

1 **A. Species-specific provisions for rodents**

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3 **1. Introduction**

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5 Mice

6 The mouse used for research purposes is derived from the wild house mouse,
7 (*Mus musculus*) a largely nocturnal burrowing and climbing animal which
8 builds nests for regulation of the microenvironment, shelter and reproduction.

9 Mice are good climbers. Mice do not readily cross open spaces, preferring to
10 remain close to walls or other structures. A wide range of social organisations
11 have been observed depending on population density and intense territoriality
12 may be seen in reproductively active males. Pregnant and lactating females
13 may prove aggressive in nest defence. As mice, particularly albino strains,
14 have poor sight they rely heavily on their sense of smell and create patterns of
15 urine markings in their environment. Mice also have very acute hearing and
16 are sensitive to ultrasound. There are considerable differences in the
17 expression and intensity of behaviour depending on the strain.

18

19 Rats

20 The rat used for research purposes is derived from the wild brown rat (*Rattus*
21 *norvegicus*) and is a highly social animal. Rats avoid open spaces, and use
22 urine to mark territory. Their sense of smell and hearing are highly developed,
23 and rats are particularly sensitive to ultrasound. Daylight vision is poor, but
24 dim-light vision is effective in some pigmented strains. Albino rats avoid areas
25 with light levels over 25 lux. Activity is greater during hours of darkness.

26 Young animals are very exploratory and often engage in social play.

27

28 Gerbils

29 The gerbil or Mongolian jird (*Meriones sp.*) is a social animal and is largely
30 nocturnal, although in the research facility it is also active during daylight. In
31 the wild, gerbils build burrows with tunnel entrances as a protection against
32 predators, and therefore in captivity often develop stereotypic digging
33 behaviour unless provided with adequate facilities.

34

35 Hamsters

36 The wild ancestors (*Mesocricetus sp.*) of the hamster are largely solitary. The
37 female hamster is larger and more aggressive than the male and can inflict
38 serious injury on her mate. Hamsters often make a latrine area within the
39 enclosure, mark areas with secretions from a flank gland, and females
40 frequently selectively reduce the size of their own litter by cannibalism.

41

42 Guinea Pigs

43 Wild guinea pigs (*Cavia porcellus*) are social, cursorial rodents which do not
44 burrow, but live under cover and may use burrows made by other animals.
45 Adult males may be aggressive to each other, but generally aggression is
46 rare. Guinea pigs tend to freeze at unexpected sounds and may stampede as
47 a group in response to sudden unexpected movements. Guinea pigs are
48 extremely sensitive to being moved and may freeze as a result for thirty
49 minutes or more.

50

51 **2. The environment and its control**

52

53 2.1. Ventilation

54 (See paragraph 2.1. of the General section)

55

56 2.2. Temperature

57 Rodents should be maintained within a room temperature range of 20°C to
58 24°C. Local temperatures among groups of rodents in solid-floored
59 enclosures will often be higher than room temperatures. Even with adequate
60 ventilation the enclosure temperatures may be up to 6°C above room
61 temperature. Nesting material/nest boxes give animals the opportunity to
62 control their own microclimate. Special attention should be paid to the
63 temperature in containment systems as well as to that provided for hairless
64 animals.

65

66 2.3. Humidity

67 The relative humidity in rodent facilities should be kept at 45 to 65%. Excepted
68 from this principle are gerbils, which should be kept at a relative humidity of 35

69 to 55%. Gerbils are susceptible to high relative humidities, which can
70 predispose them to skin conditions such as facial dermatitis and greasy coats.
71 Humidity levels of below 50% should prevent these problems. In animal units
72 in which humidity levels are maintained at 55+/-15%, lower humidities within
73 the gerbil cages can be promoted by adequate provision of dry, absorbent
74 bedding material.

75

76 2.4. Lighting

77 Light levels within the enclosure should be low. All racks should have shaded
78 tops to reduce the risk of retinal degeneration. This is of particular importance
79 for albino animals.

80

81 A period of red light at frequencies undetectable to the rodents can be useful
82 during the dark period so that staff can monitor the rodents in their active
83 phase.

84

85 2.5. Noise

86 As rodents are very sensitive to ultrasound, and use it for communication, it is
87 important that this extraneous noise is minimised. Ultrasonic noise (over 20
88 kHz) produced by many common laboratory fittings, including dripping taps,
89 trolley wheels and computer monitors, can cause abnormal behaviour and
90 breeding cycles. It may be advisable to monitor the acoustic environment over
91 a broad range of frequencies and over extended time periods.

92

93 2.6. Alarm systems

94 (See paragraph 2.6. of the General section)

95

96 **3. Health**

97 (See paragraphs 4.1. and 4.4. of the General section)

98

99 **4. Housing, enrichment and care**

100

101 4.1. Housing

102 Gregarious species should be group-housed as long as the groups are stable
103 and harmonious. Such groups can be achieved, although it is difficult, when
104 housing male mice, adult hamsters or gerbils, as this can result in severe
105 conspecific aggression.

106

107 Animals may be housed individually if adverse effects or injury are likely to
108 occur. Disruption of established stable and harmonious groups should be
109 minimised, as this can be very stressful to the animals.

110

111 4.2. Enrichment

112 The enclosures and their enrichment should allow the animals to manifest
113 normal behaviours and to enable conspecifics to reduce competitive situations
114 adequately.

115

116 Bedding and nesting material, and refuges are very important resources for
117 rodents in breeding, stock or under procedure and should be provided unless
118 there is a justification on veterinary or welfare grounds against doing so.

119 Nesting materials should allow the rodents to manipulate the material and
120 construct a nest. Nest boxes should be provided if insufficient nesting material
121 is provided for the animals to build a complete, covered nest. Bedding
122 materials should absorb urine and may be used by the rodents to lay down
123 urine marks. Nesting material is important for rats, mice, hamsters and gerbils
124 as it enables them to create appropriate microenvironments for resting and
125 breeding. Nest boxes or other refuges are important for guinea pigs, hamsters
126 and rats.

127

128 Guinea pigs should always be provided with manipulable materials such as
129 hay for chewing and concealment.

130

131 Wood sticks for chewing and gnawing may be considered for enrichment for
132 all rodent species.

133

134 Many rodent species attempt to divide up their own enclosures into areas for
135 feeding, resting, urination and food storage. These divisions may be based on

136 odour marks rather than physical division but partial barriers may be beneficial
137 to allow the animals to initiate or avoid contact with other group members. To
138 increase environmental complexity the addition of some form of enclosure
139 enrichment is strongly recommended. Tubes, boxes and climbing racks are
140 examples of devices which have been used successfully for rodents, and
141 these can have the added benefit of increasing utilisable floor area.

142

143 Gerbils need comparatively more space than other rodent species in order to
144 allow them to build and/or use burrows of sufficient size. Gerbils require either
145 a deep layer of litter for digging and nesting or a burrow substitute; (this latter
146 would need to be at least 20 cm long).

147

148 Consideration should be given to the use of translucent or tinted enclosures
149 and inserts which permit good observation of the animals without disturbing
150 them.

151

152 The same principles regarding quality and quantity of space, environmental
153 enrichment and other considerations in this document should apply to
154 containment systems such as individually ventilated cages (IVCs), although
155 the design of the system may mean that these may have to be approached
156 differently.

157

158 4.3. Enclosures – dimensions and flooring

159 The enclosures should be made of easy-to-clean materials and their design
160 should allow proper inspection of the animals without causing disturbance to
161 them.

162

163 Once young animals become active they require proportionally more space
164 than adults do.

165

166 4.3.1. Dimensions

167 In this and subsequent tables for all rodent recommendations “enclosure
168 height” means the vertical distance between the enclosure floor and the top of

169 the enclosure, and this height should apply over more than 50% of the
170 minimum enclosure floor area prior to the addition of enrichment devices.

171

172 When designing procedures, consideration should be given to the potential
173 growth of the animals to ensure adequate space is provided (as detailed in
174 **Tables A.1. to A.5)** for the duration of the study.

175

176 **Table A.1. Mice: Minimum enclosure dimensions and space allowances**

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	Body weight (g)	Minimum enclosure size (cm ²)	Floor area per animal (cm ²)	Minimum enclosure height (cm)
In stock and during procedures	up to 20	330	60	12
	over 20 to 25	330	70	12
	over 25 to 30	330	80	12
	over 30	330	100	12
Breeding		330 For a monogamous pair (outbred/inbred) or a trio (inbred). For each additional female plus litter 180 cm ² should be added.		12
Stock at breeders* Enclosure size 950 cm ²	less than 20	950	40	12
Enclosure size 1500cm ²	less than 20	1500	30	12

178

179 * Post-weaned mice may be kept at these higher stocking densities, for the short
180 period after weaning until issue, provided that the animals are housed in larger
181 enclosures with adequate enrichment. These housing conditions should not cause
182 any welfare deficit such as: increased levels of aggression, morbidity or mortality,
183 stereotypies and other behavioural deficits, weight loss, or other physiological or
184 behavioural stress responses.

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192**Table A.2. Rats: Minimum enclosure dimensions and space allowances**

	Body weight (g)	Minimum enclosure size (cm ²)	Floor area per animal (cm ²)	Minimum enclosure height (cm)
In stock and during procedures*	Up to 200	800	200	
	Over 200 to 300	800	250	
	Over 300 to 400	800	350	
	Over 400 to 600	800	450	
	Over 600	1 500	600	
Breeding		800 Mother and litter. For each additional adult animal permanently added to the enclosure add 400 cm ²		
Stock at breeders** Enclosure size 1500 cm ²	Up to 50	1500	100	
	Over 50 to 100	1500	125	
	Over 100 to 150	1500	150	
	Over 150 to 200	1500	175	
Stock at breeders** Enclosure size 2500 cm ²	up to 100	2500	100	
	over 100 to 150	2500	125	
	over 150 to 200	2500	150	

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* In lifetime studies, animals should be provided with enclosures of a suitable size to enable the animals to be socially housed. As stocking densities towards the end of such studies may be difficult to predict, consequentially there may exceptionally be occasions where space allowances per individual animal may fall below those indicated above. In such circumstances priority should be given to maintaining stable social structures.

** Post-weaned rats may be kept at these stocking densities, for the short period after weaning until issue, provided that the animals are housed in larger enclosures with adequate enrichment. These housing conditions should not cause any welfare deficit such as: increased levels of aggression, morbidity or mortality, stereotypies and other behavioural deficits, weight loss, or other physiological or behavioural stress responses.

208 **Table A.3. Gerbils: Minimum enclosure dimensions and space**
 209 **allowances**

	Body weight (g)	Minimum enclosure size (cm ²)	Floor area per animal (cm ²)	Minimum enclosure height (cm)
In stock and during procedures	Up to 40 Over 40	1200 1200	150 250	
Breeding		1200 Monogamous pair or trio with offspring		

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211 **Table A.4. Hamsters: Minimum enclosure dimensions and space**
 212 **allowances**

	Body weight (g)	Minimum enclosure size (cm ²)	Floor area per animal (cm ²)	Minimum enclosure height (cm)
In stock and during procedures	up to 60 over 60 to 100 over 100	800 800 800	150 200 250	
Breeding		800 Mother or monogamous pair with litter		
Stock at breeders*	less than 60	1500	100	

213

214 * Post-weaned hamsters may be kept at these stocking densities, for the short period
 215 after weaning until issue, provided that the animals are housed in larger enclosures
 216 with adequate enrichment. These housing conditions should not cause any welfare
 217 deficit such as: increased levels of aggression, morbidity or mortality, stereotypies
 218 and other behavioural deficits, weight loss, or other physiological or behavioural
 219 stress responses.

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228 **Table A.5. Guinea-pigs: Minimum enclosure dimensions and space**
 229 **allowances**

	Body weight (g)	Minimum enclosure size (cm ²)	Floor area per animal (cm ²)	Minimum enclosure height (cm)
In stock and during procedures	up to 200	1800	200	23
	over 200 to 300	1800	350	23
	over 300 to 450	1800	500	23
	over 450 to 700	2500	700	23
	over 700	2500	900	23
Breeding		2500 Pair with litter. For each additional breeding female add 1000 cm ²		23

230

231 4.3.2. Flooring

232 Solid floors with bedding or perforated floors are preferable to grid or wire
 233 mesh floors. If grids or wire mesh are used, a solid or bedded area or, as an
 234 alternative in the case of guinea pigs, a slatted area, should be provided for
 235 the animals to rest on unless specific experimental conditions prevent this.
 236 Bedding may be withheld as part of time-mating practices.

237

238 As mesh floors can lead to serious injuries, the floors should be closely
 239 inspected and maintained to ensure that there are no loose or sharp
 240 projections. During late pregnancy, parturition and lactation, breeding females
 241 should only be kept on solid floors with bedding.

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243 4.4. Feeding

244 (See paragraph 4.6. of the General section)

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246 4.5. Watering

247 (See paragraph 4.7. of the General section)

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249 4.6. Substrate, litter, bedding and nesting material

250 (See paragraph 4.8. of the General section)

251

252 4.7. Cleaning

253 Although high hygiene standards should be maintained, it may be advisable to
254 maintain some odour cues left by animals. Too frequent changing of
255 enclosures should be avoided, particularly where pregnant animals and
256 females with litters are concerned, as such disturbances can result in mis-
257 mothering or cannibalism.

258

259 Decisions on frequency of cleaning should therefore be based on the type of
260 the enclosure, type of animal, stocking densities, and the ability of ventilation
261 systems to maintain suitable air quality.

262

263 4.8. Handling

264 When handling, care needs to be taken to minimise disturbance of the
265 animals or their enclosure environment. This is of particular importance with
266 hamsters.

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268 4.9. Humane killing

269 (See paragraph 4.11. of the General section)

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271 4.10. Records

272 (See paragraph 4.12. of the General section)

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274 4.11. Identification

275 (See paragraph 4.13. of the General section)