

A TEXTBOOK
of
PATHOLOGY

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Seventh Edition, Thoroughly Revised

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To
G. A. MacCallum, M.D.
My Father
And My Best Friend

PREFACE TO THE SEVENTH EDITION

THE advances in medicine and related sciences have again been very great since the last revision of this book, four years ago, but still it reminds one of Goethe's statement that "it is only when we know very little about a subject that we are quite sure; and with knowledge doubt arises and grows." We must not be dogmatic, for it seems that before us paths lead into a dark forest of mystery, and it is only when we shall have followed them into outer light that we can feel that we have cleared away our doubts.

Still our efforts are in the same general direction. We know of the diseases that affect human beings, animals and plants, and it is of prime importance to search for the causes. It is on the basis of the causes, as far as we can determine them, that it is here attempted to follow their effects in disturbing the natural functions of the body, the gross and microscopical changes they produce in the tissues and their organ combinations, and the physical and chemical changes that interrupt life. In this sense Pathology must serve as an accompaniment, or even as a foundation, for the comprehension of all the clinical phenomena, and it is hoped that they may always be considered together.

Naturally other things must be studied, and especially the growth and organization of the body and its extraordinary powers of repair after an injury; but there is also its wonderful mechanism of defence, which improves with training and may fortify the body against another attack from the same injurious agent. Most important for the student is the detailed study from every viewpoint of the cases at autopsy—and this we must emphasize.

The illustrations are almost entirely from material which we have studied in the laboratory. The drawings with very few exceptions have been made by Mr. Alfred Feinberg. Photographs were made by Milton Kough and microscopical preparations by Miss Lyons, while Mrs. Kindell has given great assistance in preparing the text.

W. G. MACCALLUM.

THE JOHNS HOPKINS HOSPITAL.

CONTENTS

CHAPTER I

PAGE

DISTURBANCES OF THE FLUIDS OF THE BODY.....	1
Relation of Fluids to Tissues; Blood, Lymph, Tissue Fluids. The Blood: Variations in Quality and Quantity. Readjustment. Plethora and Oligæmia. Clotting. Thrombosis.	

CHAPTER II

LOCAL DISTURBANCES IN THE CIRCULATION OF THE BLOOD.....	17
Hyperæmia; Anæmia. Postmortem Changes in Distribution. Active and Passive Hyperæmia. Local Anæmia. Embolism. Infarction. Gangrene.	

CHAPTER III

DISTURBANCES OF INTERCELLULAR FLUIDS AND LYMPH.....	48
Their Movement, Character, and Excessive Accumulation. Œdema, Ascites.	

CHAPTER IV

THE STRUCTURE AND METABOLISM OF CELLS.....	53
Cellular Doctrine; Ultimate Unit of Life. Nucleus and Cytoplasm. Mitochondria, Plasmosomes, Paraplasmic Substances, Intercellular Substances. Tissues and Motile Cells. Variations in the Appearance of Cells. Necrosis, Coagulation, and Autolysis. Death.	

CHAPTER V

DISTURBANCES IN THE NUTRITION AND METABOLISM OF CELLS.....	65
Course of Metabolism. Disturbances Resulting in Accumulation of Various Substances. Degenerations. Atrophy: Its Causes. Hypertrophy and Hyperplasia.	

CHAPTER VI

DISTURBANCES OF FAT METABOLISM.....	78
Neutral Fats and Lipoids. Their Source. Absorption, Distribution and Functions. Pathological Disturbances.	

CHAPTER VII

DISTURBANCES OF PROTEIN AND CARBOHYDRATE METABOLISM.....	94
General Character of Protein Metabolism. The Purine Bodies. Gout. Cloudy Swelling. Hyaline Metamorphosis. Amyloid Infiltration. Carbohydrate Metabolism. Glycogen.	

CHAPTER VIII

DISTURBANCES OF MINERAL AND PIGMENT METABOLISM.....	113
Calcium: Its Source, Distribution, Deposition in Necrotic and Other Tissues; Its Relation to Various Functions of the Body. Magnesium. Iron: Its Distribution and Functional Importance. Disturbance in Its Quantitative Relations. Chlorosis. Hæmochromatosis. Pigment: Function and Distribution. Endogenous and Exogenous Pigmentation. Jaundice. Dust Diseases. Silicosis. Asbestosis.	

CHAPTER IX

	PAGE
DEFENCES OF THE BODY AGAINST INJURY.....	142
Immediate and Late Reactions to Injury. Inflammation, Fever, Immunity Production, and Repair. Inflammation an Elaborate Mechanism to Combat Injury. Details of Vascular and Phagocytic Phenomena. The Wandering Cells.	

CHAPTER X

DEFENCES OF THE BODY (CONTINUED).....	167
<i>Fever.</i> General Nature of the Reaction. Its Chemical Characters and Relation to Immunity. <i>Immunity.</i> Nature of Injurious Agents. Types of Resistance. Artificial Immunity. Anaphylaxis; Allergy. Asthma.	

CHAPTER XI

DEFENCES OF THE BODY (CONTINUED).....	180
New-growth of Tissue. General Characters. Influences of Various Agencies on Growth. Growth Stimuli.	

CHAPTER XII

DEFENCES OF THE BODY (CONTINUED).....	194
Repair. Established Character of Tissues. Their Early Differentiation. Metaplasia. Regeneration as Exemplified in the New Formation of Various Tissues.	

CHAPTER XIII

DEFENCES OF THE BODY (CONTINUED).....	210
Transplantation of Tissues and Organs, Its Limitations. Healing of Wounds—by Direct Union, Under a Crust, by Granulation Tissue, etc. Healing of an Open Ulcer, of Inflamed Wounds and Abscesses. Healing of Special Tissues.	

CHAPTER XIV

ILLUSTRATIVE EXAMPLES OF INFLAMMATORY PROCESSES.....	228
Catarrhal Inflammation. Serofibrinous and Fibrinopurulent Pericarditis, Pleuritis, Peritonitis, Appendicitis, Endocarditis, Lobular Pneumonia, Puerperal Infection. Pyæmia, Abscess Formation, Diphtheritic Inflammation.	

CHAPTER XV

INJURY WITH INFLAMMATORY REACTION AND ATTEMPTED REPAIR.....	265
Nephritis: General Nature. Relation of Anatomical Changes to Functional Disturbances. Nephrosis. Acute and Subacute Nephritis. Acute Interstitial Nephritis. Tubular Nephritis. Chronic Glomerulonephritis. Chronic Arteriosclerotic Nephritis. Functional Derangements Resulting from These.	

CHAPTER XVI

INJURY WITH INFLAMMATORY REACTION AND ATTEMPTED REPAIR (CONTINUED). —INJURY AND REPAIR OF THE LIVER.....	298
Structure of the Liver in Relation to Disease. Direct Injury to Liver-Cells. Extreme Necrosis of Liver. Eclampsia, and Infections. Repair and Compensatory Hyperplasia. Cirrhosis: Its Various Types. The Alterations in Architecture Involved. Obstruction of Portal Circulation. Collateral Circulation. Biliary and Hypertrophic Cirrhosis. Wilson's Disease.	

CHAPTER XVII

FURTHER ILLUSTRATIVE EXAMPLES OF DESTRUCTIVE AND REPARATIVE PROCESSES.	PAGE 323
Structure of Arteries. Arteriosclerosis. Anatomical Changes in Arteriosclerosis in Aorta and Other Vessels. Pathogenesis and Ætiology. Arteriosclerosis. Sclerosis of Peripheral Arteries: Thrombo-angiitis Obliterans. Mechanical and Infectious Injuries to Arteries. Cerebral Hæmorrhage. Effects.	

CHAPTER XVIII

TYPES OF INJURY: PHYSICAL AND MECHANICAL INJURIES.....	354
Mechanical Injuries: Pressure, Direct Violence Affecting Bones, Central Nervous System, etc. Gunshot and Other Wounds. Secondary Effects: Complication with Infection. Shock. Experimental Study and Various Theories. Effects of Heat: Burns, Heat-stroke, Insolation. Effects of Cold: Freezing. Effects of Light-rays and Radiant Energy on Skin, Blood-forming Organs, etc. Electricity: Effects of Strong Currents.	

CHAPTER XIX

TYPES OF INJURY (CONTINUED).—CHEMICAL INJURIES.....	380
Nature of Poisons: Their Varying Effects. Reaction of Organism; Elimination, Detoxication, Resistance. Auto-intoxication. Poisoning by Illuminating Gas, Corrosive Substances, Cyanides, Chloroform, Alcohol, Metallic Poisons, etc.	

CHAPTER XX

TYPES OF INJURY (CONTINUED).—EFFECTS OF OBSTRUCTION OF THE FLOW OF CONTENTS OF HOLLOW ORGANS. OBSTRUCTION IN THE ALIMENTARY TRACT	393
Salivary Ducts. Bile-ducts (Gall-stones, Cholecystitis, Jaundice). Pancreatic Ducts (Pancreatic Cirrhosis, Acute Pancreatitis). Obstruction of Digestive Tract: Œsophagus, Stomach (Gastric Ulcer). Intestine; Varying Mechanism of Obstruction (Hernias, Intussusception, Volvulus, Compression or Kinking by Adhesions, Paralysis, Stenosis). Diverticula of Intestine.	

CHAPTER XXI

TYPES OF INJURY.—OBSTRUCTION (CONTINUED).—OBSTRUCTION OF RESPIRATORY TRACT.....	419
Nose (Coryza, Adenoids, etc.). Larynx (Edema, Diphtheria, Foreign Bodies, Compression Stenosis). Bronchi (Foreign Bodies, Stenosis). Atelectasis: Its Causes. Mechanism of Bronchial Dilatation. Bronchiectasis. Emphysema.	

CHAPTER XXII

TYPES OF INJURY.—OBSTRUCTION (CONTINUED).—OBSTRUCTION OF THE URINARY TRACT.....	429
Urethral Stricture. Prostatic Obstruction; Hypertrophy of Prostate. Cystitis. Urinary Calculi. Hydronephrosis. Renal Calculi. Ascending Renal Infection; Pyelonephritis.	

CHAPTER XXIII

TYPES OF INJURY.—OBSTRUCTION (CONTINUED).—GENERAL DISTURBANCES OF CIRCULATION.....	449
Mechanism of Circulatory Organs, Arteries, Capillaries. Arterial Hypertension. Pathological Obstructions. Pericardial and Pleural Effusions. Emphysema. Chemical Influences. Arterial and Myocardial Disease. Coronary Obstruction. Valvular Lesions and Their Effects. Congenital Malformations of the Heart. Cardiac Hypertrophy and Dilatation. Decompensation. Disturbances in Conduction of Impulses in the Heart. Chronic Passive Congestion.	

CHAPTER XXIV	
TYPES OF INJURY (CONTINUED).—OBSTRUCTION OF THE CEREBROSPINAL FLUID: HYDROCEPHALUS.....	PAGE 488
CHAPTER XXV	
TYPES OF INJURY (CONTINUED).—BACTERIAL DISEASE.—STREPTOCOCCAL INFECTIONS.....	493
General Character of Bacterial Infection: Nature of Bacterial Action. Pyogenic Micrococci. Streptococcus Infections—of the Respiratory Tract, the Middle Ear, the Digestive Tract. Streptococcus Wound Infection, Erysipelas, Pneumonia, Endocarditis. General Septicæmia (Acute Splenic Tumor).	
CHAPTER XXVI	
TYPES OF INJURY.—BACTERIAL DISEASE (CONTINUED).—STAPHYLOCOCCUS INFECTIONS.....	520
General Character. Furunculosis. Paronychia, Impetigo, etc. General Septicæmia, Pyæmia, Suppurative Nephritis, Endocarditis, Lobular Pneumonia, Osteomyelitis.	
CHAPTER XXVII	
TYPES OF INJURY.—BACTERIAL DISEASE (CONTINUED).—PNEUMOCOCCUS INFECTIONS.....	530
Character of Organism. Lobar Pneumonia. Consolidation. Resolution. Organization, etc. Septicæmia. Endocarditis. Meningitis.	
CHAPTER XXVIII	
TYPES OF INJURY.—BACTERIAL DISEASE (CONTINUED).—MENINGOCOCCUS AND GONOCOCCUS INFECTIONS.....	544
Meningococcus Infections: Epidemic Cerebrospinal Meningitis. Endocarditis. Gonococcus Infections: Urethritis and Sequelæ. Salpingitis and Sequelæ. Arthritis. Ophthalmia. Dermatitis, Endocarditis, Vulvovaginitis in Children.	
CHAPTER XXIX	
TYPES OF INJURY.—BACTERIAL DISEASE (CONTINUED).—DIPHTHERIA. TETANUS.	558
Diphtherial Infection: Diphtheria of Respiratory Tract. General Effects upon the Heart, Kidneys, etc. Paralysis. Immunization. Tetanus Infection: Mode of Occurrence and Mechanism of Distribution of Toxin. Botulism.	
CHAPTER XXX	
TYPES OF INJURY.—BACTERIAL DISEASE (CONTINUED).—CHOLERA. PLAGUE. GLANDERS. ANTHRAX. UNDULANT FEVER. TULARÆMIA.....	568
Asiatic Cholera: Intestinal Lesions. General Intoxication. Bubonic Plague: Transmission. Bubonic Type. Pneumonic Type. Glanders: Acute and Chronic Forms. Anthrax: Infection through Skin, Digestive Tract, Lungs. Undulant Fever. Tularemia.	
CHAPTER XXXI	
TYPES OF INJURY.—BACTERIAL DISEASE (CONTINUED).—TYPHOID AND PARATYPHOID INFECTIONS.....	583
Typhoid Infection: General Relations. Intestinal, Lymphatic, Splenic, and Other Lesions. Necrosis in Various Organs. Affections of Circulatory, Respiratory, and Nervous System. Salmonella (Paratyphoid) Infection: Relation to Typhoid and Enteritis Infection. Acute Gastro-enteritis, Accessory Lesions. Dysentery: Various Organisms Concerned. Intestinal Lesions. Pyocyaneus Infections, Localization of Necroses.	

CHAPTER XXXII

PAGE

TYPES OF INJURY.—BACTERIAL DISEASE (CONTINUED).—LEPROSY.....	606
Leprosy: Nodular and Anæsthetic Forms. The Bacillus and Transmission.	
Lesions of the Internal Organs. Affections of Nerves and Their Sequelæ.	

CHAPTER XXXIII

TYPES OF INJURY.—BACTERIAL DISEASE (CONTINUED).—TUBERCULOSIS.....	616
Tuberculosis: Ætiology, Distribution and Transportation of Bacilli. Modes of Infection. Effects of the Tubercle Bacillus on the Tissues. Virulence, Immunity, Allergy, and Dosage in Relation to the Form of Lesions. Distribution of Bacilli in the Body. Acute Miliary Tuberculosis.	

CHAPTER XXXIV

TYPES OF INJURY.—BACTERIAL DISEASE.—TUBERCULOSIS (CONTINUED).....	639
Tuberculosis of Lungs in Children and Adults. Tuberculosis of Pleura and Pericardium, Digestive Tract, Heart and Arteries, Serous Surfaces, Lymph-nodes, Genito-urinary Tract, Nervous System, Ductless Glands, Skin, Bones, and Joints.	

CHAPTER XXXV

TYPES OF INJURY.—DISEASES DUE TO FUNGUS INFECTION.....	676
General Scope. Yeast-like Fungi. Torula. Meningeal Infection. Thrush. Blastomycosis or Coccidioidal Granuloma. Sporotrichosis. Actinomycosis. General Character; Mode of Infection. Ringworm. Favus.	

CHAPTER XXXVI

TYPES OF INJURY.—SPIROCHÆTAL INFECTION.—SYPHILIS.....	684
Syphilis: History, Ætiology, Course of the Disease, Immunity. Experimental Syphilis in Animals. Congenital Syphilis. General Considerations. Acquired Syphilis, Primary Stage, Secondary Lesions, Tertiary Stage.	

CHAPTER XXXVII

TYPES OF INJURY.—SPIROCHÆTAL INFECTION.—SYPHILIS (CONTINUED).....	702
Syphilitic Lesions of Circulatory System, Heart, Arteries, Aneurysms. Syphilitic Lesions of Lymph-nodes, Blood-forming Organs, Alimentary Tract, Respiratory Tract, Bones and Joints, Genital Organs.	

CHAPTER XXXVIII

TYPES OF INJURY.—SPIROCHÆTAL INFECTION (CONTINUED).....	730
Syphilitic Lesions of Central Nervous System: Meningo-encephalitis, Tabes Dorsalis, Dementia Paralytica. Congenital Syphilis: Anatomical Lesions. Other Spirochætal Infections: Yaws, Spirochaetosis Ictero-hæmorrhagica. Vincent's Angina or Trench Mouth.	

CHAPTER XXXIX

TYPES OF INJURY.—RICKETTSIA INFECTIONS.....	756
Typhus. History. Interrelation of Various Diseases Caused by Rickettsia. Character of Typhus Fever. Lesions; Experimental Studies of Transmission.	

CHAPTER XL

	PAGE
TYPES OF INJURY.—VIRUS DISEASES.....	759
General Conception of Viruses. Specific Relations. Immunity Production. Herpes Simplex, Herpes Zoster. Poliomyelitis. Infectious Nature, Transmission. Lesions of Nervous System. Epidemic Encephalitis, Various Types, Lesions and General Effects. Parkinson's Disease. Multiple Sclerosis; Schilder's Disease.	

CHAPTER XLI

TYPES OF INJURY.—INFECTIONS CAUSED BY FILTRABLE VIRUSES.....	773
Influenza. History, Mode of Occurrence, Symptoms, Complications and Sequelæ. Demonstration and Cultivation of the Virus. Common Colds, Cultivation of the Virus. Stimulation of Associated Pathogenic Bacteria. Whooping Cough or Pertussis. Rheumatism. General Character, Course and Symptoms. Cardiac Involvement. Specific Lesions. Search for Ætiological Agent.	

CHAPTER XLII

TYPES OF INJURY.—INFECTIONS CAUSED BY FILTRABLE VIRUSES.....	791
Yellow Fever: Course, Transmission by Mosquitoes, Ætiology, Anatomical Lesions. Dengue: Symptoms, Transmission. Psittacosis: Distribution, Transmission, Ætiological Studies.	

CHAPTER XLIII

TYPES OF INJURY.—INFECTIONS APPARENTLY CAUSED BY FILTRABLE VIRUSES.....	796
Rabies or Hydrophobia: Ætiology, Symptoms. Pasteur's Virus for Preventive Inoculation, Lesions. Landry's Paralysis. Mumps: Symptoms and Lesions; Ætiology. Lymphopathia Venereum. Distribution, Lesions, Virus Origin, Frei Test. Granuloma Inguinale. Regional Ileitis or Ileocolitis. Periarthritis Nodosa: Vascular Changes and Ætiology.	

CHAPTER XLIV

TYPES OF INJURY.—INFECTIONS CAUSED BY FILTRABLE VIRUSES.....	804
Exanthematic Diseases: General Character. Measles: Occurrence, Transmission, Ætiology, Secondary Infections, Pathological Anatomy, Neurological Symptoms. Scarlet Fever: Ætiology, Course, Pathological Anatomy. Smallpox: Occurrence, Relation to Vaccinia, Alastrim, Chickenpox. Ætiology, Symptoms, Pathological Anatomy; Relation of Encephalitis Following Vaccination.	

CHAPTER XLV

TYPES OF INJURY.—DISEASES DUE TO ANIMAL PARASITES.....	819
Introduction. General Relation of Parasites to Host. Table of Main Zoological Divisions. Amœbic Infections: Types of Parasites and Life-history; Intestinal Infection; Abscess of Liver; Abscess of Lung. Pyorrhœa Alveolaris. Malaria: Types and Life-history of Parasites; Symptoms and Pathological Anatomy; Blackwater Fever. Leishmaniasis; Kala-azar. Trypanosome Infections: Biology; Sleeping Sickness.	

CHAPTER XLVI

TYPES OF INJURY.—DISEASES DUE TO ANIMAL PARASITES (CONTINUED).....	839
Cestode Infections: Tænia and Bothriocephalus; T. Echinococcus; Echinococcus Cysts in Man. Trematode Infections: Bilharziosis; Paragonimus and Clonorchis. Nematode Infections: Trichiniasis. Biology of the Parasite, Symptomatology, Pathological Anatomy. Uncinariasis: Symptomatology; Life History of Parasite; Pathological Anatomy. Infections with Ascaris, Oxyuris, Onchocerca, Trichocephalus, and Filaria. Elephantiasis.	

CHAPTER XLVII

THE EFFECTS OF INJURIES UPON THE BLOOD AND BLOOD-FORMING ORGANS....	PAGE 857
Importance of Changes in Blood-forming Organs. The Bone-marrow, Its Regenerative Changes. The Spleen. The Lymphoid Tissues. Injuries to the Red Corpuscles and Erythrogenic Tissues. Polycythæmia. Anæmia or Oligocythæmia. Post-hæmorrhagic and Other Secondary Anæmias. Pernicious Anæmia: Recent Investigations. Sprue. Sick-cell Anæmia. Osteosclerotic Anæmia. Splenic Anæmia. Hæmophilia. Purpura Hæmorrhagica. Hæmatoporphyria. Hæmolytic Icterus. Erythroblastosis.	

CHAPTER XLVIII

EFFECTS OF INJURIES TO BLOOD AND BLOOD-FORMING ORGANS (CONTINUED)....	888
Leucocytosis; Leucopenia. Lymphocytosis; Eosinophilia. Agranulocytosis. Diseases of Blood-forming Organs with Corresponding Changes in Blood. General Characters; Attempt at Classification. Chronic and Acute Lymphoid Leukæmia. Mikulicz' Disease. Recent Studies of Ætiology. Infectious Mononucleosis. Leucosarcoma and Chloroma. Lymphoid Myeloma. Lymphosarcoma.	

CHAPTER XLIX

EFFECTS OF INJURIES TO THE BLOOD AND BLOOD-FORMING ORGANS (CONTINUED).	911
Chronic Myeloid Leukæmia. Acute Myeloid or Myeloblastic Leukæmia. Monocytic Leukæmia, Myeloid Chloroma, Myeloid Myeloma.	

CHAPTER L

HODGKIN'S DISEASE.....	922
History. General Character. Pathological Anatomy. Efforts to Discover Causative Agent.	

CHAPTER LI

DISEASES DUE TO INJURIES OF THE ORGANS OF INTERNAL SECRETION.....	930
Survey of Relations of Endocrine Functions. Controlling Influence of Hypophysis.	

CHAPTER LII

DISEASES DUE TO INJURY TO THE ORGANS OF INTERNAL SECRETION (CONTINUED).	935
Effects of Disturbances in the Hypophysis. Structure, Relations with Central Nervous System. Distinctions Among Cell Constituents. Experimental Studies by Partial Extirpation, Implantations, Testing of Extracts, etc. Relation with Products of Other Endocrine Organs. Effects of Hyperactivity and Hypoactivity at Different Periods of Life. Gigantism, Acromegaly, Cushing's Disease, Dwarfism, Simmonds' Disease. Fröhlich's Syndrome. Diabetes Insipidus.	

CHAPTER LIII

DISEASES DUE TO INJURY TO THE ORGANS OF INTERNAL SECRETION (CONTINUED).	948
Diabetes Mellitus: General Character, Relation to Islands of Langerhans. Experimental Studies. Insulin. Relation to Action of Hypophysis. Carbohydrate Metabolism. Relation to Fat Metabolism. Pathological Anatomy. Symptoms. Metabolic Disturbances. Fat and Carbohydrate in Diet. Hyperinsulinism. Diabetes in Pregnancy. Von Gierke's Disease. Accumulation of Glycogen in Tissues.	

CHAPTER LIV

DISEASES DUE TO INJURIES OF ORGANS OF INTERNAL SECRETION (CONTINUED).	PAGE 985
Disturbances of the Functions of the Thyroid Gland. Anatomy and Physiology. Chemical Studies of Secretion. Relation of Iodine. Relation to Hypophysis. Effect of Loss of Thyroid Function. Myxœdema. Colloid Formation. Goitre, Various Forms, Ætiology, Relation to Iodine Consumption. Cretinism. Riedel's Ligneous Thyroiditis. Exophthalmic Goitre. Symptoms, Pathological Anatomy. Theories of Origin and Nature. Effect of Iodine.	

CHAPTER LV

DISEASES DUE TO INJURIES OF THE ORGANS OF INTERNAL SECRETION (CONTINUED).	985
The Parathyroid: Anatomy, Physiology. Tetany; Hyperexcitability of Nerves. Relation to Calcium Metabolism. Effect of Excessive Action by Parathyroid Tumors or by Renal Insufficiency. Role of Phosphorus in Parathyroid Activity. Osteitis Fibrosa. Thymus: Anatomy. Evolution and Involution. Effects of Extirpation. Hyperplasia. Relation of Thymus and Thyroid. Status Thymico-lymphaticus. Effect of Extracts upon Growth and Maturation.	

CHAPTER LVI

DISEASES DUE TO INJURIES OF THE ORGANS OF INTERNAL SECRETION (CONTINUED)	995
The Adrenals: Anatomy, Functions of Medulla and Cortex. Extracts of Medulla, Adrenalin or Epinephrine. Extract of Cortex, Cortin. Influence upon Electrolytes. Addison's Disease. Tumors of Cortex. Effect upon Reproductive System. Aplasia in Anencephalic Monsters.	

CHAPTER LVII

DISEASES RELATED TO SPECIFIC DIETARY DEFICIENCIES.....	1003
Vitamins. Their Occurrence in Natural Food. Chemical and Physical Characters. Vitamin A: Relation to Xerophthalmia, Metaplasia of Mucosæ. Vitamin B ₁ : Antineuritic. Beriberi. Vitamin B ₂ : Pellagra. Vitamin C: Scurvy. Vitamin D: Rickets. Vitamin E: Fertility. Vitamin K. Rickets: Pathological Anatomy. Effect of Sunlight, Irradiated Ergosterol, etc. Osteomalacia. Scurvy.	

CHAPTER LVIII

DISTURBANCES OF LIPOID METABOLISM.—LIPOIDOSES.....	1022
Gaucher's Disease. Niemann-Pick's Disease. Hand-Schüller-Christian Disease. Xanthoma or Xanthelasma.	

CHAPTER LIX

CONDITIONS OF UNKNOWN ÆTIOLOGY AFFECTING CENTRAL NERVOUS SYSTEM OR MUSCLES.....	1025
Syringomyelia. Pathological Anatomy. Amaurotic Family Idiocy or Tay-Sachs' Disease; Eye Changes. Myasthenia Gravis, Muscular Infiltration, Thymus Tumor. Progressive Muscular Atrophy. Amyotonia Congenita. Amyotrophic Lateral Sclerosis. Progressive Muscular Dystrophy. Myotonia Congenita. Friedreich's Ataxia.	

CHAPTER LX

DISEASES OF UNDETERMINED ORIGIN AFFECTING BONES.....	1029
Chondrodystrophia Fœtal. Osteogenesis Imperfecta. Osteopetrosis, Legg-Perthes' Disease. Osteitis Deformans (Paget's Disease).	

CHAPTER LXI

PAGE

1034

ARTHRITIS DEFORMANS.....	1034
Confusion as to Classification; Infectious, Traumatic, Neuropathic, and Gouty Forms. Terminology: 1. Proliferative Arthritis Deformans or Progressive Polyarthritis: Clinical and Gross Pathological Characters; Histology. Spondylitis of Bechterew and Marie. 2. Degenerative Arthritis Deformans: Clinical and Gross Pathological Changes; Histology. Malum Coxæ Senile; Spondylitis Deformans.	

CHAPTER LXII

DISEASES AFFECTING TEETH AND RELATED STRUCTURES.....	1044
Formation and Structure of Teeth; Development. Influence of Metabolic Disturbances. Caries. Pyorrhœa Alveolaris. Periapical Abscesses. Relation to Distant Disturbances.	

CHAPTER LXIII

TUMORS.....	1047
General Nature of Tumors; Difficulty of Classification. Fibromata, Keloids, Lipomata. Chondromata. Osteomata. Myomata; Leiomyomata, Adenomyomata, Rhabdomyomata.	

CHAPTER LXIV

TUMORS (CONTINUED).....	1065
Tumors Derived from Elements of the Nervous System: General Relations to Stages in Development. Neuroblastoma; Neurinoma, Ganglioneuroma, Paraganglioma. Tumors of the Brain, of the Glioma Type, Medulloblastomata, Spongioblastomata, Astrocytomata.	

CHAPTER LXV

TUMORS (CONTINUED).....	1077
Angiomata, Hæmangiomata, Lymphangiomata. Sarcomata: General Characters; Spindle-cell, Mixed, and Round-cell, and Alveolar Sarcomata. Giant-cell and Osteosarcomata. Myxomata.	

CHAPTER LXVI

TUMORS (CONTINUED).....	1098
Pigmented Tumors: Nævi. Their Relation to Epithelium and Connective Tissue. Melanomata or Melanotic Sarcomata. Tumors of Adrenal Origin: Hypernephromata; Relation to Aberrant Adrenal Tissue. Endotheliomata: Difficulty of Establishing Their Relation to Endothelium. Endotheliomata from Lymphatic Endothelium. Cylindromata. Pleural and Peritoneal Tumors. Endotheliomata of the Meninges. Tumors Derived from Endothelium of the Blood-vessels.	

CHAPTER LXVII

TUMORS OF EPITHELIAL ORIGIN.....	1116
Relation of Epithelium to Stroma. Papillomata: Origin from Skin and Mucosæ, Papillomata of Antrum or Sinuses, of Bladder and Ovary. Adenomata: Origin from Skin, Salivary Glands, Gastric and Intestinal Mucosæ, Kidney, Liver, Adrenal, Hypophysis, and Prostate. Adamantinomata. Adenomata of the Breast; Intracanalicular Forms. Cystadenomata of Ovary; Their Origin and Form; Papillomatous Types. Adenomata of the Uterus.	

CHAPTER LXVIII

	PAGE
CARCINOMATA.....	1137
General Characters, Grouping. Flat-cell Carcinomata. Epitheliomata of Lip, Skin, etc. Mode of Growth and Metastasis. Epitheliomata of Tongue, Tonsils, Bronchi, Oesophagus, Gall-bladder, Urinary Bladder. Epitheliomata of the Vaginal Portion of the Cervix Uteri. Their Frequency and Importance. Basal-cell Carcinomata. Their Relatively Benign Character. Distribution, Peculiar Morphology. Relation to Nævi. Argentaffine Tumors of Intestine and Appendix.	

CHAPTER LXIX

CARCINOMATA (CONTINUED).....	1157
Adenocarcinomata: General Characters and Distribution. Carcinomata of the Stomach: Polypoid, Solid and Scirrhus Forms. Their Histology and Mode of Growth; Metastasis. Colloid Forms, Their Somewhat Different Mode of Growth. Carcinomata of the Gall-bladder and Ducts. Carcinomata of the Pancreas, of the Colon, of the Prostate. Metastasis of Prostatic Tumors in Bones. Adenocarcinomata of the Uterus and of the Ovary.	

CHAPTER LXX

CARCINOMATA (CONTINUED).....	1179
Gland-cell Carcinomata. Carcinoma of the Breast. Carcinoma of the Ovary, of Thyroid. Primary Carcinoma of Liver with Cirrhosis. Ovarian Tumors with Endocrine Character. Disgerminoma, Brenner Tumor, Granulosa Cell Tumor, Arrhenoblastoma. Chorionic Tumors. Hydatidiform Mole. Chorionic Epithelioma. Histogenesis, Relation to Corpus Luteum.	

CHAPTER LXXI

CONGENITAL MALFORMATIONS.....	1200
General Character: Repetition of Typical Forms. Defective Embryonic Development in Localized Areas of the Body. Medullary Groove, Face, Genito-urinary Apparatus, etc. Double Monsters. Twins.	

CHAPTER LXXII

TERATOMATA: COMPOSITE TUMORS.....	1204
Chorionic Epithelium in Tumors of the Male and in Female Apart from Pregnancy. Teratomata, Their Composition. Theories of Origin; Inclusion of Blastomere, Parthenogenetic Development of Sex Cell. Experimental Production of Teratomata by Auto-implantation of Such a Cell. Character and Maturity of Tissues of Teratoma. Malignant Character. Teratomata of Testis. Dermoid Cysts. Mixed Tumors of Salivaries.	

CHAPTER LXXIII

CLASSIFICATION OF TUMORS.....	1221
-------------------------------	------

CHAPTER LXXIV

GENERAL DISCUSSION OF TUMORS.....	1223
General Character of Tumors: Origin from Tissue of Host. Independence of Laws Governing Growth of Normal Tissue. Mode of Growth: Idea of Return to Embryonic State; Dependence upon Host for Nutrition. Implantation, Invasion, Metastasis, Recurrences. Predisposing and Actual Causes of Tumor Growth. Experimental Production in Normal Animals. Recent Work on Tar Derivatives. Parasites as Inciting Cause. Viruses in Production of Tumor Growth. Influence of Internal Secretions, Senility; Heredity.	

CHAPTER LXXV

	PAGE
GENERAL DISCUSSION OF TUMORS (CONTINUED).....	1243
Resistance and Immunity. Theories as to the Ætiology of Tumors: Parasitic Origin; Effect of Irritants; Disturbance of Equilibrium of Tissues; Displacement of Embryonic Cells. Changes in Structure and Mitosis in Cells; Abnormal Metabolic Activities of Cells. Fundamental Changes in Cells Releasing Them from Laws of Normal Growth.	

INDEX.....	1251
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TEXTBOOK OF PATHOLOGY

CHAPTER I

DISTURBANCES OF THE FLUIDS OF THE BODY

Relation of fluids to tissues; blood, lymph, tissue fluids. The blood: variations in quality and quantity. Readjustment. Plethora and oligæmia. Clotting. Thrombosis.

Relation of Fluids to Tissues.—The cells of the tissues are, like other living beings, dependent for their life and activity upon a constant and abundant supply of food and oxygen and an equally adequate removal of their waste products. This service is rendered them by the circulation of the various fluids through every part, propelled by a mechanical arrangement, the perfection of which we shall have frequent occasion to admire. There are three main types into which we may divide these circulating fluids, the blood, the tissue fluids, and the lymph.

The blood is practically everywhere separated from actual contact with the cells of the tissues by a semi-permeable membrane composed of other cells, the endothelium. It flows through the whole body, giving off certain substances and withdrawing others, always through this membrane. Between the cells outside the blood-vessels there are spaces, or at least potential spaces, in which a small amount of fluid collects which directly bathes the cells and directly receives their waste. This tissue fluid is constantly being changed too, by interaction with the blood. But it also stands in exactly the same relation to the lymph, which, like the blood, flows inside channels with semi-permeable walls composed of endothelial cells and goes to empty into the vein. We do not believe now that there are open communication between the lymphatic channels and the tissue crevices. That idea, it seems, has been thoroughly disproved by the recent work which shows the completeness of the endothelial lining of these channels.*

Of course, a moment's thought will make it clear that everything, whether necessary to life or a waste product to be excreted, must take a rather roundabout course in the blood. All that is absorbed from the digestive tract by veins or lymphatics must go a long way to reach the arteries and be distributed to the tissues and the waste from every tissue must travel in veins or lymphatics to reach the arteries so as to be carried to the organs of excretion. The actual interchange must be continuous but only partial as the blood hurries by, whether in bringing nutriment or removing waste and everywhere the two processes go on simultaneously. Materials pass from the arterial side of the capillaries into the tissue spaces in immediate contact with the cells which absorb

* MacCallum: *Archiv f. Anat. u. Physiol., Anat. Abth.*, 1902, 273. *Bull. Johns Hopkins Hosp.*, 1903, xiv, 1, 195.