic organelles:
  - 1** Cytosol: Matrix is a gel; suspends organelles.
  - 2** Mitochondria: Double membrane divided by space. Cristae are folds of inner membrane. Contains enzymes (components of integrated pathways for energy manufacture).
  - 3** Golgi complex: Lamellar stacking of unit membranes in cup shape, forming cisterns, usually dilated at end. Free intercommunication with endoplasmic reticulum. Function is synthesis of proteins and packaging in membranes, usually for secretion or excretion.
  - 4** Lysosomes: Single membrane-bound bodies, rich in hydrolases. Stages include *primary* (inactive); *secondary* (autophagic), containing cytoplasmic bodies being eliminated; and *residual body*—unidentifiable debris after disposal, often containing the pigment lipofuscin tending to accumulate over the years especially in the heart, liver, and neurons. Abnormalities in enzymes (individual or multiple) are frequent causes of genetic metabolic storage diseases (see Chapter 14).
- 5** Peroxisomes (microbodies): Structures of variable morphology (usually spherical or granular, mitochondrion-sized) found in liver or kidney, containing catalase plus one or more oxidases. Probably participate in lipid peroxidation (very long chain fatty acids [VLCFA]). Proliferation (electron microscopy [EM]) in liver provoked by hypolipidemic drugs, clofibrate, and certain phthalate plasticizers. Rare, heritable (autosomal recessive or X-linked) congenital deficiencies recognized; severe, usually fatal central nervous system and adrenal abnormalities result from accumulation of VLCFA in cells.
- D** Endoplasmic reticulum ([ER] smooth, rough membranes; ribosomes):
  - 1** Morphology: Variable structure of anastomosing tubules (cisternae); membrane bound; forming parallel sacs and vesicles.
  - 2** Rough endoplasmic reticulum: Studded with ribosomes on outside; protein synthetic; guided by ribosomes (RNA).
  - 3** Smooth endoplasmic reticulum: Less regular; lacks ribosome binding sites; locus of metabolizing enzymes (steroids, drugs, lipid, glycogen). In striated muscle, transports energy-rich material.
- E** Cytoskeleton: Heterogeneous intracellular structures that maintain cellular form and movement:
  - 1** Microtubules: Hollow, noncontractile elements