

Contents

Contributors	xiii
Preface	xvii

I The Molecules Involved in Sperm-Egg Recognition and Binding

1 The Regulation of Spermatozoan Function by the Egg

David L. Garbers

I. Introduction	3
II. Background	4
III. Future Concerns	12
References	15

2 Receptors and Membrane Interactions during Fertilization

Norka Ruiz-Bravo and William J. Lennarz

I. Introduction	21
II. Acrosome Reaction	23
III. Receptor-Mediated Sperm-Egg Binding	26
IV. Gamete Fusion and Cortical Granule Exocytosis	31
V. Conclusion	33
References	34

3 Galactosyltransferase as a Recognition Molecule during Fertilization and Development

Barry D. Shur

I. Introduction	38
II. Galactosyltransferase	40
III. Cell Surface GalTase	42
IV. The T/t Complex	43

V.	Receptor Function of GalTase during Gamete Binding	45
VI.	The Zona Pellucida Receptor for Sperm	49
VII.	Expression of Surface GalTase during Spermatogenesis and Epididymal Maturation	51
VIII.	Exposure of Sperm GalTase Prior to Binding the Zona Pellucida	53
IX.	The Fate of Surface GalTase following Sperm Binding to the Zona Pellucida	54
X.	Surface GalTase Participates in Other Cell Interactions during Development	56
XI.	Future Directions	62
	References	65

4 The Molecular Biology of Bindin

Joseph E. Minor, Boning Gao, and Eric H. Davidson

I.	Introduction	73
II.	Bindin and cDNA Cloning	78
III.	Information from the cDNA Clone	80
IV.	Bindin as a Testis-Specific Gene	82
V.	Species Specificity of the Bindin-Receptor Interaction	82
VI.	Future Prospects	84
	References	85

II Pronuclear Formation and Cytoskeletal Events Resulting in Syngamy and Cell Cycle Progression

5 Formation and Function of the Male Pronucleus during Mammalian Fertilization

Barry R. Zirkin, Sally D. Perreault, and Sally J. Naish

I.	Introduction	91
II.	Decondensation of the Mammalian Sperm Nucleus: <i>In Vitro</i> Analyses	93
III.	Decondensation of the Mammalian Sperm Nucleus: Analyses of Fertilization	96
IV.	Oocyte Maturation and Sperm Nuclear Decondensation	101
V.	Formation of the Male Pronucleus	102
VI.	Function of the Male Pronucleus: DNA Synthesis	105
	References	109

6 Reactivation and Remodeling of the Sperm Nucleus following Fertilization

Dominic Poccia

I.	Introduction	115
II.	The Nucleus of the Mature Sperm	118

III.	Pronuclear Decondensation	119
IV.	Initiation of Replication	122
V.	Chromatin Remodeling	124
VI.	Transcriptional Activation	127
VII.	Conclusions and Speculations	129
	References	131

7 Redistribution of Nuclear Envelope, Nucleolar, and Kinetochore Antigens during Mouse Spermatogenesis and Early Development

Gerd G. Maul

I.	Introduction	137
II.	Lamins in Different Cell Types	138
III.	Nucleolar Position during Spermatogenesis in Mouse	147
IV.	Kinetochore Distribution during Spermatogenesis in Mouse	148
	References	150

8 Developmental Control of Nuclear Proteins in Amphibia

Reimer Stick and Christine Dreyer

I.	Introduction	153
II.	Accumulation and State of the Maternal Store	154
III.	Metabolic Changes and Topological Rearrangements during Egg Maturation	161
IV.	Consumption of the Maternal Store and the Beginning of Gene Expression in the Embryo	164
V.	Summary and Prospects	177
	References	178

9 Centrosomes, Centrioles, and Posttranslationally Modified α -Tubulins during Fertilization

Heide Schatten, Cathy Thompson-Coffe, Gérard Coffe, Calvin Simerly, and Gerald Schatten

I.	Cytoskeletal Activity and Motility during Fertilization	189
II.	Centrosomes	191
III.	Centrioles	198
IV.	Posttranslational Modification of α -Tubulins	198
V.	Conclusions and Future Prospects	205
	References	207

10 Cyclins and Regulation of the Cell Cycle in Early Embryos

Katherine Swenson, Joanne Westendorf, Tim Hunt, and Joan Ruderman

I.	Introduction	212
II.	Newly Synthesized Proteins Are Required for Each Mitosis in Early Embryos and in Somatic Cells	212
III.	Meiosis and the Requirement for Protein Synthesis	215
IV.	Cyclins: Continuous Synthesis, Periodic Destruction	216
V.	Cyclin A Acts as Inducer of M Phase; High Levels of Cyclin B May Keep Cells in M Phase	219
VI.	Molecular Characterization of the Cyclins	222
VII.	Discussion	225
	References	228

III Gene Activation, Protooncogenes, and Nuclear Determination at Fertilization and during Embryogenesis

11 Genetic Control of Germ Cell Function: Developmentally Regulated Gene Expression during Gametogenesis

Debra J. Wolgemuth, Elena Gizang-Ginsberg, Carola Ponzetto, and Zahra F. Zakeri

I.	Introduction	236
II.	Genes That Exhibit a Unique Pattern of Expression in the Testis as Compared to Their Expression in Other Adult Tissues	239
III.	Genes That Are Expressed Specifically during Embryonic Development and in the Germ Line in the Adult	245
IV.	Genes That Are Expressed Uniquely in Germ Cells	249
V.	Concluding Remarks	251
	References	252

12 The Molecular Biology of Mammalian Oocyte Maturation

M. Lorraine Leibfried-Rutledge, Harvey M. Florman, and Neal L. First

I.	Introduction	259
II.	Life Cycle of the Developing Egg in Mammals	260
III.	Regulation of Meiotic State Prior to GVBD	270
IV.	Completion of Meiosis I	281
V.	Consequences of Oogenesis for Fertilization and Early Embryonic Development	285
	References	288

13 Changes in Gene Activity Early after Fertilization

Carlos L. Santiago and William F. Marzluff

I.	Introduction	303
II.	General Patterns of Gene Activity	304
III.	Activation of Protein Synthesis	305
IV.	Synthesis of Specific Proteins after Fertilization	307
V.	Regulation of Histone Synthesis	309
VI.	Accumulation of snRNAs	312
VII.	Conclusions	316
	References	317

14 Nuclear Transfer in Mammals and Amphibians: Nuclear Equivalence, Species Specificity?

Randall Scott Prather

I.	Introduction	323
II.	Nuclear Transfer: Amphibians	324
III.	Nuclear Transfer: Mammals	325
IV.	Nuclear Modifications after Nuclear Transfer	328
V.	Differentiation in Various Species	334
VI.	Conclusions	336
	References	336

15 Ooplasmic Segregation in the Ascidian *Styela*

William R. Jeffery and William R. Bates

I.	Introduction	342
II.	Ooplasmic Segregation in <i>Styela</i>	343
III.	Components Involved in Ooplasmic Segregation	346
IV.	Mechanism of Ooplasmic Segregation	351
V.	Spatial Control of Ooplasmic Segregation	353
VI.	Developmental Significance of Ooplasmic Segregation	359
VII.	General Features of Ooplasmic Segregation	362
	References	364

Index	369
-------------	-----