



Contents

PART ONE

WHAT HISTOLOGY IS AND HOW IT IS STUDIED

1. HISTOLOGY AND ITS RELATIONSHIP TO OTHER SUBJECTS.....	3
Definition and Scope of Histology.....	3
Relation to Other Subjects.....	4
The Human Body as a Cell State.....	5
2. How HISTOLOGY IS STUDIED BY ORDINARY HISTOLOGIC METHODS.....	8
The Paraffin Method.....	8
The Freeze-dry Method.....	10
Acid and Basic Stains.....	12
The Ordinary Freezing Method.....	14
The Celloidin Method	14
3. How HISTOLOGY IS STUDIED BY SPECIAL HISTOLOGIC TECHNICS.....	16
The Study of Fresh Tissue.....	16
The Phase Microscope.....	16
Tissue Culture	17
The Quartz-rod Illuminator.....	19
Transparent Chambers	19
Micrurgy (Micromanipulation)	19
Histochemistry and Cytochemistry.....	20
Microincineration	20
Radioautography	21
The High-speed Centrifuge.....	21
The Ultraviolet Microscope.....	21
The Electron Microscope.....	21
4. How HISTOLOGY IS STUDIED: THE STUDY AND THE INTERPRETATION OF SECTIONS	26
Three-dimensional Visualization	26
Reconstructions	28
Aids to Making Mental Reconstructions	29
How to Use the High-power Objectives.....	34
Artifacts	36
Photomicrography	39
Estimating Size with the Microscope.....	40

PART TWO
CELLS, INTERCELLULAR SUBSTANCES AND FLUIDS

5. CELLS	43
History of the Term	43
General Appearance in Sections	45
Protoplasm and Its Properties	46
The Colloidal State of Protoplasm	48
Nucleoproteins (DNA and RNA)	49
The Nucleus	54
Mitosis	54
The Structure of Chromosomes	55
The Sex Chromatin	62
Appearances after Death	65
Cytoplasmic Organelles	69
Mitochondria	69
The Golgi Apparatus	73
The Ergastoplasm: Endoplasmic Reticulum and Submicroscopic Particulates	75
Growth and Differentiation	80
Cytoplasmic Inclusions	85
Stored Foods	86
Secretion Granules	89
Pigments	90
6. INTERCELLULAR SUBSTANCES	98
General Considerations	98
Collagenic Fibers	99
Reticular Fibers	102
Elastic Fibers	103
Amorphous Intercellular Substances (Mucopolysaccharides)	103
The P.A. Schiff Technic	105
Intercellular Substances and Aging	107
7. TISSUE FLUID	111
General Considerations	111
Hydrostatic Pressure and the Formation of Tissue Fluid	114
The Absorption of Tissue Fluid	114
Edema	115
Some Causes of Edema	116
8. THE CELLS OF BLOOD	122
General Considerations	122
Erythrocytes	123
Anemia	129

9. THE CELLS OF BLOOD (<i>Continued</i>)	136
Leukocytes	136
Why Leukocytes are Important	136
The Study of Leukocytes in the Stained Blood Film	139
The Differential Count	144
10. PLATELETS AND FIBRIN	150
Coagulation	150
Agglutination	151
Functions of Platelets	154
A Few Illustrative Examples	156

PART THREE

THE FOUR PRIMARY TISSUES AND THEIR SUBDIVISIONS

11. THE FOUR PRIMARY TISSUES OF THE BODY	161
General Considerations	161
How Tissues are Classified	162
A Note on How To Study the Tissues	164
12. EPITHELIAL TISSUE	165
Covering and Lining Membranes	165
Types of Epithelium Found on Wet Surfaces	168
Stratified Membranes on Dry Surfaces	172
13. EPITHELIAL TISSUE (<i>Continued</i>)	175
Glandular Division	175
The Development of Glands	175
Exocrine Glands	177
Endocrine Glands	185
Glands that are Both Exocrine and Endocrine	187
14. CONNECTIVE TISSUE	188
The Development of Connective Tissue	188
Classification	190
Loose Areolar Tissue	190
The Function of Fibroblasts and the Formation of Intercellular Substances	193
Some Details about Tendons	201
15. CARTILAGE	204
Microscopic Appearance	204
Development	207
Nutrition	208
Calcification	208
Elastic Cartilage	213
Fibrocartilage	213

16. BONE	215
The Differences between Calcified Cartilage and Bone	215
Types of Preparations Used for Bone Study	217
Intramembranous Ossification	220
The Problem of Bone Resorption	226
Endochondral Ossification	229
The Further Growth of the Model	238
The Growth of a Long Bone as a Whole	243
How Shafts of Bones Grow in Width	247
How Disturbances of Mineral Metabolism Can Affect Growing Bones	255
Osteoporosis	257
Periosteum and Endosteum	257
The Repair of Fractures	259
The Transplantation of Bone	266
17. HEMOPOIETIC TISSUE	276
Myeloid Tissue	276
Cells and Structure	277
Formation of Erythrocytes	281
Formation of Granular Leukocytes	285
Megakaryocytes and the Formation of Platelets	287
The Origin of the Lymphocytes, Monocytes and Plasma Cells of Myeloid Tissue	289
The Study of Bone Marrow in Clinical Medicine	290
18. HEMOPOIETIC TISSUE (<i>Continued</i>)	293
Lymphatic Tissue	293
For Filtering Tissue Fluid	296
For Filtering Lymph (Lymph Nodes)	297
For Filtering Blood (the Spleen)	302
The Origin of Monocytes	313
Different Theories of Hemopoiesis	314
19. MUSCULAR TISSUE	317
Smooth Muscle	318
Striated Muscle	322
The Phenomenon of Contraction	327
How Striated Muscles are Harnessed	329
Regeneration of Striated Muscle	331
Cardiac Muscle	333
20. NERVOUS TISSUE	337
Properties of Nervous Tissue	337
Evolution of Nervous Tissue	338
Relation of Nervous Tissue to the Nervous System	346
Development of the Central Nervous System	348
The Cells of the Central Nervous System	359
The Microscopic Structure of the Spinal Cord	367
The Microscopic Structure of Some Parts of the Brain	371

20. NERVOUS TISSUE—(Continued)	
The Meninges	377
The Formation, the Circulation and the Absorption of Cerebrospinal Fluid	379
The Peripheral Nervous System	382
The Microscopic Structure of Peripheral Nerves	384
The Degeneration and Regeneration of Peripheral Nerves	389
The Autonomic Nervous System	392

PART FOUR
THE HISTOLOGY OF THE SYSTEMS

21. THE CIRCULATORY SYSTEM	405
Some Mechanical Problems Inherent in a Circulatory System	405
The Microscopic Structure of Arteries	407
The Nervous Control of Arteries and Arterial Pressure	413
The Microscopic Structure of Capillaries	415
Veins	420
The Heart	423
The Impulse-conducting System of the Heart	426
The Lymphatic Division of the Circulatory System	432
22. THE INTEGUMENTARY SYSTEM	437
The General Microscopic Structure of Skin	438
The Microscopic Structure of Thick Skin	439
Sweat Glands	443
The Microscopic Structure of Thin Skin	444
Hair Follicles	445
Sebaceous Glands	456
The Pigmentation of the Skin	458
The Blood Supply of the Skin	461
Nails	465
Skin Grafting	467
23. THE DIGESTIVE SYSTEM	472
Introduction	472
The Lips	474
The Cheeks	475
The Tongue	476
The Teeth	479
The Salivary Glands	495
The Hard and Soft Palate	497
The Pharynx	498
The General Plan of the Gastro-intestinal Tract	500
The Esophagus	506

23. THE DIGESTIVE SYSTEM—(<i>Continued</i>)	
The Stomach	508
The Small Intestine	516
The Large Intestine	523
The Pancreas	527
The Liver	532
The Gallbladder	550
24. THE RESPIRATORY SYSTEM	558
Introduction	558
The Nasal Cavities	561
The Paranasal Air Sinuses of the Nose	563
The Pharyngeal Tonsil	563
The Larynx	564
The Trachea	566
The Bronchial Tree	567
The Microscopic Structure of Respiratory Tissue	572
The Development of the Lungs	576
The Blood Supply of the Lungs	584
The Lymphatics of the Lungs	584
Recent Studies on the Nature of Alveolar Walls	586
25. THE URINARY SYSTEM	590
Some General Considerations	590
The Basic Mechanisms of Excretory Tubules	591
The Nephrons of Higher Animals and How They Function	591
The Unilobar Kidney	593
Lobules and Medullary Rays	597
The Multilobar Kidney of Man	598
The Nephron of the Kidney of Man: Its Parts and Their Functions	600
The Juxtaglomerular Complex	604
The Connective Tissue of the Kidney	613
The Circulation of Blood Through the Kidney	614
The Lymphatics of the Kidney	618
Postnatal Growth of the Kidney	619
The Ureter	620
The Urinary Bladder	621
The Urethra	621
The Innervation of the Urinary System	622
26. THE ENDOCRINE SYSTEM	626
How Knowledge of Endocrines and Hormones Developed	628
The Pituitary Gland	630
The Blood Supply of the Pituitary Gland	633
The Pars Anterior of the Pituitary Gland	635
The Pars Nervosa of the Pituitary Gland	642
The Thyroid Gland	645
The Parathyroid Glands	653

26. THE ENDOCRINE SYSTEM—(<i>Continued</i>)	
The Suprarenal (Adrenal) Glands.....	659
The Adrenal Cortex.....	663
The Adrenal Medulla.....	669
The Islets of Langerhans.....	675
The Thymus Gland.....	686
The Pineal Body.....	690
27. THE FEMALE REPRODUCTIVE SYSTEM.....	699
Introductory Remarks About Sex.....	699
The Parts of the Female Reproductive System.....	701
The Ovary: Ovulation and Hormone Secretion.....	706
The Oviducts.....	723
The Body and the Fundus of the Uterus.....	724
The Cervix	732
The Vagina	735
The Mammary Glands.....	740
28. THE MALE REPRODUCTIVE SYSTEM.....	753
The Parts of the System and Their Functions.....	753
The Testes	757
The Epididymis	768
The Ductus Deferens.....	768
The Seminal Vesicles	769
The Prostate Gland	771
The Penis	774
The Male Urethra.....	776
29. THE SYSTEM OF SENSORY RECEPTORS.....	780
Introduction	780
Receptors Concerned in Cutaneous and Deep Sensibility.....	781
The Olfactory Organ	783
The Eye	786
Taste Buds	812
The Ear	813
30. THE SYSTEM OF ARTICULATIONS.....	832
Introduction	832
Syndesmoses	833
Synchondroses	834
Synostoses	834
Symphyses	834
Synovial Joints	836
INDEX	847