

Contents

Part I. Maturation of Spermatozoa in the Epididymis	1
1. Acquisition in the Epididymis of Sperm Fertilising Ability	1
2. Involvement of the Epididymis in the Development of Sperm Fertilising Ability	2
3. The Nature of the Androgen-Dependent Epididymal Secretions Involved	4
4. Response of Immature Spermatozoa to Epididymal Secretions	4
5. Scope of this Review	4
6. Summary	5
7. References	5
 Part II. Fertilisation	 9
A. Sperm Motility	9
1. The Need for Flagellar Activity of Sperm for Them to Reach the Egg	9
2. The Ability of Immature Spermatozoa to Reach the Site of Fertilisation	10
3. Development in the Epididymis of Sperm Motility In-Vitro	11
4. The Nature of the Reduced Motility of Immature Spermatozoa	12
5. Involvement of the Epididymis in the Maturation of Motility	23
6. Induction of Motility in Immature Spermatozoa In-Vitro	24
7. Relationship of Induced Forward Motility to Fertilising Ability	27
8. Summary	27
9. References	27
 B. Capacitation	 42
1. Detection of Capacitation	42
2. Changes in the Sperm Surface During Capacitation	43
3. Mechanisms of Capacitation	43

4. Consequences for Membrane Fluidity	45
5. Action of Decapacitation Factors	45
6. Maintenance of Motility	46
7. Requirements of Capacitation	46
8. Development in the Epididymis of the Ability of Spermatozoa to be Capacitated	46
9. Involvement of the Epididymis in Permitting Capacitation	47
10. Summary	49
11. References	49
C. Consequences of Capacitation. I. Sperm-Egg Binding . . .	56
1. Sperm-Egg Binding	56
2. Relationship to Capacitation	56
3. Relationship to the Acrosome Reaction	56
4. Mechanisms of Binding	57
5. Development in the Epididymis of the Ability of Sperm to Bind to Eggs	58
6. Involvement of the Epididymis in the Development of the Sperm Surface	59
7. Summary	62
8. References	62
D. Consequences of Capacitation. II. The Acrosome Reaction . . .	67
1. The Acrosome Reaction	67
2. Mechanism of the Acrosome Reaction	67
3. Requirements for the Acrosome Reaction	68
4. Stimulus to the Acrosome Reaction	72
5. Relationship to Capacitation	72
6. Relationship to Hyperactivated Motility	73
7. Relationship to Fertilisation	73
8. Site of the Acrosome Reaction	73
9. Consequences of the Acrosome Reaction	74
10. Development in the Epididymis of the Ability of Spermatozoa to Undergo the Acrosome Reaction	76
11. Involvement of the Epididymis in Permitting the Acrosome Reaction	78
12. Summary	79
13. References	79
E. Consequences of Capacitation. III. Hyperactivation . . .	89
1. Hyperactivation	89
2. Requirements of Hyperactivated Motility	90
3. Mechanisms of Hyperactivated Motility	91
4. Stimulus to Hyperactivated Motility	92
5. Relationship to Capacitation	92
6. Relationship to the Acrosome Reaction	92
7. Relationship to Fertilisation	93

8. Site of Hyperactivated Motility	93
9. Consequences of Hyperactivated Motility	94
10. Development in the Epididymis of the Ability of Sperm to Display Hyperactivated Motility	95
11. Involvement of the Epididymis in Permitting Hyperactivation	96
12. Summary	96
13. References	96
F. Sperm-Egg Fusion	101
1. Binding to the Vitellus	101
2. Fusion with the Vitellus	101
3. Relationship to Capacitation	102
4. Relationship to the Acrosome Reaction	102
5. Relationship to Sperm Motility	102
6. Regions of the Sperm Head Involved in Fusion	102
7. Basis of Fusion	104
8. Development in the Epididymis of the Ability of Sperm to Fuse with Eggs	104
9. Involvement of the Epididymis in Permitting Sperm-Egg Fusion	105
10. Summary	105
11. References	105
G. Post-Fusion Events	108
1. Activation of the Eggs	108
2. Decondensation of Sperm Chromatin	109
3. Formation of the Male Pronucleus	110
4. Chromosome Condensation	110
5. Development in the Epididymis of the Ability of Sperm to Interact with the Vitellus	110
6. Involvement of the Epididymis in Permitting Post-Fusion Events	111
7. Summary	112
8. References	112
 Part III. Function of the Epididymis and Its Secretory Products	 117
A. Epididymal Structure and Function	117
1. Introduction	117
2. Epididymal Structure	118
3. Blood Supply	119
4. Lymphatics	120
5. Methods of Study	120
6. Epithelial Cells	121

7. Testicular Control of Epididymal Function	123
8. Permeability of the Epididymal Epithelium	124
9. Resorptive Activity of the Epididymis	127
10. Secretory Activity of the Epididymis	128
11. Summary	128
12. References	128
B. Secretion of Steroids by the Epididymis	139
1. Steroids in Epididymal Tissue	139
2. Origin of Epididymal Steroids	140
3. Testicular Control of Androgenic Function in the Epididymis	142
4. Endocrine Role of the Epididymis	146
5. Role of Steroids in Epididymal Function	147
6. Interactions of Steroids with Spermatozoa	149
7. Role of Steroids in Spermatozoal Function	150
8. Summary	152
9. References	152
C. Resorption and Secretion of Ions by the Epididymis	163
1. Luminal Contents	163
2. Transporting Activities	163
3. Control of Transporting Activities	164
4. Role of Monovalent and Divalent Cations	165
5. Interactions of Ions with Maturing Spermatozoa	166
6. ATPase Activity in Spermatozoa	167
7. Polycations	167
8. Summary	168
9. References	169
D. Epididymal Secretion of Glycerophosphocholine (GPC)	174
1. Concentration in Epididymal Tissue	174
2. Origin of Epididymal GPC	174
3. Androgen Dependence	176
4. Role of GPC in Epididymal Function	176
5. Summary	177
6. References	177
E. Epididymal Secretion of Carnitine	180
1. Concentration in Epididymal Tissue	180
2. Origin of Epididymal Carnitine	180
3. Androgen Dependence	181
4. Interaction of Carnitine with Maturing Spermatozoa	182
5. Roles of Carnitine in Epididymal Function	182
6. Summary	186
7. References	186

F. Epididymal Secretion of <i>myo</i>-Inositol	191
1. Concentration in Epididymal Tissue	191
2. Origin of Epididymal Inositol	192
3. Androgen Dependence	193
4. Metabolism of Inositol	194
5. Interaction of Inositol with Maturing Spermatozoa	194
6. Role of Inositol in Epididymal Function	195
7. Summary	196
8. References	196
G. Epididymal Secretion and Resorption of Proteins	200
1. Luminal Proteins	200
2. Origin of Epididymal Proteins	200
3. Protein Synthesis and Precursors in the Epididymis	202
4. Protein Secretion in the Epididymis	204
5. Androgen Dependence	205
6. Control of Protein Synthesis by Luminal Fluid	206
7. Site of Synthesis of Specific Proteins	207
8. Evidence for Interactions of Luminal Proteins with Spermatozoa	207
9. Binding of Proteins to Maturing Spermatozoa	209
10. The Nature of the Interaction	211
11. Site of Binding	212
12. Role of Proteins in Epididymal Function	212
13. Peptides	215
14. Resorption of Proteins by the Epididymis	216
15. Summary	217
16. References	217
Part IV. Conclusions	231
1. The Importance of the Epididymis in Male Fertility	231
2. Summary	232
Appendix I (Tables 1–21)	233
Appendix II (Figures 1–8)	269
Subject Index	277