

CONTENTS

<i>Acknowledgments</i>	v
<i>Preface</i>	xi

Chapter 1	How Do Cells Regulate the Positions and Amounts of Their Organelles?	1
	1. Regulation of Nuclear Shape and Function	1
	<i>Regulation of DNA transcription</i>	6
	2. Regulation of the Endoplasmic Reticulum	12
	<i>The unfolded protein response</i>	17
	3. Regulation of Mitochondrial Number	19
	4. Control of Centrioles and Cilia	22
	5. Control of Overall Cell Shape	25
	References	26
Chapter 2	How Do Cells of the Four Basic Tissues Arise from Embryonic Stem Cells?	31
	1. Cell Specialization in <i>Drosophila</i>	32
	2. Cell Specialization in <i>Xenopus</i>	35
	3. Cell Specialization in Mammals	37
	4. Specialized Features of Epithelial Cells	43
	5. Special Features of Nerve Cells	47
	6. Special Features of Connective Tissue and Blood Cells	52
	7. Special Features of Muscle Cells	53
	8. Germ Cells	53
	References	53

Chapter 3	How Do Adult Stem Cells Contribute to Basic Tissue Functions?	57
1.	Embryonic Stem Cells	57
2.	Stem Cells of Epithelia	58
3.	Stem Cells of Muscle	61
	<i>A. Skeletal muscle stem cells</i>	61
	<i>B. Cardiac muscle stem cells</i>	67
	<i>C. Smooth muscle stem cells</i>	69
4.	Stem Cells of the Nervous System	71
5.	Stem Cells of Connective Tissue	75
	References	77
 Chapter 4	 How Do Giant Cells Form?	 81
1.	Megakaryocytes and the Regulation of Chromosome Number	81
	<i>Induction of polyploidy in megakaryocytes</i>	84
	<i>Megakaryocyte cytoplasm</i>	89
2.	Osteoclasts, Giant Cells of Bone	91
3.	Adipocytes, Giant Cells of Connective Tissue	94
4.	Oocytes, Giant Cells of the Ovaries	99
	References	103
 Chapter 5	 How Do Lymphocytes and Other Blood Cells Protect the Body From Harm?	 107
1.	B-Lymphocytes	107
	<i>B-Cell development</i>	109
	<i>Immunoglobulin production</i>	110
	<i>B-lymphocyte activation</i>	113
2.	T-Lymphocytes	116
	<i>Reticulo-epithelial cells of the thymus</i>	117
	<i>Thymic nurse cells</i>	119
	<i>Medullary reticulo-epithelial cells</i>	120
	<i>Mature T-lymphocytes</i>	121
	<i>Immunological synapses</i>	123
	<i>Cytotoxic T-cells</i>	125

	<i>Infection of helper T-cells by the HIV virus</i>	125
	<i>RNA interference and defense against viruses</i>	126
	3. Neutrophils	127
	4. Eosinophils	129
	5. Mast Cells and Basophils	130
	References	133
Chapter 6	Glial cells — The Unsung Heroes of the Brain	137
	1. Astrocytes	137
	<i>Astrocytes and brain blood vessels</i>	138
	<i>Sensory functions of astrocytes</i>	141
	<i>Astrocytes and neuronal function</i>	142
	<i>Gomori-positive astrocytes</i>	143
	2. Oligodendrocytes	145
	3. Microglia	147
	References	149
Chapter 7	How are the Numbers of Cells in an Organ Regulated?	155
	1. Events and Mechanisms of Apoptosis	160
	2. Other Mechanisms for the Control of Cell Number	165
	References	167
Chapter 8	How Do Sensory Cells Function?	171
	1. Types of Sensory Receptors	171
	2. Sensors of the Skin	172
	<i>Sensations of touch</i>	173
	<i>Sensation of temperature</i>	173
	<i>Painful sensations</i>	174
	<i>Encapsulated sensory axons</i>	175
	3. Sensory Neurons of the Brain	176
	<i>Reactions of neurons to neurotransmitters</i>	178

4. Sensory Functions of the Inner Ear	183
<i>Maculae</i>	183
<i>Cristae</i>	186
<i>Organ of Corti</i>	187
5. Sensory Functions of the Eye	191
6. Olfaction	195
7. Taste	199
References	201
Epilogue	205
References	207
<i>Index</i>	209