
Contents

1	Introduction	
Development of Embryology as a Science	1	
Embryology as a Subject in the Medical Curriculum	5	
Necessity of Laboratory Study	6	
2	Reproductive Organs; Gametogenesis	
Reproductive Organs	8	
Gametogenesis	11	
Ovulation	24	
Corpus Luteum	25	
3	Sexual Cycle and Fertilization	
Sexual Cycle	38	
Fertilization	52	
Sex Determination	56	
4	Cleavage, Germ Layers, and Establishment of Embryonic Body	
Cleavage	59	
Differentiation of Blastodermic Vesicle	62	
Formation of Germ Layers	66	
Formation of Notochord	70	
Structure of Young Human Embryos	75	
5	Early Differentiation of the Body and Establishing of Organ Systems	
Primitive Streak as a Growth Center	85	
Early Differentiation of Cephalic Region	87	
Early Differentiation in Trunk Region	92	
Early Differentiation of Mesoderm	97	
Nervous System	105	
Digestive System	117	
Urogenital System	122	
Coelom	123	
Circulatory System	125	
6	Fetal Membranes and Placenta	
Formation and Primary Relations of Fetal Membranes	139	
Human Fetal-Maternal Relations	145	

Birth and the "After-birth"	167
Hormonal Regulatory Actions During Pregnancy	170
Anomalies of Fetal-Maternal Relations	173
7 Age, Growth, and Changes in External Form of Body	
Estimation of Age and Methods of Measuring Embryos	181
Growth of Body as a Whole	183
Development of External Form of Body	189
Growth of Organ Systems	198
8 Twins; Double Monsters and Teratology	
Twins	204
Frequency of Multiple Births	205
Double Monsters	209
Embryomata and Teratomata	217
Teratology	219
Gigantism and Acromegaly	224
Dwarfism	224
Causative Factors in Abnormal Development	227
9 Integumentary System	
The Skin	233
Nails and Hair	235
Glands of the Skin	239
Developmental Abnormalities of Integumentary Structures	244
10 Connective Tissues and Skeletal System	
Histogenesis of Fibrous Connective Tissues and Cartilage	248
Histogenesis of Bone	253
<i>Intramembranous Bone Formation</i>	253
<i>Endochondral Bone Formation</i>	257
<i>Formation of Compact Bone from Primary Cancellous Bone</i>	259
Development of the Skeleton	260
<i>Development of Flat Bones</i>	261
<i>Development of Long Bones</i>	261
<i>Development of Joints</i>	264
<i>Formation of Vertebrae and Ribs</i>	268
<i>Appendicular Skeleton</i>	274
<i>Development of the Skull</i>	277
<i>Progress of Ossification in Skeleton as a Whole</i>	286
<i>Abnormalities of Skeletal Development</i>	290
11 The Muscular System	
Histogenesis of Muscle	292
<i>Smooth Muscle</i>	292
<i>Cardiac Muscle</i>	293
<i>Skeletal Muscle</i>	295

Visceral Musculature	297
Skeletal Musculature	298
<i>Primary Arrangement of Myotomes in Young Embryos.</i>	298
<i>Muscles of Trunk and Body-wall.</i>	302
<i>Muscles of Appendages.</i>	304
<i>Muscles of Perineal Region.</i>	306
<i>Muscles of Head and Neck</i>	306
12 Development of the Nervous System	
Functional Significance of the Various Parts of the Nervous System	315
Histogenesis of Spinal Cord and Formation of Spinal Nerves	325
<i>Ependymal, Mantle, and Marginal Layers</i>	325
<i>Neuroglia.</i>	327
<i>Growth and Migration of Neuroblasts and Formation of Spinal Nerves</i>	330
<i>Formation of Sheaths about Nerve Fibers.</i>	335
<i>Development of the Gray and White Matter of the Cord</i>	337
Regional Differentiation of the Brain	339
<i>The Myelencephalon.</i>	339
<i>The Metencephalon.</i>	343
<i>The Mesencephalon.</i>	347
<i>The Diencephalon</i>	350
<i>The Telencephalon</i>	352
Ventricular System of the Brain, Choroid Plexuses, and Cerebrospinal Fluid	362
Cranial Nerves,	367
Autonomic Nervous System	378
Developmental Abnormalities of the Nervous System.	379
13 The Sense Organs	
General Sensory Organs.	389
Organs of Taste	391
Olfactory Organ	392
The Eye.	396
The Ear.	415
14 Development of the Face and Jaws and the Teeth	
The Jaws	427
Nasal Chambers	430
The Palate.	430
The Tongue	434
Developmental Defects of the Face, Jaws, and Palate.	437
The Teeth.	441
Developmental Abnormalities of Teeth.	457
15 Development of the Digestive and Respiratory Systems	
Digestive System	460
<i>Digestive Tube.</i>	460
<i>Histogenesis of the Walls of the Digestive Tube.</i>	467

<i>Abnormalities of the Digestive Tube.</i>	472
<i>Glands of the Digestive Tract</i>	475
Respiratory System	487
<i>Larynx</i>	487
<i>Trachea</i>	487
<i>Bronchi and Lungs</i>	489
<i>Abnormalities of the Respiratory System</i>	497
16 Body Cavities and Mesenteries	
Body Cavities	499
<i>Primitive Coelom</i>	499
<i>Primary Relations in Pericardial Part of the Coelom</i>	501
<i>Septum Transversum</i>	501
<i>Pleuropericardial and Pleuroperitoneal Folds</i>	503
<i>Abnormalities in Development of Body Cavities</i>	508
Mesenteries	510
<i>Primary Mesentery</i>	510
<i>Later Changes in Relations of Mesenteries</i>	514
<i>Abnormalities in Development of Mesenteries and in Visceral Position</i>	521
17 Ductless Glands and Pharyngeal Derivatives	
Development of the Hypophysis	525
Embryonic Pharynx	528
Thyroid Gland	530
Parathyroid Glands	535
Thymus	535
Tonsils	537
Adrenal Gland and Accessory Chromaffin System	541
18 Development of the Urogenital System	
Urinary System	549
<i>General Relationships of Pronephros, Mesonephros, and Metanephros</i>	549
<i>Pronephros</i>	551
<i>Mesonephros</i>	552
<i>Establishing of the Metanephros or Permanent Kidney</i>	556
<i>Developmental Abnormalities of the Kidneys</i>	566
<i>Formation of Bladder and Early Changes in Cloacal Region</i>	569
<i>Developmental Abnormalities in Region of Cloaca and Bladder</i>	572
Internal Reproductive Organs	575
<i>Indifferent Stage</i>	575
<i>Origin of Gonads</i>	576
<i>Sexual Duct System in the Male</i>	577
<i>Female Duct System</i>	579
<i>Abnormalities of Uterus and Vagina</i>	584
<i>Histogenesis of the Gonads</i>	587
<i>Later Changes in Relations of Internal Reproductive Organs</i>	593
External Genitalia	599
<i>The Indifferent Stages</i>	599
<i>Male Genitalia</i>	600

<i>Female Genitalia</i>	602
<i>Accessory Sex Glands</i>	603
<i>Abnormalities of External Genitals</i>	604
19 Development of the Circulatory System	
The Plan of the Embryonic Circulation and Its Significance	608
Formation of Blood Corpuscles	611
Arteries	621
<i>Derivatives of the Aortic Arches</i>	621
<i>Arteries of the Body-wall</i>	627
<i>Arteries to the Viscera</i>	629
<i>Arteries of the Extremities</i>	632
Veins	637
<i>Superior Caval System</i>	638
<i>Inferior Caval System</i>	642
<i>Coronary Sinus</i>	644
<i>Portal Vein</i>	646
<i>Umbilical Veins</i>	646
Development of Lymphatic System	649
<i>Primordial Lymph Sacs</i>	649
<i>Establishing of the Major Lymphatic Channels</i>	651
<i>Formation of Lymph Nodes</i>	653
Development of the Heart	656
<i>Formation of Cardiac Loop and Establishment of Regional Divisions of the Heart</i>	657
<i>Partitioning of the Atrium and Atrio-ventricular Canal</i>	661
<i>Primary Muscular Part of the Interventricular Septum</i>	664
<i>Partitioning of the Truncus Arteriosus and Formation of the Aortic and Pulmonary Valves</i>	666
<i>Closing of the Interventricular Foramen</i>	670
<i>Changes in Sinus Region</i>	671
Developmental Disturbances of Cardiovascular System	673
<i>Abnormalities in Vascular Pattern</i>	673
<i>Congenital Defects of the Heart</i>	683
Postnatal Changes in Circulation	691
Bibliography	706
Supplement to Bibliography 1945-1952	749
Index	763