Contents

Chapter	I	From Descriptive to Molecular En	ıbı	ryo	lo	gy		•		-	•		1
Chapter		How Genes Direct the Synthesis on Living Cells		-									7
Chapter	Ш	How Eggs and Embryos Are Made	;										24
1	Thec	ries of Embryonic Differentiation											24
1.1		mary of Descriptive Observations											24
1.2		w Important Experimental Facts											30
1.3		etic Theories of Morphogenesis.											34
Chapter	IV	Gametogenesis and Maturation: The Formation of Eggs and Sperm	ıat	oz	oa	1			•				39
1	Oog	enesis											39
1.1		plasm											39
1.2		Nucleus (Germinal Vesicle: GV)											44
1.2.1	The	Nuclear Membrane											45
1.2.2		omosomes											47
1.2.3	Nuc	eoli											51
1.2.4	Nuc	ear Sap (Nucleoplasm)											55
1.2.5		pus Oocytes as Test-Tubes											56
2		aration of Xenopus Oocytes											58
3		matogenesis											63
Chapter	r V	Fertilization: How the Sleeping Eg	g	Αw	al	(es	3 .		•				66
1	Gen	eral Outlook											66
2		Fertilizin Problem											71
3		ical and Chemical Changes at Fer											71
3.1		y Changes											72
3.2	Late	r Biochemical Changes											72
3.2.1		gen Consumption											72
3.2.2		oohvdrate Metabolism											74

XII	Contents
3.2.3	Protein Metabolism
3.2.4	Lipid Metabolism
4	Nucleic Acid and Protein Synthesis
4.1	DNA Synthesis
4.2	RNA Synthesis
4.3	Protein Synthesis
5	Parthenogenetic Activation
6	Molecular Embryology and Classical Theories of Fertilization 84
	Wolcewar Emolyclogy and Classical Theories of Fernization
Chapte	VI Egg Cleavage: A Story of Cell Division
1	General Outlook
2	The Biochemistry of Cleavage
2.1	Energy Production
2.2	Chemical Nature of the Mitotic Apparatus
2.3	DNA Replication During Cleavage
2.4	RNA Synthesis During Cleavage
2.5	Protein Synthesis During Cleavage
2.6	Furrow Formation
Chapter	VII Molecular Embryology of Invertebrate Eggs 106
1	Chaetopterus Eggs
2	Mollusk Eggs
3	Tunicate (Ascidian) Eggs
4	Insect Eggs
5	Sea Urchins
Chapte	r VIII Molecular Embryology of Amphibian Eggs
1	Respiration of the Amphibian Gastrula and Neurula 122
2	The Nature of the Inducing Substance
3	RNA Localization and Synthesis
4	The Links Between RNA Synthesis and Morphogenesis 130
5	Size and Mode of Action of the Inducing Agent
6	Molecular Basis of Cell Movements
Chapte	r IX Molecular Embryology of Mammals
1	The Biology of Mammalian Sperm
1.1	Male Sex Determination in Mammals
1.2	Mammalian Spermatozoa from Testis to Fertilization 136
2	Molecular Embryology of Mammalian Eggs
2.1	Oogenesis
2.2	Maturation (Resumption of Meiosis)
2.3	Preimplantation Period

		Contents	XIII
3	Experimental Embryology of the Preimplantation Stages		142
4	Early Postimplantation Stages		148
4.1	Trophectoderm Differentiation		148
4.2	ICM Development		150
4.3	X Chromosome Inactivation		152
5	Interspecific Hybrids and Chimaeras		153
•	'		100
Chapter	X Biochemical Interactions Between the Nucleus and th	ie	
	Cytoplasm During Morphogenesis		155
1	Biology and Biochemistry of the Alga Acetabularia		155
1.1	Biological Cycle. Regeneration		155
1.2	Morphology of the Cytoplasm and the Nucleus		158
1.3	Biochemical Studies		159
1.3.1	Morphogenetic Substances and mRNAs: Experiments wi		
	Inhibitors		159
1.3.2	Energy Production		160
1.3.3	Protein Synthesis		161
1.3.4	RNA Synthesis		162
1.3.5	DNA Synthesis. Relative Autonomy of the Chloroplasts		164
1.3.6	Complexity of Nucleocytoplasmic Interactions		165
2	Biochemistry of Anucleate Fragments of Eggs		166
2.1	Amphibian Eggs		166
2.2	Sea Urchin Eggs		167
2.2.1	Biological Observations		167
2.2.2	Biochemical Studies		168
3	The Importance of the Nucleus for Embryonic Developm		171
3.1	General Background		171
3.2	Lethal Hybrids		172
3.2.1	Biological Observations		172
3.2.2	Biochemical Studies on Lethal Hybrids		173
3.2.2.1	Respiration		173
3.2.2.2	Nucleic Acid and Protein Synthesis		174
4	Biochemistry of Early Developmental Mutants		176
5	"Transgenic" Mice and Teratocarcinoma		178
6	Conclusions		180
Chapter	XI How Cells Differentiate		182
1	General Introduction		182
2	Specific Properties of Cell Membranes		185
3	Effects of Tissue Extracts on Cell Differentiation		187
4	Immunological Studies on Embryonic Differentiation		188
5	Enzyme Synthesis and Embryonic Differentiation		191
			193
6	Differentiation of Cultured Embryonic Cells		193
6.1	A Brief Description of a Few Biological Systems		173

XIV	Contents			
6.2	Experimental Analysis of Cell Differentiation in Culture 195			
6.2.1	Cell Fusion			
6.2.2	Effects of Bromodeoxyuridine (BrdUr) on Cell			
	Differentiation			
6.2.3	Effects of Phorbol Esters and Retinoids			
6.2.4	Other Inducers and Inhibitors of Cell Differentiation 200			
7	Embryonic Differentiation and Cancer			
8	The Future of Molecular Embryology			
~ .	204			
Referen	ces			
Further Reading				
Author	and Subject Index			