

Contents

Acknowledgements

xvii

1 Education and Training for the Personal Licence Holder	1
Introduction	1
Framework for Education and Training of Licence Holders	2
Core modules	4
Prerequisite and additional modules	4
Education and training in the UK	4
Aims of Accredited Training	4
Continuing Professional Development and Reflective Practice	5
Summary	5
References	6
2 Ethical Considerations around using Animals in Research	7
History of the Use of Animals in Research	7
The Ethics of Using Animals in Experiments	9
The Local Ethical Review Process	12
Measuring harms and benefits	12
The Principles of the Three RS	13
Replacement	13
Reduction	14
Refinement	15
Prospective, ongoing and retrospective review: reflective practice and the refinement loop	15
Public Perceptions	17
Transparency and freedom of information	18
References	18
3 The Regulatory Framework	21
Introduction to Legislation Regulating the Use of Animals in Research	21
European legislation	22
The Animals (Scientific Procedures) Act 1986	22

Protected animals	23
Regulated procedures	23
Exemptions	24
Licensing of places	24
The personal licence	25
Project licences	28
The Section 2C licence	30
Additional controls	32
Administration of the Act	33
Assessment of licences and inspection of premises	33
Offences and infringements	33
Communication	34
Statistics of Animal Usage	34
Other Relevant Legislation	34
References	36
4 Balancing Animal Welfare with Science	37
Welfare versus Science?	37
What is Welfare?	37
Quality of life	38
Why assess welfare?	39
Who should assess welfare?	40
How to assess welfare	40
Development of welfare assessment systems	44
Consideration of cumulative suffering	46
References	48
5 Animal Husbandry, Environmental Enrichment and Occupational Health and Safety	51
Animal Husbandry	51
Types of housing	52
Bedding and nesting materials	54
Nutrition	54
Environment	55
Handling techniques	56
Environmental Enrichment	56
Evaluation of enrichment and other refinements to housing and care	58
Evaluating the effect of a potential refinement on animals	58
Evaluating the effect of a potential refinement on science	61
Evaluating the effect of a potential refinement on animal house management	62
Supply and Transport	63
Aspects of Health, Safety and Security Affecting Animal Care	64
COSHH, CLP and REACH	65
Genetically modified organisms	66
Health and safety in animal facilities	67
Miscellaneous health and safety hazards and risks	71
Acknowledgements	74
References and Further Reading	74

6 Principles of Animal Use and Experimental Design	77
Principles of Experimental Design	77
Minimising variation	78
Selection of animals: species, strain, genetically altered animals	79
Genetic and Welfare Monitoring of GA and HM Animals	81
Background health status	82
Sources of infection	83
Health monitoring	84
Biosecurity and containment for rodents	86
References	87
7 Handling and Techniques	89
Prior Considerations	89
Training and competence of operator	89
Acclimatisation	90
Training of animals	90
Restraint of animals	90
Equipment	91
Administration of Substances	91
ADME	91
Administration volumes	93
Administration techniques	93
Legal considerations	103
Removal of Blood	104
Quality of samples	104
Technique for venipuncture	105
Methods of venipuncture in different species	108
Placement and Maintenance of Indwelling Cannulae	111
Withdrawal of blood	112
Long-term cannulation	112
Removal of cannulae	112
Potential sequelae	112
Arterial Sampling and Arterial Loops	113
Needle puncture	113
Arterial cannulae	113
Arterial loops	113
Miscellaneous Procedures	113
Creation and maintenance of fistulae	113
Administration techniques	114
Sampling	115
Antibody production	116
Equipment for Blood Collection and Administration of Substances	119
Over-the-needle cannulae	119
Evacuated blood-collection tubes	119
Butterfly needles	120
Tourniquets	120
Vasodilating agents	120
References	120

8 Humane Methods of Killing	123
Ethical Considerations in Killing Animals	123
Legal constraints	123
When to kill an animal	123
Preparation for humane killing	125
Methods of Euthanasia	127
Chemical methods of euthanasia	127
Physical methods of euthanasia	130
Other methods of euthanasia	131
Schedule 1 methods	132
References	133
 9 Anaesthesia and Analgesia	 137
Introduction	137
Pre-Anaesthetic Care and Evaluation	138
Acclimatisation	138
Training	138
Fasting	138
Handling	139
Health status	139
Local anaesthetics	139
Premedication	139
General Anaesthesia	142
General principles	142
Balanced anaesthesia	142
Administration of anaesthetics	143
Inhalation anaesthesia	144
Injectable anaesthesia	151
Long-term and non-recovery anaesthesia	164
Recovery and post-anaesthetic care	165
Local anaesthetics	166
Anaesthetic Management	167
Physiological stability	167
Depth of anaesthesia	170
Equipment monitoring	171
Anaesthetic Emergencies	171
Muscle Relaxation During Anaesthesia	172
Monitoring anaesthesia under neuromuscular blocking agents	173
Neuromuscular blocking agents	173
References	174
 10 Introduction to Surgery and Surgical Techniques	 177
Pre-Surgical Preparation	177
Animal	177
Instruments and equipment	178
Facilities	178
Personnel	178
Principles of Aseptic Technique	179

Atmosphere	180
Surgical team	180
Instruments	181
Methods of sterilisation	181
Preparation of the animal	183
Summary of Lasa Guidelines on Rodent Surgery	184
Conduct of Surgical Procedures	184
Inflammation and wound healing	184
Types of healing	185
Factors affecting healing	186
Performance of surgical procedures	187
Surgical Instruments	189
Skin incision	190
Dissection	191
Haemostasis	191
Wound closure	193
Other instruments	193
Suturing Techniques and Materials	195
Suture needles	196
Suture placement	197
Surgical knots	197
Suture patterns	198
Suture materials	201
Sizes of suture	206
Packaging	206
Summary	207
References	207
11 Small Laboratory Animals	209
Rodents	209
Dentition	209
Nutrition and digestion	210
Water	210
Behaviour	211
Senses and communication	211
Housing	211
Environment	211
Anaesthesia	212
Mouse	212
Behaviour	212
Communication	213
Feeding	214
Environment	215
Breeding	215
Growth	215
Handling	216
Pain and stress recognition	217
Common diseases and health monitoring	218
Biological data and useful reference data	218

Rat	218
Behaviour	219
Housing	219
Feeding	220
Water	220
Environment	220
Breeding	220
Growth and development	221
Handling	221
Pain and stress recognition	222
Common diseases and health monitoring	223
Biological data and useful reference data	223
Hamster	223
Behaviour	224
Housing	224
Feeding	225
Water	225
Environment	226
Breeding	226
Handling	227
Pain and stress recognition	227
Common diseases and health monitoring	227
Biological data and useful reference data	227
Gerbil	227
Behaviour	228
Housing	229
Feeding	229
Water	230
Environment	230
Breeding	230
Handling	230
Pain and stress recognition	231
Common diseases and health monitoring	231
Biological data and useful reference data	231
Guinea Pig	232
Behaviour	232
Housing	233
Feeding and water	233
Environment	234
Breeding	234
Growth	234
Handling	235
Recognition of pain and stress	235
Common diseases and health monitoring	235
Anaesthesia	236
Biological data and useful reference data	236
Rabbit	237
Behaviour	237
Housing	238
Feeding	239
Water	240

Environment	240
Breeding	241
Growth	241
Handling	242
Pain and stress recognition	242
Common diseases and health monitoring	243
Biological data and useful reference data	243
Anaesthesia in the rabbit	243
References	244
12 Carnivores	247
Dog	247
Behaviour	248
Housing	249
Feeding	249
Water	250
Environment	250
Breeding	250
Growth	251
Handling	251
Pain and stress recognition	251
Common diseases and health monitoring	253
Biological data and useful reference data	253
Anaesthesia	254
Ferret	254
Behaviour	255
Housing	255
Feeding	256
Water	257
Environment	257
Breeding	257
Growth	258
Handling	258
Pain and stress recognition	259
Common diseases and health monitoring	259
Biological data and useful reference data	260
Anaesthesia	260
References	261
13 Primates	263
Use of Primates in Research	263
New World Monkeys	263
Marmoset	264
Old World Monkeys	266
Sources, supply and transportation	266
Breeding	268
Housing	269
Feeding/watering	271

Health Monitoring, Quarantine and Common Diseases	272
Health-screening programme	273
Laboratory Procedures	274
Handling and restraint	274
Training	275
Administration of substances, blood sampling	276
Telemetry	277
Anaesthesia, analgesia and post-operative care	277
Husbandry post-surgery	277
Welfare	278
Natural behaviour	278
Assessment of welfare	279
Euthanasia	281
Record keeping	281
References	281
14 Production (Farm) Animals	287
C. J. Trower	
Poultry	287
Biology	288
Domestic Chicken	289
Behaviour	289
Housing	289
Feeding	290
Water	290
Environment	291
Breeding	291
Handling	292
Techniques	292
Pain and stress recognition	294
Common diseases and health monitoring	294
Biological data and useful reference data	295
Anaesthesia of chickens	296
Ruminants	296
Sheep	297
Behaviour	298
Housing	298
Feeding	299
Water	300
Environment	300
Breeding	300
Handling	301
Pain and stress recognition	302
Common diseases and health monitoring	302
Anaesthesia and surgery	304
Useful data	304
Goats	305
Behaviour	306

Housing	306
Feeding	306
Water	307
Environment	307
Breeding	307
Handling	307
Pain and stress recognition	307
Common diseases and health monitoring	308
Anaesthesia and analgesia	308
Cattle	308
Behaviour	308
Housing	309
Feeding	309
Environment	310
Breeding	310
Handling	310
Pain and stress recognition	311
Common diseases and health monitoring	311
Anaesthesia	312
Useful data	312
Pigs	312
Supply	313
Behaviour	313
Housing	313
Feeding	314
Water	315
Environment	316
Breeding	316
Growth	317
Handling	317
Pain and stress recognition	318
Common diseases and health monitoring	318
Techniques	319
Anaesthesia	319
Useful data	321
References and Further Reading	321
References	321
Further reading	321
15 Wild Animals	323
General Considerations	323
Legislation and Guidance	323
Considerations under the UK Animals (Scientific Procedures) Act 1986	324
Project Planning	325
Catching and Trapping	325
Handling Wild Animals	326
Anaesthesia of Wild Animals	326

General considerations	326
Inhalational anaesthesia	329
Injectable anaesthesia	330
Identification of Wild Animals	333
Release of Animals Back to the Wild	334
References	335
16 Aquatic Species	337
Introduction	337
Fish	337
Sources of fish	338
General biology	338
Biological data	338
Husbandry	338
Water quality	340
Feeding	340
Handling and Techniques	340
Identification	341
Anaesthesia	342
Administration of compounds	342
Collection of samples	343
Surgery	344
Post-operative care and analgesia	344
Health and disease	345
Recognition of pain and distress	345
Euthanasia	346
Zebrafish	346
Sources of fish	346
Behaviour	347
Husbandry	347
Feeding	347
Breeding	348
Health and disease	349
Rainbow Trout	349
Feeding	349
Breeding	349
Health and disease	350
Amphibians	350
Biology and behaviour	351
Identification	352
Husbandry	352
Feeding	353
Breeding	354
Handling	355
Anaesthesia	355
Techniques	356
Surgery	356
Health and disease	356

Euthanasia
References

357
357

Glossary

359

Index

Acknowledgements 363

Thanks are due to Ann Lynch, David and Mary, and MCD for their support and
planning for chapters 7, 10 and