Contents

PART I
Early Developmental and the Fetal-Maternal Relationship

1 Getting Ready for Pregnancy, 1
Gametogenesis, 1
Preparation of the Female Reproductive Tract for Pregnancy, 13
Hormonal Interactions Involved with Reproduction in Males, 19

2 Transport of Gametes and Fertilization, 23
Ovulation and Egg and Sperm Transport, 23
Fertilization, 27

3 Molecular Basis of and Genetic Methods for Studying Embryonic Development, 35
Fundamental Molecular Processes in Development, 35
Genetic Methods for Studying Embryonic Development, 49

4 Cleavage and Implantation, 52
Cleavage, 52
Embryo Transport and Implantation, 64

5 Formation of Germ Layers and Early Derivatives, 71
Two-Germ-Layer Stage, 71
Gastrulation and the Three Embryonic Germ Layers, 74
Induction of the Nervous System, 79
Cell Adhesion Molecules, 80

6 Establishment of the Basic Embryonic Body Plan, 87
Development of the Ectodermal Germ Layer, 87
Development of the Mesodermal Germ Layer, 91
Development of the Endodermal Germ Layer, 101
Basic Structure of a 4-Week-Old Embryo, 104

7 Placenta and Extraembryonic Membranes, 110
Extraembryonic Tissues, 110
Chorion and Placenta, 113
Placental Physiology, 120
Placenta and Membranes in Multiple Pregnancies, 122

8 Developmental Disorders: Causes, Mechanisms, and Patterns, 128
General Principles, 129
Causes of Malformations, 133
Developmental Disturbances Resulting in Malformations, 140

PART II
Development of the Body Systems

9 Integumentary, Skeletal, and Muscular Systems, 145
Integumentary System, 145
Skeleton, 155
Muscular System, 168

10 Limb Development, 183
Initiation of Limb Development, 183
Regulative Properties and Axial Determination, 183
Outgrowth of Limb Bud, 184
Morphogenetic Control of Early Limb Development, 189
Development of Limb Tissues, 192

11 Nervous System, 205
Establishment of the Nervous System, 205
Early Shaping of the Nervous System, 205
Histogenesis within the Central Nervous System, 205
Craniocaudal Pattern Formation and Segmentation, 212
Peripheral Nervous System, 215
Autonomic Nervous System, 220
Later Structural Changes in the Central Nervous System, 222
Ventricles, Meninges and Cerebrospinal Fluid Formation, 233
Cranial Nerves, 234
Development of Neural Function, 234

12 Neural Crest, 242
Developmental History of the Neural Crest, 242
Major Divisions of the Neural Crest, 245

13 Sense Organs, 255
Eye, 255
Ear, 271

14 Head and Neck, 279
Early Development of Head and Neck, 279
Establishing the Pattern of the Craniofacial Region, 282
Development of the Facial Region, 283
Development of the Pharynx and Its Derivatives, 299

15 Digestive and Respiratory Systems and Body Cavities, 318
Digestive System, 318
Respiratory System, 340
Body Cavities, 346

16 Urogenital System, 358
Urinary System, 358
Genital System, 372
Sexual Duct System, 377
External Genitalia, 382

17 Cardiovascular System, 391
Development of Blood and the Vascular System, 391
Development and Partitioning of the Heart, 409
Fetal Circulation, 419

18 Fetal Period and Birth, 435
Growth and Form of the Fetus, 435
Fetal Physiology, 435
Parturition, 448
Adaptations to Postnatal Life, 450

Answers to Clinical Vignettes and Review Questions, 455

Index, 461