PATHOLOGY

BY

Peter A. Herbut, M.D.

Professor of Pathology, Jefferson Medical College and Director of Clinical Laboratories, Jefferson Medical College Hospital, Philadelphia, Pennsylvania

Second Edition, Thoroughly Revised

1506 Illustrations on 758 Figures and 6 Colour Plates

First Edition, 1955

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CONTRIBUTORS

Except as indicated, all contributors are connected with the Jefferson Medical College, Philadelphia, Pennsylvania.

Bernard J. Alpers, M.D., Sc.D.
Professor of Neurology and Head of the Department.

Eugene Aserinsky, Ph.D.
Assistant Professor of Physiology.

Gordon O. Bain, M.D.
Assistant Professor of Pathology, Faculty of Medicine, University of Alberta, Edmonton, Alberta, Canada.

Robert T. Carroll, B.S., M.D.
Head Section on Blood Transfusion, Charlotte Drake Cardeza Foundation, and Assistant in Medicine.

Richard T. Cathcart, B.A., M.D.
Assistant Professor of Medicine.

Anthony F. DePalma, M.D.
James Edwards Professor of Orthopedic Surgery and Head of the Department.

John E. C. Dorchester, B.A., M.A., Ph.D.
Assistant Professor of Physiology.

Willard M. Drake, Jr., A.B., M.D.
Associate in Urology.

M. H. F. Friedman, B.Sc., M.A., Ph.D.
Professor of Physiology and Head of the Department.

Franz Goldstein, M.D.
Instructor in Medicine.

Fred Harbert, A.B., M.D., M.Sc., D.Sc.
Professor of Oto-Rhino-Laryngology and Broncho-Esophagology and Head of the Department.

W. Paul Havens, Jr., A.B., M.D.
Professor of Medicine and Professor of Clinical Microbiology.

Hans G. Keitel, B.S., M.D.
Professor of Pediatrics and Head of the Department.

Joseph F. McCloskey, B.S., M.D.
Associate Professor of Pathology.

William V. McDonnell, A.B., M.D.
Associate Professor of Pathology.

Francis A. McKeon, Jr., B.S., M.D.
Instructor in Pathology.

Abraham E. Rakoff, A.B., M.D.
Clinical Professor of Obstetric and Gynecologic Endocrinology.

Joseph J. Rupp, B.S., M.D.
Assistant Professor of Clinical Medicine.

William A. Sodeman, B.S., M.D.
Dean and Professor of Medicine.

Leandro M. Tocantins, M.D.
Professor of Clinical and Experimental Medicine and Director Charlotte Drake Cardeza Foundation.

Frederick B. Wagner, Jr., A.B., M.D.
Clinical Professor of Surgery.

PREFACE TO THE SECOND EDITION

In this second edition of Pathology your author has endeavored to correct some of the defects in the first edition that have been so kindly and so constructively pointed out by both colleagues and medical students alike. This, of necessity, has added 288 pages and 213 photographs to the book but still, it is hoped, keeps it within usable bounds.

In the first section on general pathologic processes material pertaining to the following subject matter has been added, extended, or completely rewritten, in most instances with greater emphasis on mechanisms and pathophysiologic aspects: names of more recently deceased pathologists of note, laws concerning disposal of bodies after death, atrophy, fibrinoid degeneration, amyloidosis, mucus, carbohydrate metabolism, lipid metabolism, iron and iron metabolism, hemoglobin, bilirubin, vitamins, porphyrins, melanin, inflammation, allergic inflammations, viral inflammations, rickettsial inflammations, fungous inflammations, parasitic inflammations, tuberculous inflammation, syphilitic inflammation, fluid balance, shock, thrombosis, embolism, heat exhaustion, heat stroke, chilblains, hypothermia, electricity, and irradiation.

The greatest change effected in the remainder of the book on systemic pathology has been the addition of a section on pathologic physiology at the beginning of each chapter and concerned with the organ or system therein discussed. Where possible, the material included consists of (1) brief summary of the normal physiology, (2) a discussion of the deviations from normal referring to specific disease states or groups of diseases in which such deviations occur, (3) an explanation, as far as possible, on morphologic grounds of the reasons for the altered physiology, and (4) a brief discussion of the various laboratory tests by which altered physiologic function can be discerned. This rather formidable task was accomplished by twenty of your author's colleagues at Jefferson. To these contributors your author is most grateful. Some of the remaining revisions and additions in connection with systemic pathology are concerned with hypopotassemia, myxedema heart, Fiedler's myocarditis, transaminase, heart failure, cardiac arrest, mechanism of arteriosclerosis, dissecting aneurysm, glomus jugulare tumors, malignant granuloma of the face, mucocele of the sinuses, eosinophilic granuloma of the lungs, pulmonary hemosiderosis, tumors of the nasopharynx, pulmonary edema, pulmonary microlithiasis, cretinism with goiter, intestinal polyposis and mucocutaneous pigmentation, syndrome of malignant carcinoid, barium sulfate granuloma, subphrenic abscess, nephrocalcinosis, fibromatosis, discoid lupus erythematosus, reticulohistiocytic granuloma, and keratoacanthoma.

Finally, this second edition would not have been possible without the continued interest and encouragement of Lea & Febiger in publishing the book, the aid of Mr. Robert T. Lenz and his library staff in providing medical journals, and the loyalty and perseverance of Miss Lucille S. Holmes in the adroitness of the secretarial work. To all of these your author wishes to express sincere thanks.

Peter A. Herbut, M.D.

Philadelphia, Pa.

PREFACE TO THE FIRST EDITION

THIS book on Pathology is intended for the student of medicine—be he undergraduate or postgraduate. It consists of a general dissertation on both medical and surgical diseases and represents an attempt to reduce an encyclopedic amount of information to the confines of a single volume. To achieve this end a rather rigid pattern is necessarily followed throughout the text and the material is presented with little if any adornment.

The first Chapter is concerned with orientation. It contains a delineation of pathology and its various subdivisions, a sketchy outline of the evolution of pathology as a separate specialty in medicine, and brief mention of some of the great names and contributions of the past. The second Chapter deals with the all-important but often neglected topic of The Autopsy. It encompasses a brief account of the ownership of the body, permission for autopsy, equipment necessary for performance of an autopsy, actual procedure involved, medicolegal autopsy, and weights and measurements of normal organs. The next five Chapters are devoted successively to general discussions of the basic pathologic processes of Congenital Anomalies, Degenerations, Inflammations, Physical Disturbances, and Tumors. This division sets the pattern for the majority of the remaining Chapters wherein the diseases of most of the organs are classified into the five major categories just listed. In addition, whenever a disease receives more than passing comment, its characteristics are usually presented in the following sequence: definition, incidence, cause, gross appearance, microscopic appearance, spread (in the case of tumors), complications, clinicopathologic correlation, diagnosis, treatment, and prognosis. In each instance, while the pathologic anatomy is stressed, an attempt has been made to include enough of the other aspects to give the reader a bird's-eye view of the disease as a whole.

Much of the incentive for undertaking the writing of the book has come from association with enthusiastic and inquisitive medical students. To them, your author wishes to voice genuine appreciation. He also wishes to express sincere gratitude to Doctor Bernard J. Alpers for contributing the Chapter on the Central Nervous System, to the Staff Members of the Department of Pathology and Clinical Laboratories for their helpful suggestions and aid in preparing material for photography, to Doctor William V. McDonnell for the monotonous and unrewarding task of reading the manuscript, to Miss Lucille S. Holmes for excellent secretarial performance, to Mr. Robert T. Lentz and the library personnel for their co-operation, and to Mr. Allen F. Hancock for the photography. The photographs of parasites were made from slides purchased from Ward's Natural Science Estab., Inc., Rochester, N. Y. and Tropical Biologicals, San Juan, Puerto Rico.

PETER A. HERBUT, M.D.

PHILADELPHIA, PA.

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PATHOLOGY

Chapter

1

Orientation

DEFINITIONS

IN ORDER to better understand the meaning of pathology, one must first know what is meant by disease and this, in turn, requires an understanding of the meaning of health. *Health* (AS. = whole) may be defined as a normal state of the body or as the condition of the body when it exists in complete harmony with its surroundings. *Disease* (Fr. = negative + ease) is any departure from a state of health or the state of the body when it exists in discord with its surroundings. It is a disordered condition of the mind or body.

Pathology (Gr. = disease + discourse) may be defined as a study of disease or as that fundamental branch of medicine that is concerned with the study of the causes, nature, and evolution of disease and the changes in anatomy, physiology, and chemistry resulting therefrom. The study of the causation of disease is spoken of as *etiology* (Gr. = cause + discourse). The precise etiological or causative agents are known in many diseases but in others they are as yet obscure. Some of the more common causes of disease are bacteria, rickettsia, viruses, fungi, parasites, chemicals, heat, cold, light, electricity, irradiation, foreign bodies, and trauma. The *nature* of a disease may be defined as its essential character or its distinguishing quality. Fundamentally, diseases may be divided into the following five groups: congenital anomalies, degenerations, inflammations, physical disturbances, and tumors. The *evolution* of a disease, known as *pathogenesis* (Gr. = disease + origin), is its unfolding or development. Changes in anatomy connote morphologic alterations and are grouped under the designation of *pathologic anatomy*. This branch is further subdivided into gross, microscopic, general, and special pathology. *Gross* (or macroscopic) pathology means the study of alterations in organs and tissues as seen with the naked eye. *Microscopic* (or histologic) pathology concerns changes in organs, tissues, and cells as visualized with the aid of a microscope. *General* pathology encompasses fundamental processes which are usually common to more than one tissue or organ and which often eventuate from more than one etiologic agent. An example is parenchymatous degeneration which affects the liver, kidneys, and other organs and results from the action of bacteria, chemicals, and other agents. The term *special* pathology is reserved for the study of diseases peculiar to certain organs or systems. Thus, one speaks of *surgical* pathology (those conditions that come within the field of surgery), *genito-urinary* pathology (changes confined to the genital and urinary systems), *gynecological* and *obstetrical* pathology (dis-

orders of the female generative system), *neuropathology* (alterations in nerve tissue), pathology in *internal medicine* (those conditions that come within the scope of the internist), etc. Changes in physiology consequent to disease are referred to as *pathologic physiology*, and changes in chemistry are called *pathologic chemistry*. *Clinical pathology* is that branch of pathology that is usually practiced in a hospital. It is a hybrid that is closely connected with clinical medicine and encompasses chemistry, parasitology, hematology, serology, bacteriology, and pathologic anatomy. *Experimental pathology* is the study of disease willfully produced in animals. *Comparative pathology* is that branch of pathology wherein diseases of lower animals are compared with those in man.

EVOLUTION OF PATHOLOGY

It is apparent, from the above definitions, that pathology is intimately associated with disease and it is not surprising, therefore, that it did not emerge as a basic and more or less separate science until relatively recently.

In *ancient times* theology dominated the practice of healing. The diseased visited the temples of the gods for relief from their miseries. As a token of their appreciation, some of those who were cured left rewards of sculptured or modeled forms which have from time to time been unearthed by archeologists. A few of the disorders thus represented are varicose veins, ulcers, hernias, obesity, and breast tumors. Aside from these, the earliest records of disease date to ancient Egypt. Here, too, theology dominated the scene. Demons caused disease and the art of healing was relegated to priests who drove out the evil spirits. By 1550 B. C. there was some knowledge concerning intestinal parasites, castration, circumcision, bone injuries, ulcerating masses, and trachoma.

Around the *time of Christ* there were five men that made a lasting imprint on medicine. *Hippocrates* (460–370 B. C.) was the first to break away from the demonistic doctrines. He propounded the theory that disease was caused by disturbances in body fluids or humors, and so was born *humoral pathology*. According to Hippocrates, the body contained four humors—blood which came from the heart, phlegm from the brain, yellow bile from the liver, and black bile from the spleen. He described suppuration and introduced the terms cancer and scirrhous. *Aristotle* (384–322 B. C.), through extensive animal dissections, originated the science of Zoology. At Alexandria, he founded the first university and it was here that dissection of the human body (on a large scale) was first practiced. *Herophilus*, born in 300 B. C., held that life was based on the following four factors: nourishment which originated from the liver and the digestive tract, warmth which came from the heart, mental activity which was associated with the brain, and sensations derived from the nerves. *Cornelius Celsus* (30 B. C.–38 A. D.) was the first to write a text on special pathology. Among other things, he propounded the cardinal signs of inflammation: rubor (redness), tumor (swelling), calor (heat), and dolor (pain). Finally, there was *Galen* (129–201 A. D.) who expanded the humoral pathology of Hippocrates and, through his writings, dominated thinking in medicine for centuries to come. With the Christian era, dissection of human bodies practically ceased. Galen, therefore, turned to the dissection of animals and projected his findings to man. He explained disease on two factors—presentation and adhesion. If proper amount of material was presented to a part, it ad-

hered and was utilized; otherwise, it was discarded. He wrote more than five textbooks on pathology.

Following Galen there was little progress in medicine until the *Renaissance* (14th to 16th centuries) when *pathologic anatomy* emerged as a separate science. *Antonio Benivieni* (1440–1502) was the first to ask relatives for postmortems on obscure cases. *Fracastoro* (early 1500) likened fermentation of wine to infection and spoke for the first time of a transmissible virus. He gave an excellent account of the clinical course of syphilis and both recognized and emphasized its venereal origin. *Jean Fernel* (born in 1497) wrote extensively on syphilis and suggested that aneurysms were of syphilitic origin.

The seventeenth century produced several great men in medicine. *William Harvey* (1578–1657) discovered the circulation. *Marco Aurelio Severino* (1580–1656) wrote extensively on tumors of the genital organs. *Thomas Bartholin* (1616–1656) organized the first medical journal. *Johann Jakob Wepfer* (1620–1695) discovered the relationship of cerebral hemorrhage to apoplexy. *Marcello Malpighi* (1628–1694) introduced the microscope into pathology and, among other things, described the histology of the kidneys, lungs and spleen. *Georgio Baglivi* (1669–1707) looked upon the body as a complicated machine, placed diseases in the solid portions of the body rather than in the humors, and thus was the first to break away from the humoral pathology of Hippocrates and Galen. Also born in the 17th century, but really a product of the 18th century, was *Giovanni Battista Morgagni* (1682–1771). In his great work, the "Seat and Causes of Disease," he was the first to correlate organic changes found at postmortem with clinical symptoms. Thus, it was with him that modern pathology began.

Gradually the great centers of medicine, and therefore pathology, shifted from the Mediterranean area to central and western Europe and then to America. *France* produced several notables. *Raymond de Vieusseus* (1641–1716) recognized aortic insufficiency and gave a lucid description of its effect upon the pulse. *Bichat* (1771–1802) was aware of the need of histologic methods for the further advancement of pathology. He contended that the body was made of textures or tissues and that diseases of organs were in reality diseases of tissues. By means of fine dissection and subjection of organs to action of heat and chemicals he recognized twenty-one different tissues in the body. *Laennec* (1781–1826) contributed greatly to the knowledge of pulmonary tuberculosis, bronchiectasis, emphysema, and lobar pneumonia and also invented the stethoscope. *Jean Cruveilheir* (1791–1873) was made Professor of Pathologic Anatomy at Hotel Dieu in Paris (the first to occupy such a position anywhere) and produced a lithographed atlas on pathologic anatomy. *Philip Record* (1799–1889) separated gonorrhea from syphilis, and *Jean Martin Charcot* (1825–1893) excelled in pathology of the nervous system. Although best known for his work on a destructive type of arthritis he also contributed to multiple sclerosis, amyotropic lateral sclerosis, and locomotor ataxia.

In *England* there were at least six men who distinguished themselves. *John Hunter* (1728–1793) wrote extensively on the treatment of battle wounds to which he was exposed during the Seven Years' War, discovered collateral circulation, and recognized the usefulness of the clotting of blood. *Mathew Baillie* (1761–1823) wrote the first textbook devoted exclusively to pathology. *Richard Bright* (1789–1858) correlated albuminuria, kidney disease, and dropsy. *Thomas Addison* (1793–1860) described a re-

fractory type of anemia and tuberculous disease of the adrenal cortex, both of which bear his name. *James Paget* (1814–1899) described an eczema of the nipple and a lesion of bones which are now known respectively as Paget's disease of the nipple and Paget's disease of bone (osteitis deformans). The sixth man was *Jonathan Hutchinson* (1828–1913) who is remembered for his work on congenital syphilis.

In *Vienna* the greatest single figure of all time in the field of pathology was *Carl Rokitansky* (1804–1878). He insisted upon a careful examination of the entire body at postmortem and not only correlated these findings with clinical manifestations but was also interested in their etiology and evolution. At the time of his retirement, he had available 70,000 protocols of autopsies performed under his directorship.

In the last century *Germany*, too, produced a brilliant and colorful array of students in pathology. Their father was *Johannes Muller* (1801–1858). To him can be credited two achievements that stand apart from other successes—(1) the routine use of the microscope in analyzing tissues and (2) the training of three pupils—Henle, Schwann, and Virchow. *Jacob Henle* (1809–1885) was the first to classify tissues histologically. *Theodore Schwann* (1810–1882) established the fact that all animal tissue was cellular. The most flamboyant, however, was *Rudolph Virchow* (1821–1902). He wrote voluminously on many topics including inflammation, pyemia, embolism, and thrombosis. He divided leukemias into two types—one in which the cells were like those in lymph nodes and the other in which they resembled those in the spleen. In 1847, he started a medical journal which is now known as Virchow's Archives. Other men of import in Germany were (1) *Recklinghausen* (1833–1910) known for his work on neurofibromatosis and osteitis fibrosa cystica, (2) *Klebs* (1834–1913) remembered for linking bacteriology with pathology, (3) *Julius Cohnheim* (1839–1884) noted for explaining the origin of tumors from misplaced rests of tissues, and (4) *Carl Weigert* (1834–1904) known for his work on tissue degeneration, necrosis and repair, and innovations in histologic technique.

Gradually but inexorably the center of interest in pathology (and indeed in medicine as a whole) began to shift from Europe to America where it is now focused. Some Americans of the past who have contributed to the field of pathology are: *Samuel D. Gross* (1805–1884) gave the first course in pathology in the United States and, in 1839, wrote a textbook on pathology; *William Pepper* (1843–1898) separated pseudoleukemia from leukemia and described the changes in the bone marrow in pernicious anemia; *Francis Delafield* (1841–1915) and *Mitchell Prudden* (1849–1924), in 1885, wrote the second textbook on pathology in America; *William Osler* (1849–1919) did much to correlate clinical medicine and pathology; *William Henry Welsh* (1850–1934) advanced more than anyone else the field of experimental pathology and bacteriology; *Frank Burr Mallory* (1862–1941) developed and perfected numerous tissue stains, especially emphasized the demonstration of collagen, myoglia, and neuroglia fibrils, and wrote a book on Pathological Technique which, although out of print today, still remains a classic; *William George MacCallum* (1874–1944) worked on parasites, demonstrated that the lymphatic system is a closed system, discovered that calcium metabolism is controlled by the parathyroid glands, showed that carbohydrate metabolism is regulated by the islets of Langerhans in the pancreas, and wrote a textbook on pathology that was used in medical schools for thirty years; *James Ewing* (1866–1943) who can best be described as the father of oncology in America. He will

be remembered (1) for his treatise on Neoplastic Diseases which has been used as a reference book for decades, and (2) for championing the use of roentgen rays and radium in the treatment of cancer; *Tracy Burr Mallory* (1896–1951) developed the clinicopathologic conference into one of the most important teaching conferences in medicine; and *Ludwig Hektoen* (1863–1951) contributed notably to our understanding of immunology and infectious disease.

Other, more recently deceased, pathologists of note were: *Balduin Lucke* (1889–1954) who discovered that an adenocarcinoma of the kidney of the leopard frog (*Rana pipiens*) was due to a filter-passing virus and that it was easily transplantable into the anterior chamber of the eye and who enhanced our knowledge of such disorders as influenza, viral hepatitis, and the renal changes in shock; *Horst Ortel* (1873–1956) who contributed much to our understanding of renal diseases and who insisted that pathology be studied from strictly causative and logically observed aspects; *Carl Vernon Weller* (1887–1956) who, among other things, pioneered in the study of cancer of the lung and who was Editor-in-Chief of the American Journal of Pathology from 1941–1956; and *G. Lyman Duff* (1904–1956) who approached pathology from an experimental point of view and who concentrated on elucidating the pathogenesis of arteriosclerosis.

Thus, after a rather prolonged evolution, pathology has at length emerged as a fundamental branch of medicine that not only holds its own with other specialties but that serves as a hub around which medical practice is built. In a modern institution the pathologist always holds a key position. He is the "silent partner"—the "father confessor"—who hears, weighs, and advises on the many problems that perplex the practicing physician. Without his aid the road for the clinician would indeed be rough and the outcome for the patient would often be disastrous.

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