

TABLE OF CONTENTS

Equine Reproduction, 2nd Edition [2-volume set]

Contributors

Preface to the second edition

Preface to the first edition

Acknowledgments

Color plates between pages 812 and 813

Volume 1

Part I: The Foal

Section (a) Prepartum assessment of the foal

1 Identification of the high-risk pregnancy 5

Elizabeth M. Santschi and Wendy E. Vaala

2 Monitoring the high-risk pregnancy 16

Wendy E. Vaala

3 Management of the high-risk pregnancy 25

Elizabeth M. Santschi and Wendy E. Vaala

4 Ultrasonographic monitoring of the fetus 39

Stefania Bucca

5 Sedation and anesthesia of the pregnant mare 55

John A.E. Hubbell

Section (b) Foal adaptation to parturition

6 The normal post partum foal 63

Sarah J. Stoneham

7 Endocrinological adaptation 69

Jennifer C. Ousey

8 The placenta 84

Peter R. Morresey

Section (c) Postpartum fetal assessment

9 Examination of the placenta 99

Donald H. Schlafer

10 Peri-parturient management of the mare and neonate 111

T. Douglas Byars and Barry W. Simon

Section (d) Problems of the immediate postpartum period

11 Foal rejection 117

Wendy E. Vaala

12 Prematurity, dysmaturity and assessment of maturity 121

Guy D. Lester

13 Resuscitation (foal and birth) 128

Niamh M. Collins, Jane E. Axon and Jonathan E. Palmer

14 Shock 136

Niamh M. Collins, Jane E. Axon and Jonathan E. Palmer

15 Perinatal asphyxia syndrome 147

Pamela A. Wilkins

16 Sepsis 154

L. Chris Sanchez

Section (e) Specific diagnostic and management techniques

17 Critical care – assessment 167

Jane E. Axon

18 Critical care – monitoring 177

Darien J. Feary

19 Critical care – treatment 189

Jane E. Axon

20 Complications of neonatal infection 198

Mary Rose Paradis

21 Fluid therapy 205

Robert P. Franklin

22 Respiratory assistance 215

Jonathan E. Palmer

23 Sedation, anesthesia and analgesia 221

Lori A. Bidwell

24 Stabilization and preparation for transport 230

Robert P. Franklin and Jennifer R. Read

25 Transfusion techniques 238

John F. Freestone

26 Diagnostic ultrasonography of the abdomen 243

Virginia B. Reef and JoAnn Slack

27 Antibiotic therapy 253

K. Gary Magdesian

28 Enteral and parenteral nutrition for the neonatal foal 263

Wendy E. Vaala

29 Growth of horses 280

Clarissa Brown-Douglas, Peter Huntington and Joe Pagan

30 Important gastrointestinal parasites 292

Eugene T. Lyons, Mariana Ionita and Sharon C. Tolliver

31 Vaccination of mares, foals and weanlings 302

W. David Wilson

Section (f) Immune system

32 Development of the foal immune system 331

M. Julia B. Felippe Flaminio and Rebecca L. Tallmadge

33 Colostrum: Assessment of quality and artificial supplementation 342

Guy D. Lester

34 Assessment and modification of passive transfer 346

Sally L. Vivrette

35 Neonatal isoerythrolysis 353

Jill R. Johnson

36 Immunodeficiencies in foals 361

M. Julia B. Felippe Flaminio

37 Severe combined immunodeficiency 369

Melissa T. Hines

38 Thrombocytopenia and selective IgM deficiency 373

Rodney L. Belgrave

Section (g) Gastrointestinal system

39 Meconium impaction 379

Wendy E. Vaala

40 Neonatal diarrhea 385

K. Gary Magdesian

41 Gastroduodenal ulceration: The neonatal perspective 394

L. Chris Sanchez

42 Surgical gastrointestinal conditions 399

Brett J. Woodie

43 Other gastrointestinal disorders (chyloperitoneum, Atresia, lethal white) 405

K. Gary Magdesian

44 Hepatic disease 409

Thomas J. Divers and T. Douglas Byars

Section (h) Hemopoetic system

45 Anemia 419

Jane E. Axon

46 Coagulation disorders 426

Fairfield T. Bain

Section (i) Musculoskeletal system

47 Fetal ossification and normal joint development 433

Elwyn C. Firth

48 Flexural deformities 441

Stephen B. Adams and Timothy B. Lescun

49 Fractures commonly seen in foals 446

Angus R. Adkins

50 Infectious arthritis and osteomyelitis 457

Fairfield T. Bain

51 Muscle disorders 463

Erica C. McKenzie and Jennifer M. MacLeay

52 Tendon and ligament disorders 469

Timothy B. Lescun and Stephen B. Adams

Section (j) Nervous system

53 Neurological evaluation 477

Robert J. MacKay

54 Neurological disorders in the neonatal foal 483
Robert J. MacKay

Section (k) Cardiovascular system

55 Techniques in diagnosis and monitoring of cardiovascular disease 499
Anne Desrochers

56 Congenital abnormalities of the cardiovascular system 507
Celia M. Marr

57 Acquired abnormalities of the cardiovascular system 511
C.J. (Kate) Savage

Section (l) Endocrinology system

58 Endocrine abnormalities 523
Melissa T. Hines

Section (m) Ocular system

59 Ophthalmic disorders of the foal 535
Caryn E. Plummer and Dennis E. Brooks

Section (n) Integument system

60 Diseases of the skin 555
Derek C. Knottenbelt

Section (o) Respiratory System

61 Diagnostic approach to respiratory disorders 575
Guy D. Lester

62 Acute respiratory distress syndrome (ARDS) 582
Pamela A. Wilkins

63 Respiratory diseases specific to the neonate 586
Guy D. Lester

64 Aspiration pneumonia 592
Mary Rose Paradis

65 Other disorders of breathing 597
Pamela A. Wilkins

66 Bacterial and viral respiratory disease of the neonate 601
Renaud Léguillette

67 Congenital abnormalities of the respiratory system 609
Eric J. Parente

68 Genetic basis of respiratory disorders 615
Eliane Marti, Caroline Tessier and Vincent Gerber

Section (p) Urogenital system

69 Disorders of the bladder ureters and urethra 625
Thomas J. Divers

70 Disorders of the umbilicus and urachus 632
Kirsten M. Neil

71 Renal problems 646
Jonathan E. Palmer

Section (q) System disorders

72 Congenital problems of foals 663
Antonio M. Cruz

73 Inherited problems of foals 673
Sharon J. Spier Carrie J. Finno and Stephanie J. Valberg

Section (r) Problems of older foals weanlings and yearlings

74 Gastroduodenal ulcer complex of the older foal 683
Bonnie Barr

75 *Rhodococcus* pneumonia: Epidemiology and prophylaxis 688
Noah D. Cohen

76 *Rhodococcus* pneumonia: Pathogenesis diagnosis and therapy 695
Steeve Gigu`ere

77 Strangles 704
John F. Timoney

78 Other bacterial respiratory diseases of the older foal 710
Steeve Gigu`ere

79 Viral respiratory diseases of the older foal 720
Lutz S. Goehring and D. Paul Lunn

80 Neurological conditions (EPM, EMND wobblers, Trauma, etc) 728
Guy D. Lester

81 Diarrhea 734
Kirsten M. Neil

82 Colic 749
Joanne Hardy

83 Weight loss 758
Kirsten M. Neil

84 Angular limb deformities 768
Earl M. Gaughan and Sarah E.T. Hanna

85 Developmental orthopedic disease 772
C. Wayne McIlwraith

86 Feeding the growing horse to avoid developmental orthopedic disease (DOD) 782
Paul D. Siciliano

87 Presale endoscopy 794
Rolf M. Embertson

88 Presale radiographs 801
James P. Morehead and Brent N. Cassady

89 Presale radiographic interpretation and significance 809
C. Wayne McIlwraith

Section (s) Appendix

90 Development of a NICU 821
Nathan M. Slovis and Lynne M. Hewlett

91 Diagnostic laboratory resources and critical care supplies 830
Nathan M. Slovis and Wendy E. Vaala

92 Formulary 838
Robert P. Franklin

93 Hematology and biochemical reference values 851
Robert P. Franklin and Joan Palmero

94 SI Conversion Table 857

Part II: The Stallion

Section (a) Anatomy, physiology and endocrinology

95 Functional anatomy of the adult male 867
Rupert P. Amann

96 Physiology and endocrinology 881
Rupert P. Amann

97 From a sperm's eye view: Revisiting our perception of this intriguing cell 909
Dickson D. Varner and Larry Johnson

98 Oxidative stress in sperm 991
Barry A. Ball

99 Endocrine–paracrine–autocrine regulation of reproductive function in the stallion 996
Janet F. Roser

100 Puberty 1015
Noah L. Heninger

101 Spermatogenesis 1026
Larry Johnson, Cleet E. Griffin and Michael T. Martin

102 Spermatozoal function 1053
Rupert P. Amann and James K. Graham

103 Sperm–oviduct interactions 1085
Barry A. Ball

104 Sperm–uterine interactions 1092
Terttu Katila

105 Testicular descent 1099
Mimi Arighi

Section (b) Abnormalities of the stallion's reproductive tract

106 Developmental abnormalities of the male reproductive tract 1109
Mimi Arighi

107 Abnormalities of the accessory sex glands 1113
Dickson D. Varner and James Schumacher

108 Abnormalities of the ejaculate 1119
Regina M.O. Turner

109 Abnormalities of the penis and prepuce 1130
James Schumacher and Dickson D. Varner

110 Abnormalities of the spermatic cord 1145
James Schumacher and Dickson D. Varner

111 Epididymal abnormalities 1156
Aime K. Johnson and Charles C. Love

112 Abnormalities of the testicles 1161
Warren Beard

113 Neoplasia of the reproductive tract 1166
John F. Edwards

Section (c) Management

114 Drugs that adversely affect spermatogenesis 1175
Rupert P. Amann

115 Dual hemisphere breeding programs 1184
Norman W. Umphenour

116 Immunocastration 1191
Tom A.E. Stout and Ben Colenbrander

117 Management of stallions in artificial insemination 1198
H. Steve Conboy

118 Management of stallions in natural-service programs 1208
Norman W. Umphenour, Phillip McCarthy and Terry L. Blanchard

119 Nutrition and exercise for breeding stallions 1228
Stephen G. Jackson

120 Management of subfertile stallions under natural-mating conditions 1240
Terry L. Blanchard

121 Venereal disease 1250
Elizabeth S. Metcalf

Section (d) Semen collection, evaluation and artificial insemination

122 Historical perspectives of artificial insemination 1261
John M. Bowen

123 Semen collection techniques and insemination procedures 1268
Steven P. Brinsko

124 Evaluation of semen 1278
Julie Baumber-Skaife

125 Spermatozoal motility 1292
Aaron D.J. Hodder and Irwin K.M. Liu

126 Spermatozoal morphology 1297
D.N. Rao Veeramachaneni

127 Principles of cooled semen 1308
James K. Graham

- 128 Breeding with cooled transported semen 1316
Juan C. Samper
- 129 Experiences with a large-scale cooled – transported semen program 1323
Simon J. Robinson
- 130 Containers for transport of equine semen 1330
Terttu Katila
- 131 Semen extenders for cooled semen (Europe) 1336
Christine Aurich
- 132 Semen extenders for cooled semen (North America) 1341
Steven P. Brinsko
- 133 Factors affecting sperm production and output 1344
Edward L. Squires and Bill W. Pickett
- 134 Reproductive parameters of draft horse, friesian and warmblood stallions 1362
Tom A.E. Stout and Ben Colenbrander
- 135 Reproductive parameters from light horse stallions 1367
Edward L. Squires
- 136 Reproductive parameters from miniature stallions 1377
Dale L. Paccamonti and Paul J. De Vries
- Section (e) Sexual behavior**
- 137 Normal sexual behavior 1385
Sue M. McDonnell
- 138 Handling the breeding stallion 1391
Dickson D. Varner
- 139 The novice breeding stallion 1396
H. Steve Conboy
- 140 Training a stallion to the phantom 1402
Glenn P. Blodgett
- 141 Abnormal sexual behavior 1407
Sue M. McDonnell
- 142 Pharmacological manipulation of ejaculation 1413
Sue M. McDonnell
- 143 Pharmacological manipulation of stallion behavior 1415
Sue M. McDonnell

144 Specific erection and ejaculatory dysfunctions 1419
Sue M. McDonnell

145 Stereotypic behavior of stallions 1423
Katherine A. Houpt

Section (f) Specific techniques used in reproductive examination of the stallion

146 Historical information 1429
Charles C. Love

147 Diagnostics and therapeutics for stallions with declining fertility: An endocrine–paracrine–autocrine approach 1435
Janet F. Roser

148 Endoscopy of the internal reproductive tract 1448
Carla L. Carleton

149 Examination of external genitalia 1458
Patricia L. Sertich

150 Cytogenetic evaluation 1462
Keith W. Durkin, Terje Raudsepp and Bhanu P. Chowdhary

151 Ultrasonography of the genital tract 1469
Regina M.O. Turner

Section (g) Specific techniques used in semen evaluation of the stallion

152 Acrosomal function 1491
Stuart A. Meyers

153 Evaluation of the plasma membrane 1498
Ben Colenbrander and Tom A.E. Stout

154 Sperm chromatin structure assay 1506
Aime K. Johnson and Charles C. Love

155 Spermatozoal viability 1510
Stuart A. Meyers

Section (h) Surgical procedures of the male reproductive tract

156 Clinical uses of testicular biopsy 1517
Terry L. Blanchard

157 Testicular biopsy 1523
Walter R. Threlfall

158 Cryptorchid castration 1531
Thomas M. Russell and Patrick J. Pollock

159 Inguinal hernia 1540
Patrick J. Pollock and Thomas M. Russell

160 Laparoscopic surgery 1546
David G. Wilson

161 Laser assisted castration 1553
Scott E. Palmer

162 Normal field castration 1557
Glenn P. Blodgett

163 Surgery of the penis and prepuce 1562
James Schumacher and Dickson D. Varner

Index 1573

Volume 2

Part III: The Mare

Section (a) Anatomy

164 External reproductive anatomy 1577
John J. Dascanio

165 Internal reproductive anatomy 1582
Robert A. Kainer

Section (b) Physiology and endocrinology

166 How hormones work 1601
Peter R. Morresey

167 GnRH 1608
Susan L. Alexander and Clifford H.G. Irvine

168 FSH and LH 1619
Susan L. Alexander and Clifford H.G. Irvine

169 Estrogens 1631
Bruce W. Christensen

170 Progesterone 1637
Dirk K. Vanderwall

171 Prostaglandins 1642

Tom A.E. Stout

172 Equine chorionic gonadotropin (eCG) 1648

Amanda M. de Mestre, Douglas F. Antczak and W.R. (Twink) Allen

173 Adrenal steroids 1665

Valerie J. Linse

174 Melatonin 1669

Daniel C. Sharp

175 Oxytocin, Inhibin, Activin, relaxin and prolactin 1679

Peter R. Morresey

Section (c) The estrous cycle

176 Puberty 1689

Bruce E. Eilts

177 Anestrus 1696

Donald L. Thompson Jr.

178 Vernal transition into the breeding season 1704

Daniel C. Sharp

179 Estrus 1716

Patrick M. McCue, Charles F. Scoggin and Alicia R.G. Lindholm

180 Diestrus 1728

Robert M. Löfstedt

181 Autumnal transition out of the breeding season 1732

Sheryl S. King

182 The abnormal estrous cycle 1754

Patrick M. McCue and Ryan A. Ferris

Section (d) The transitional mare

183 Photoperiod 1771

Daniel C. Sharp

184 Progesterone 1778

Edward L. Squires

185 GnRH 1782

John Hyland

186 Dopamine antagonists 1788
Ahmed Tibary

Section (e) Pharmacological manipulation of reproduction

187 Prostaglandins 1797
Simon A. Staempfli

188 Human chorionic gonadotropin 1804
John R. Newcombe

189 Progestagens and progesterone 1811
Carlos R.F. Pinto

190 Gonadotropin-releasing hormones 1820
Edward L. Squires

191 Estrogen therapy 1825
Ahmed Tibary

192 Oxytocin 1830
Michelle M. LeBlanc

193 Superovulation 1836
Edward L. Squires and Patrick M. McCue

194 Estrus suppression 1845
Dirk K. Vanderwall and Gary J. Nie

195 Inhibin immunotherapy 1854
Patrick M. McCue

196 Induction of ovulation 1858
Angus O. McKinnon and Patrick M. McCue

197 Synchronization of ovulation 1870
Etta A. Bradecamp

198 New techniques in hormonal delivery 1879
Patrick J. Burns

199 Contraception 1888
Jay F. Kirkpatrick and John W. Turner

Section (f) Techniques in reproductive examination

200 History 1897
Walter W. Zent

201 Vaginal examination 1900
Walter W. Zent and John V. Steiner

202 Direct rectal palpation 1904
Thomas R. Bowman Jr.

203 Ultrasonography 1914
Jonathan F. Pycock

204 Uterine cytology 1922
Michelle M. LeBlanc

205 Endometrial biopsy 1929
Charles C. Love

206 Endoscopic examination 1940
Claire E. Card

207 Cytogenetic evaluation of mares and foals 1951
Teri L. Lear and Daniel A.F. Villagomez

208 Uterine and clitoral cultures 1963
Sidney W. Ricketts

209 Use of chromogenic agar to diagnose reproductive pathogens 1979
Angus O. McKinnon and David P. Beehan

210 Evaluation of uterine tubal patency 1988
William B. Ley

211 Laparoscopy 1991
Dean A. Hendrickson and David G. Wilson

Section (g) Diagnostic ultrasonography

212 Normal anatomy 2003
Elaine M. Carnevale and Lawrence M. Olsen

213 Folliculogenesis 2009
Mohd A. Beg and Don R. Bergfelt

214 Ovulation: Part 1. Follicle development and endocrinology during the periovulatory period 2020
Eduardo L. Gastal

215 Ovulation: Part 2. Ultrasonographic morphology of the preovulatory follicle 2032
Eduardo L. Gastal

216 Luteal development 2055
Don R. Bergfelt and Gregg P. Adams

217 Pregnancy 2065

Don R. Bergfelt and Gregg P. Adams

218 Equine fetal sex determination between 55 and 150 days 2080

Richard D. Holder

219 Fetal gender determination from mid to advanced gestation 2094

Stefania Bucca

220 Management of twins 2099

Angus O. McKinnon

221 Early embryonic loss 2118

Dirk K. Vanderwall

222 Ovarian abnormalities 2123

Patrick M. McCue and Angus O. McKinnon

223 Uterine abnormalities 2137

Angus O. McKinnon and Patrick M. McCue

224 Mammary gland 2162

Bryan M. Waldridge

Section (h) Pregnancy, parturition and the puerperal period

225 Embryo morphology, growth and development 2167

Keith J. Betteridge

226 Fetal membrane differentiation, implantation and early placentation 2187

W.R. (Twink) Allen, Susan Gower and Sandra Wilsher

227 Maternal recognition of pregnancy 2200

Karen J. McDowell and Daniel C. Sharp

228 Sex determination and differentiation 2211

Bruce W. Christensen and Vicki N. Meyers-Wallen

229 Endocrinology of pregnancy 2222

Jennifer C. Ousey

230 Development and morphology of the placenta 2234

Sandra Wilsher and W.R. (Twink) Allen

231 Pregnancy examination 2245

Patrick M. McCue and Angus O. McKinnon

232 Induction of parturition 2262

Margo L. Macpherson and Dale L. Paccamonti

233 Parturition 2268
Bruce W. Christensen

234 Lactation 2277
Patrick M. McCue and Sofie Sitters

235 Uterine involution 2291
Mary E. Stanton

236 Breeding mares on foal heat 2294
Terry L. Blanchard and Margo L. Macpherson

237 Inter and extraspecies equine pregnancies 2302
W.R. (Twink) Allen Julia H. Kydd Roger V. Short and Douglas F. Antczak

238 Induction of abortion 2320
Claire E. Card

Section (i) Problems of pregnancy

239 Embryonic loss 2327
Barry A. Ball

240 Abortions and stillbirths: A pathologists overview 2339
Katherine E. Whitwell

241 Origin and outcome of twin pregnancies 2350
Angus O. McKinnon

242 Placentitis 2359
Mats H.T. Troedsson and Margo L. Macpherson

243 Hydrops 2368
Rudolf O. Waelchli

244 Fetal maceration and mummification 2373
Claire E. Card

245 Equine herpesvirus 2376
Peter J. Timoney

246 Equine viral arteritis 2391
Peter J. Timoney

247 Contagious equine metritis 2399
Peter J. Timoney

248 Mare reproductive loss syndrome 2410
David G. Powell

249 Fescue toxicosis 2418

Dee L. Cross

250 Prepubic and abdominal wall rupture 2428

Dwayne H. Rodgerson

251 Uterine prolapse 2431

Michael A. Spirito and Kim A. Sprayberry

252 Uterine torsion 2435

James R. Vasey and Tom Russell

253 Abnormalities of pregnancy 2441

Robert M. Löfstedt

254 Maintenance of pregnancy 2455

Angus O. McKinnon and Jonathan F. Pycock

255 Dystocia management 2479

Grant Frazer

256 Fetotomy 2497

Grant Frazer

257 Cesarian section 2505

David E. Freeman

258 Referral dystocias 2511

Rolf M. Embertson

259 Periparturient hemorrhage 2517

T. Douglas Byars and Thomas J. Divers

260 Retained fetal membranes 2520

Walter R. Threlfall

261 Postpartum metritis 2530

Terry L. Blanchard

Section (j) Female urogenital surgery

262 Pneumovagina 2537

Etta A. Bradecamp

263 Surgery of the caudal reproductive tract 2545

Angus O. McKinnon and Sarah L. Jalim

264 Cervical surgery 2559

Patrick J. Pollock and Thomas M. Russell

265 Ovariectomy 2564
Dwayne H. Rodgerson and Dawn A. Loesch

266 Hysterectomy 2574
Anna K. Roetting and David E. Freeman

267 Rectal tears 2578
David E. Freeman

Section (k) Disease of the uterus

268 Immunological considerations 2587
Sara K. Lyle

269 Abnormalities of contractility 2597
Terttu Katila

270 Abnormalities of development 2607
John P. Hurtgen

271 Endometritis 2608
Mats H.T. Troedsson

272 Breeding the problem mare 2620
Michelle M. LeBlanc and Angus O. McKinnon

273 Fungal endometritis 2643
Marco A. Coutinho da Silva and Marco A. Alvarenga

274 Pyometra 2652
Kristina G. Lu

275 Treatment of fluid accumulation 2655
Jonathan F. Pycock

276 Uterine cysts 2665
Mary E. Stanton

277 Uterine abnormalities 2669
John P. Hurtgen

278 Laboratory methods for isolation and evaluation of bacteria fungi and yeast 2674
David L. Hartman and Shalyn Bliss

Section (l) Diseases of the ovary and oviduct

279 Disorders of ovulation 2685
Patrick M. McCue

280 Disorders of the oviduct 2692

Irwin K.M. Liu

281 Non-neoplastic abnormalities 2697

Donald H. Schlafer

282 Ovarian neoplasia 2707

Claire E. Card

Section (m) Problems of the cervix

283 Abnormalities of cervical and vaginal development 2719

John P. Hurtgen

284 Cervix adhesions 2721

Patricia L. Sertich

285 Failure to dilate 2724

Ahmed Tibary

Section (n) The mammary gland

286 Pre-foaling mammary secretions 2733

William B. Ley

287 Mastitis 2738

Erica K. Gee and Patrick M. McCue

288 Mammary neoplasia 2742

Jack R. Snyder and Omar Maher

Section (o) Specific diagnostic and management techniques

289 Preventative medicine for broodmare farms 2747

John B. Chopin

Section (p) Nutrition

290 Dietary support for geriatric broodmares and stallions 2755

Sarah L. Ralston

291 Nutrition for the broodmare 2760

Laurie M. Lawrence

Section (q) Behavior

292 Stereotypic behavior 2771

Paul McGreevy

Section (r) General interest

293 Reproductive efficiency 2779

Laura C. Nath

294 Pituitary pars intermedia dysfunction (Equine Cushing's syndrome) 2790

Philip J. Johnson, Nat T. Messer and Venkataseshu K. Ganjam

295 Epidemiology applied to horse reproduction 2796

Nigel R. Perkins

296 Management of the geriatric mare 2803

Scott Madill

297 Parentage testing 2820

Ernest Bailey

298 Relevance of genomics to equine reproduction 2827

Ernest Bailey

Section (s) Other equids

299 Donkey reproduction 2835

Robyn R. Wilborn and David G. Pugh

300 Miniature pony reproduction 2839

Paul J. De Vries and Dale L. Paccamonti

301 Asian wild horse reproduction: *Equus ferus przewalskii* 2846

C. Wynne Collins, Lee E. Boyd and Katherine A. Houpt

302 Zebra reproduction 2851

Cassandra M.V. Nuñez, Cheryl S. Asa and Daniel I. Rubenstein

Part IV: Assisted Reproductive Technologies (ART)

Section (a) Embryos

303 Embryo transfer 2871

David L. Hartman

304 Cooled transported embryo technology 2880

Patrick M. McCue Catherine A. DeLuca and Jillian J. Wall

305 Freezing of embryos 2887

Jean-François Bruyas

306 Import and export of embryos 2921

Erin C. Bishop

307 Nuclear Transfer 2924

Katrin Hinrichs

Section (b) Oocytes

308 Immature oocyte collection and maturation 2931
Katrin Hinrichs

309 Mature oocyte collection 2936
Elaine M. Carnevale

310 Oocyte transfer 2941
Elaine M. Carnevale

311 Gamete intrafallopian transfer (GIFT) 2945
Marco A. Coutinho da Silva

312 Intracytoplasmic sperm injection (ICSI) 2948
Young-Ho Choi and Katrin Hinrichs

313 Oocyte cryopreservation 2953
Lisa J. Maclellan

Section (c) Semen

314 Principles of cryopreservation 2959
James K. Graham

315 Semen extenders for frozen semen 2964
Harald Sieme

316 Freezing semen 2972
Harald Sieme

317 Freezing epididymal spermatozoa 2983
Jason E. Breummer

318 Breeding with frozen semen 2987
Sandro Barbacini

319 Techniques for evaluating frozen semen 2994
Ben Colenbrander and Tom A.E. Stout

320 Storage management and distribution of frozen semen 3005
Paul R. Loomis

321 Diseases potentially transmitted with frozen or cooled semen 3015
Peter J. Timoney

322 Import and export of frozen semen 3029
Elizabeth S. Metcalf

323 Low dose insemination 3036
Lee H.A. Morris and Sara K. Lyle

324 Sex-sorted spermatozoa 3042
Lee H.A. Morris

Section (d) Future technologies

325 Future reproductive technology 3051
George E. Seidel Jr

Index 3057.