**Chapter 10: Laboratory animal breeding**

**Authors:** Anuradha Panwar1, Chhaya Rani1, Harshit Kumar2

**Affiliation**: 1ICAR-Indian Veterinary Research Institute, Izzatnagar, Bareilly

 2 ICAR-National Research Centre on Mithun, Nagaland

**Some important terms**

**Laboratory animal**

Any non human member of the animal kingdom which is kept in captivity for experimental or observational purposes.

**Specific pathogen free animals**

Laboratory animals that are free from a defined list of pathogens. SPF animals ensure that specific diseases do not interfere with an experiment at any stage of experimentation. Obtained by caesarean or the use of embryo transfer methods.

**Gnotobiotic animals**

An animal in which certain known strains of bacteria and other micro-organisms are present.

**Knock out animals**

They are genetically modified animals in which researchers inactivate or knock out, an existing gene by replacing it or disrupting it with an artificial piece of DNA.

**Transgenic animals**

These are the animals that have a foreign gene deliberately inserted into their genome.

**The Bruce effect**

When a recently impregnated female mouse encounters a normal male mouse other than the one with which she mated, the pregnancy is likely to fail. This effect, too, is caused by a substance secreted in the urine of intact males, but not of male that have been castrated.

**The Whitten effect**

The Whitten effect refers to a phenomenon observed in laboratory mice where the presence of male mice's urine or their pheromones can synchronize the estrus (reproductive) cycles of female mice who are housed together. This synchronization leads to a phenomenon where female mice living in proximity to males or their scent tend to have their estrus cycles align, often resulting in simultaneous mating or fertility.

**The Lee-Boot effect**

Female mice housed together in groups of four or more tend to become pseudopregnant that is, although they are virgins, they develop long loved progesterone secreting corpora lutea as if they were pregnant.

**Table 1: Common laboratory animals, their scientific name and chromosome number**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No.** | **Name of laboratory animal** | **Scientific name** | **Chromosome Number (2N)** |
|  | Mouse | *Mus musculus* | 40 |
|  | Rat | *Rattus norvegicus* | 42 |
|  | Hamster | Syrian/Golden Hamster | *Mesocricetus auratus* | 44 |
| Chinese Hamster | *Cricetulus griseus* | 22 |
| European Hamster | *Cricetulus cricetulus* | 22 |
|  | Gerbils | *Meriones unguiculatus* | 44 |
|  | Guinea pig/Cavy | *Cavia porcellus* | 64 |
|  | Rabbit | *Oryctolagus cuniculus* | 44 |
|  | Non-human primates | Rhesus monkey | *Macaca mullata* | 42 |
| Bonnet monkey | *Macaca radiata* | 42 |
| Cynomolgus monkey | *Macaca fasicularis* | 42 |
| Baboon | *Pan troglodytes* | 42 |
|  | Dog | *Canis familiaris* | 78 |

**Table 2: Few important parameters in different laboratory animals**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Animals** | **Chromosome number** | **Birth weight** | **Adult body weight** | **Body Temperature**  | **Age of puberty** | **Breeding age** | **Pregnancy period** | **Litter size** | **Weaning age** | **Environmental requirements** |
| **Temperature** | **Ventilation** | **Relative humidity** |
| **Mouse** | 40 | 1.5 gram | 20-25 gm | 36.5-38 °C | 5 weeks | 7-8 weeks | 19-21 days | 11 | 21-28 days | 22-25 °C | 8-12 changes/hour | 50-60 % |
| **Rat** | 42 | 5-6 gram | 250-350 gm | 37-38 °C | 6-8 weeks | 10-12 weeks | 21-23 days | 8-12 | 21 days | 22-25 °C | 12-15 changes/hour | 50-60 % |
| **Hamster** | 44 | 2-3 gram | 90-120 gm | 37-38 °C | 6-8 weeks | 6-8 weeks | 15-17 days | 6-8 | 20-22 days | 20-25 °C | 12-15 changes/hour | 50-60 % |
| **Gerbils** | 44 | 2.5 gram | 80-110 gm | 38 °C | 8-10 weeks | 9-12 weeks | 25-26 days | 4-6 | 20-30 days | 20-24 °C | 15 changes/hour | 35-45 % |
| **Guinea pig** | 64 | 90 gram | 900-1000 gm | 38-40 °C | 4-6 weeks | 9-10 weeks | 68-72 days | 1-6 | 15-28 days | 20-24 °C | 8-10 changes/hour | 50-60 % |
| **Rabbit** | 44 | 60gram | 2-5 kg | 38.5-39.5 °C | 16 weeks | 20-36 weeks | 30 days | 5-6 | 38-56 days | 16-22 °C | 12 changes/hour | 50-60 % |
| **Non-human primate** | 42 |  | 4-9 kg | 36-40 °C | 3-4 years | 3-4 years | 160 days | 1 | 6-12 months | 20-28 °C | 9-10 changes/hour | 50-60 % |
| **Dog** | 78 | 170-400 gram | 10-80 kg | 38-39 °C | 7-8 months | 12-14 months | 63-67 days | 3-6 | 3-8 weeks | 15-21 °C | 15-20 changes/hour | 40-60 % |

**Table 3: Some important uses of laboratory animals**

|  |  |  |
| --- | --- | --- |
| **S.No.** | **Animal** | **Uses** |
| **1.** | Mouse | Drug screening, Safety test, Cancer research, Vaccine production |
| **2.** | Rat | Medicine and toxicity research, Food, Behaviour studies |
| **3.** | Syrian hamsters | Reproduction and teratogenicity studies, Tumour and blood circulation research |
| **4.** | Chinese hamster | Karyotyping research, Model for Diabetes mellitus |
| **5.** | Gerbils | Environmental biosafety, Model animal for studying epilepsy, Cholesterol metabolism studies |
| **6.** | Guinea pig | Sera production, vaccine production, acute anaphylactic or chronic hypersensitivity reaction studies, Due to high susceptibility to infectious diseases used for Tuberculosis, Diphtheria, Leptospirosis, Brucellosis studies, Otiology experiment, Nutritional studies related to vitamin C, Folic acid, Thiamine, Arginine, and Calcium |
| **7.** | Rabbits | Toxicity tests, production of anti-sera, evaluation of biologically active product, eye and skin irritation test, artherosclerosis |
| **8.** | Non-human primates | Testing vaccines and medicines, Behavious research, AIDS, Malaria, Tuberculosis, Neurological degenerative diseases, reproductive studies and research on dental caries |
| **9.** | Dog | Toxicology or safety testing |

**Animal strains and their breeding systems**

**Inbred strains**

They are produced by 20 or more consecutive generation of brother and sister mating.

“In inbreeding the homozygosity increases from F1 generation onwards and becomes about 98.4% in F21 generation”.

**Sub-strains**

An inbred strain maybe designated as sub-strain after F20 generation of brother-sister mating.

**Examples:** C57BL/6J (6J is a sub-strain of C57BL), C3H/N (N is a sub-strain of C3H)

**Inbred (F1) hybrids**

Here, the F1 hybrids are developed from the crosses between two inbred strains.

**Examples:** D2B6F1 (DBA/2J mother **×** C57BL/6J father)

**Coisogenic (inbred) strains**

Mutants found among the individuals of the established inbred strain which differ from the original inbred strains by only one differentiating gene.

**Examples:** BALB/cj

**Cogenic strain**

They are produced by backcrossing of an inbred strain with selection for a particular marker from the donar strain. Strains are regarded as cogenic when a minimum of 10 backcross generations to a background strain have been made

**Examples**: B6 AKR-H2K

**Recombinant inbred strains**

Produced by crossing animals of two inbred strain followed by brother and sister mating of F1 animals for 20 or more consecutive generations

**Examples:** C**×**B strain (BALB/C**×**C57BL/6J)

**Out bred stock**

Produced by breeding of distantly related animals to minimize inbreeding and to increase the heterozygous and vigour

Denoted by breeder name, followed by colon (:) and then the name of outbred stock

**Examples:** Cdri:SD, where SD is Sprague Dawley

Strains of Rat

 Cdri:DR, where DR is Druckery

 Cdri:CF, where CF is Charles Foster

**Multiple choice questions**

(1) The diploid number of chromosomes in rhesus monkey is?

 a. 34

 b. **42**

 c. 24

 d. 48

(2) Which of the following lab animal is induced ovulator?

 a. *Cavia porcellus*

 b. *Mus musculus*

 c. ***Oryctolagus cuniculus***

 d. *Rattus novergicus*

(3) Which term describes the phenomenon where female mice housed together synchronize their estrous cycles?

 a. Lee-Boot effect

 b. **Whitten effect**

 c. Harem effect

 d. Estrus synchronization

(4) What is the term for the process of introducing a new breeding partner to a laboratory animal to maintain genetic diversity?

 a. Inbreeding

 b. **Outbreeding**

 c. Hybridization

 d. Mutation

(5) The Whitten effect is characterized by the synchronization of estrous cycles among female laboratory animals due to the presence of:

 a. Female pheromones

 b. **Male pheromones**

 c. Environmental cues

 d. Genetic mutations

(6) Which laboratory animal species is commonly used in toxicology studies due to its physiological similarities to humans?

 a. Zebrafish

 b. **Rats**

 c. Frogs

 d. Hamsters

(7) Who is credited with introducing the concept of the "replacement, refinement, and reduction" of animal use in scientific research?

 a. Louis Pasteur

 b. Charles Darwin

 c. Claude Bernard

 d. **William Russell and Rex Burch**

(8) The American Association for Laboratory Animal Science (AALAS) was formed in?

 a. **1950**

 b. 1932

 c. 1968

 d. 1998

(9) Who first described the Bruce effect in laboratory mice?

 a. Robert Bruce

 b. **Hilda Bruce**

 c. William Bruce

 d. James Bruce

(10) Which of the following types of genetic manipulations allow a researcher to experimentally increase gene expression in a mouse model?

 a. Knockout

 b. **Transgenic**

 c. Knockouts and knockins

 d. Knockin

(11) In which of the following models might paralogues mask the effect of a genetic manipulation?

 a. **Knockouts and knockins**
 b. Knockins only
 c. Knockouts
 d. All of the above

(12) Average life span for Guinea Pigs is?
 a. 3-4 years
 b. 4-5 Years
 c. **5-7 Years**
 d. 10-15 Years

 (13) The birth weight of laboratory rats is?

 a. 2 gm
 b. **5 gm**
 c. 10 gm
 d. 15 gm

 (14) Total number of Chromosome in laboratory Guinea pig is?
 a. 22
 b. 24
 C. 44
 d. **64**

 (15) Which of following is induced ovulator?
 a. **Rabbit**
 b. Hamster
 c. Gerbil
 d. Mice

(16) To certify SPF, the population is checked for the presence of?
 a. **Specific pathogens**
 b. Specific Hormone
 c. Specific gene
 d. Specific peptide

(17) Induced ovulators includes which of the following species?
 a. Rabbit
 b. Ferrets
 c. Mink
 d. Cat

 e. **All of the above**

 (18) Which term refers to the process to create congenic strains in laboratory animals?

 a. Crossbreeding

 b. Recombination

 c. Inbreeding

 d. **Backcrossing**

(19) Gestation period in rabbit is?
 a. 20-25 days
 b. **30-33 days**
 c. 60 days
 d. 70 days

(20) European hamster is?
 a. *Cricetulus griceus*
 b**. *Cricetus cricetus***
 c. *Mesocricetus airutus*
 d. None

(21) Most commonly used gas for euthanasia of lab animal is?
 a. H₂S
 b. CO
 c. NH3
 d. **CO₂**

(22) The coccidiosis in rabbit is caused by?
 a. *Coccidia tenella*
 b. *Eimeria coccidia*
 c. *Clostridium perfringens*
 d. ***Eimeria flavescens***

(23) Tularaemia in rabbit is due to?
 a. Virus
 b. **Bacteria**
 c. Tapeworm
 d. Nematode

(24) Life span of mice is of?
 a. **Upto 1 yr**

 b. 1.5-2 yr

 c. 2.5-3.5 yr

 d. 3.5-5 yr

(25) Which of the following is the nocturnal breeder?
 a. **Mice**
 b. Rabbit

 c. Guinea pig

 d. All

(26) Number of chromosome in mice and rat are?
 a. 42, 40

 b. **40, 42**

 c. 44, 46

 d. 46, 44

(27) Super foetation is noticed in?

 a. Mice

 b. **Rat**

 c. Guinea pig

 d. Dog

(28) For getting pregnancy in single batch following is used?

 a. Pseudo pregnancy
 b. Whitten effect

 c. Superfoetation

 d. **Bruce effect**

(29) Breeding age for rat is?
 a. **5-6 week**
 b. 7-8 week
 c. 8-10 week
 d. more than one

(30) Light intensity in lab animal house should not exceed
 a. 250 lux
 b. **350 lux**
 c. 550 lux
 d. 650 lux

(31) Swine fever vaccine is produce by using?

 a. **Guinea pig**

 b. Rabbit

 c. Mice

 d. Hamster

(32) Which hamster is having highest body weight?

 a. **Syrian**
 b. Chinese
 c. European
 d. Mongolian

(33) Gestation period of hamster is?
 a. 4 day
 b. **16 days**
 c. 30 days
 d. 70 days

(34) Which of the following is used for studying epilepsy and atherosclerosis?
 a. Hamster

 b. **Gerbil**

 c. Rat

 d. Mice

(35) Which of the following is not a breed of laboratory dog?
 a. Spaniel
 b. Mongrel

 c. Spaniel

 d. **Wistar**

(36) In social groups of monkey breeding male is called as?
 a. Beta monkey
 b. **Alpha monkey**

 c. Gamma Monkey

 d. Super monkey

(37) Rhesus monkey is?
 a. **Old world monkey**
 b. Baboon
 c. New world monkey
 d. Prosimians

(38) Which of the following animals does not have estrus cycles?
 a. Cat
 b. **Monkey**

 c. Cat

 d. Hamster

(39) Which type of social grouping is found in Rhesus monkey?
 a. Monogamous family
 b. Fission-Fusion society

 c. **Multimale-Multifemale**
 d. One male-Several females

(40) Positive and negative selection is mandatory for screening?
 a. Transgenic animal
 b. **Knock out animals**

 c. SPF animals

 d. All the above

(41) Caesarian section is mandatory for?
 a. Transgenic animal
 b. Knock out animals
 c. **SPF animals**

 d. Gnotobiotic animals

(42) Bioreactors are?
 a. **Transgenic animal**
 b. SPF animals
 c. Gnotobiotic animals
 d. Knock out animals

(43) Large offspring symptom is encountered in?
 a. **Transgenic animal**
 b. Knock out animals
 c. Gnotobiotic animals
 d. SPF animals

(44) Vaccine production with highest accuracy can be done using?
 a. **Transgenic animal**
 b. SPF animals
 c. Knock out animals
 d. Gnotobiotic animals

(45) Average length of estrus cycle in guinea pig is?
 a. **16 days**
 b. 12 days
 c. 21 days
 d. 30 days

(46) Average gestation period in guinea pig is?
 a. 60 days
 b. 30 days
 c. **68 days**
 d. 90 days

(47) Average litter size, in Syrian hamster is?
 a. **8**
 b. 3
 c. 4
 d. 10

(48) Life span of guinea pig is?
 a. 2-3year
 b. 3-4year
 c. **4-5year**
 d. 5-6year

(49) Guinea pig is a model for study of?
 a. Magnesium

 b**. Vitamin C**
 c. Vitamin D
 d. Vitamin E

(50) Lordosis posture is observed in rabbit during?
 a. Feeding
 b. **Mating**
 c. Resting
 d. Fearing

(51) The source of Vero cell line is?

a. **African Green Monkey (Kidney)**

 b. African Green Monkey (liver)

 c. Hamster (Kidney)

 d. Human (Lungs)

(52) Choose the laboratory animal most suitable for typing FMD virus

 a. **Guinea pig**

 b. Hamster

 c. Weaned mice

 d. Mice

(53) Genetically mutant mice lacking NK cells is called?

 a. Biege

 b. Athymic mice

 c. Nude

d. **All of above**

(54) Bruce effect in mice involve blockage of which hormone?

a. **Prolactin**

 b. Estrogen

 c. Progesterone

 d. LH

(55) The experimental animal used for FMD research is?

a. **Guinea pig**

 b. Rat

 c. Hamsters

 d. Mice

(56) For guinea pig the Vitamin C requirement in diet is?

a. **222 mg/kg DM**

 b. 100 mg/kg DM

 c. 450 mg/kg DM

 d. 45 mg/kg DM

(57) Vitamin C requirement for guinea pig diet?

a. **200 mg/kg feed**

 b. 320 mg/kg feed

 c. 110 mg/kg feed

 d. 700 mg/kg feed

(58) The diploid number of chromosomes are equal in

 a. Sheep and goat

 b. Cattle and goat

 c. Buffalo and sheep

d. **Man and rhesus monkey**

(59) By applying slight pressure in the genital space of guinea pig, a slit like appearance which slopes slightly towards the anus is an indicative of
 a. Male
 b. **Female**

 c. Hermaphrodite

 d. None

(60) For yellow coloration of laboratory animal dye used is
 a. **Picric acid**

 b. Malachite
 c. Trypan blue
 d. Fuchsine acid

(61) Of the total protein required by the rats and mice,.........% must be from animal origin.

 a. 3-5
 b. 5-10
 c. 10-15
 d. **25-30**

(62) Mice is used so often in experiments because
 a. All most all genes that human possess
 b. Relatively easy to change their genetic makeup
 c. Small generation Interval
 d. **All of the above**

(63) Which one is/are true for mice and rats
 a. Mice are having rod shaped droppings
 b. Rats are having spindle/capsule shaped droppings
 c. Mice are smaller than rats
 d. **All of the above**

(64) Which one is/are true for mice
 a. Whiskers are used to sense temperature changes
 b. Capable to produce ultrasound
 c. Can hear ultrasound up to 90 kHz
 d. **All of the above**

(65) Which one of them is a tailless rodent
 a. Rat
 b. Mice
 c. **Guinea pig**
 d. Rabbit

(66) 'Guinea' of guinea pig derives its name from the country
 a. **Guyana**

 b. Guinea

 c. Andes

 d. All of the above

(67) Adult male and female of guinea pig is commonly termed as
 a. Bull and Cow
 b. Buck and doe

 c. **Boar and Sow**

 d. None of the above

(68) Oldest guinea pig that put its name in the Guiness book of record last for
 a. 5 yrs

 b. 10 yrs
 c. **15 yrs**
 d. 20 yrs

(69) Which one is true about toes in Guinea pig
 a. 3 in fore feet and 4 in hind feet
 b. **4 in fore feet and 3 in hind feet**

 c. 3 in both fore feet and hind feet
 d. 4 in both fore feet and hind feet

(70) Noises produced by Guinea pig is/are?
 a. chirping
 b. Squealing

 c. rumbling
 d. **All of the above**

(71) Baby Guinea pigs is termed as
 a. Kit
 b. Piglet
 c. **Pup**
 d. Kid

(72) *Mariones unguiculatus* is the scientific name of
 a. Guinea pig
 b. **Gerbil**
 c. Rat
 d. None of the above

(73) Life span of Guinea pig is
 a. 2-3 years
 b. **5-7 years**
 c. 10-15 years
 d. 8-9 years

(74) Gestation period in Hamster is
 a. **15-16 days**
 b. 25-26 days
 c. 22-21 days

 d. 30-31 days

(75) Weaning age (days) in mice is
 a. 0

b. **21**

 c. 11

 d. 31

(76) Among the laboratory animals which one is used mostly?
 a. Rabbit

 b. Rat

c. **Mice**

 d. Guinea pig

(77) Weaning age in case of rabbit is.
 a. 12-17 days
 b. 15-16 days
 c. 20-21 days
 d. **42-47 days**

(78) The eyes of baby rabbit open at the age of
 a. 5-6 days
 b. **10-11 days**

 c. 15-16 days

 d. 20-21 days

(79) Normal gestation period (days) of rabbit is
 a. **30-32**

 b. 50-52

 c. 65-67

 d. 16-20

(80) Rabbits are:
 a. Fore gut digester
 b. Middle gut digester

c. **Hind gut digester**
 d. All of the above

(81) Cecum in rabbit is
 a. Smaller than stomach
 b. **Bigger than stomach**
 c. Equal-to stomach

 d. Not present

(82) Rabbit will start eating on their own at around
 a. **14 days**
 b. 3 days

 c. 7 days

 d. 21 days

(83) Average litter size in rabbit is
 a. 8-10
 b. 15-16

 c. 12-14

d. **5-6**

(84) Breeding of rabbit doe can be done after (days) of weaning
 a. Just after weaning

b. **7-10**
 c. 18-20
 d. 30-32

(85) Dressing percentage of rabbit meat is
 a. **62%**
 b. 42%
 c. 52%
 d. 32%

(86) Wistar and Sprague Dawley are the strains of
 a. Mice
 b. **Rat**
 c. Guinea pig
 d. Rabbit

(87) Space between anus and genital papilla is much greater in males than in females in
 a. Mice
 b. Rat
 c. Hamster
 **d. All of the above**

(88) Which one of the following is termed as “Desert rat”

 **a. Gerbil**

 b. Hamster

 c. Wistar rat

 d. Gunn rat

(89) SCID (Severe Combined Immuno Deficient) mice has which of the following?

 **a. Defective T and B receptors**

 b. Defective monocytes

 c. Calcium deficiency

 d. Vitamin D deficiency

(90) Strain is regarded as cogenic when a minimum.......... backcross generation to a background strain has been made counting the first hybrid or F1 generation as generation1.

 **a. 10**

 b. 20

 c. 14

 d. 25

(91) Sprague Dawley (SD) is the outbred strain of?

 **a. Rat**

 b. Mice

 c. Gerbil

 d. None

(92) Match the following

|  |  |
| --- | --- |
| a. Form B | 1. Record of animals bred/acquired |
| b. Form D | 2. Permission for animal experiment |
| c. Form C | 3. Record of animal acquired and experiment performed |

 Answers:

 a. **a-1, b-3, c-2**

 b. a-2, b-3, c-1

 c. a-2, b-1, c-3

 d. a-1, b-3, c-2

(93) Match the following

|  |  |
| --- | --- |
| a. Nude mice | 1. Used in toxicity research  |
| b. Rats | 2. Used for xenograft studies |
| c. Chinese Hamster | 3. Used for studying Artherosclerosis |
| d. Rabbits | 4. Used for studying Diabetes mellitus |

 Answers:

 a. a-1, b-3, c-2, d-4

 b. **a-2, b-1, c-4, d-3**

 c. a-2, b-1, c-3, d-1

 d. a-1, b-3, c-2, d-2

(94) Match the following

|  |  |
| --- | --- |
| a. SPF animals | 1. Defective thymic epithelial cell differentiation |
| b. Gnotobiotic animals | 2. Free from pathogens |
| c. Knock out mice | 3. Specific gene is turned off |
| d. Nude mice | 4. Certains known strains of bacteria or other microorganisms are present |

 Answers:

 a. a-1, b-3, c-2, d-4

 b. **a-2, b-4, c-3, d-1**

 c. a-2, b-1, c-3, d-1

 d. a-1, b-3, c-3, d-2

(95) Match the following

|  |  |
| --- | --- |
| a. Syrian hamster | 1. *Cricetulus cricetulus* |
| b. Chinese hamster | 2. *Cricetulus griseus* |
| c. European hamster | 3. *Mesocricetus auratus* |

 Answers:

 a. **a-3, b-2, c-2**

 b. a-3, b-1, c-2

 c. a-3, b-2, c-3

 d. a-1, b-3, c-2

(96) Match the following

|  |  |
| --- | --- |
| a. Mutant rat strain | 1. Fisher 344 (F 344) |
| b. Outbred rat strain | 2. Wistar |
| c. Inbred rat strain | 3. Bmrattleboro |
| d. Mice strain | 4. Holtzman |

 Answers:

 a. a-1, b-3, c-2, d-4

 b. **a-3, b-4, c-1, d-2**

 c. a-2, b-1, c-3, d-1

 d. a-1, b-3, c-2, d-2

(97) Match the following

|  |  |
| --- | --- |
| a. Weil’s disease | 1. *Oryctolagus cuniculus* |
| b. Dunkin Hartley | 2. *L. icterohaemorhagiae* |
| c. Gerbil | 3. Guinea pig |
| d. Induced ovulator | 4. Desert rat |

 Answers:

 a. a-1, b-3, c-2, d-4

 b. a-2, b-1, c-3, d-1

 c. **a-2, b-3, c-4, d-1**

 d. a-1, b-3, c-2, d-2

(98) Match the following

|  |  |
| --- | --- |
| a. Nude mice | 1. SCID |
| b. Tailless rodent | 2. Gerbil |
| c. Bioreactors | 3. Guinea pig |
| d. Desert rat | 4. Transgenic animals |

 Answers:

 a. a-1, b-3, c-2, d-4

 b. a-1, b-3, c-2, d-2

 c. a-2, b-1, c-3, d-1

 d. **a-1, b-3, c-4, d-2**

(99) Match the following

|  |  |
| --- | --- |
| a. Gerbils | 1. Teratogenicity studies |
| b. Syrian hamster | 2. Epilepsy |
| c. Chinese Hamster | 3. Eye and skin irritation test |
| d. Rabbits | 4. Diabetes mellitus |

 Answers:

 a. a-1, b-3, c-2, d-4

 b. **a-2, b-1, c-4, d-3**

 c. a-2, b-1, c-3, d-1

 d. a-1, b-3, c-2, d-2

(100) Match the following

|  |  |
| --- | --- |
| a. 1998 | 1. Prevention of Cruelty to Animals Act |
| b. 1964 | 2. Institutional Animal Ethics Committee |
| c. 2006 | 3. The breeding and Experiment on Animals (Control and Supervision) rules |
| d. 1960 | 4. The Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) |

 Answers:

 a. a-1, b-3, c-2, d-4

 b. **a-3, b-4, c-2, d-1**

c. a-2, b-1, c-3, d-1

 d. a-1, b-3, c-2, d-2

(101) Assertion: knockout mice, are helpful in determining the function of a gene

 Reason: The phenotype of the knockout mouse often gives a good indication of

 the function of the missing gene

 **(a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.**

(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

 (c) Assertion is true, but the reason is false.

 (d) Assertion is false.

(102) Assertion: SCID mice has defective T and B receptors

Reason:They are not capable of mounting either cell mediated or humoral immune response

**(a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.**

(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

 (c) Assertion is true, but the reason is false.

 (d) Assertion is false.

(103) Assertion: Outbred stock are produced by breeding of distantly related animals

Reason: Here, the inbreeding is increased and the heterozygosis is reduced

(a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.

(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

 **(c) Assertion is true, but the reason is false.**

 (d) Assertion is false.

(104) Assertion: Guinea pig are used for studying infectious diseases of animals like tuberculosis, leptospirosis, and brucellosis.

Reason: They are highly susceptible to these infectious diseases.

(a) **Both assertion and reason are true, and the reason is the correct explanation of the assertion.**

(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

 (c) Assertion is true, but the reason is false.

 (d) Assertion is false.

(105) Assertion: Guinea pig has been proved as a model for studying anaphylactic shock.

Reason: They are highly sensitive to histamine.

(a) **Both assertion and reason are true, and the reason is the correct explanation of the assertion.**

(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

 (c) Assertion is true, but the reason is false.

 (d) Assertion is false.

(106) Assertion: Albino rat is the most suitable animal for experimental work.

Reason: It has small size and is greatly sensitive to most drugs.

(a) **Both assertion and reason are true, and the reason is the correct explanation of the assertion.**

(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

 (c) Assertion is true, but the reason is false.

 (d) Assertion is false.

(107) Assertion: Latent infected animals are often referred to as carriers.

Reason: Show no clinical evidence of infection but periodically shed pathogen during the time of stress.

(a) **Both assertion and reason are true, and the reason is the correct explanation of the assertion.**

(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

 (c) Assertion is true, but the reason is false.

 (d) Assertion is false.

(108) Assertion: Guinea pig has been proved as a model for studying scurvy.

Reason: They are deficient in vitamin C.

(a) **Both assertion and reason are true, and the reason is the correct explanation of the assertion.**

(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

 (c) Assertion is true, but the reason is false.

 (d) Assertion is false.

(109) Assertion: The Bruce effect is physiological abortion induced in mice by the presence of a new male.

Reason: It is named for Hilda Bruce, who reported this phenomenon in 1959.

 (a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.

(b) **Both assertion and reason are true, but the reason is not the correct explanation of the assertion.**

 (c) Assertion is true, but the reason is false.

 (d) Assertion is false.

(110) Assertion: Inbred strains are produced by 20 or more consecutive generation of brother and sister mating.

Reason: Have increased homozygosity and reduced heterozygosity.

(a) **Both assertion and reason are true, and the reason is the correct explanation of the assertion.**

 (b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

 (c) Assertion is true, but the reason is false.

 (d) Assertion is false.

(111) What is the purpose of creating knock-out mice?

 a. To increase their lifespan

 b. **To study the effects of specific genes**

 c. To make them immune to infections

 d. To enhance their reproductive capabilities

(112) Which of the following about knock out mice is true.

 a. First knock out mice was created by Capecchi, Evans, and Smithies in 1989

 b. Got noble prize in 2007 in physiology and medicine

 c. **Both a and b are true**

 d. None

(113) Dwarf or small breeds of rabbits have what weight?

 a. **less than 2kg**

 b. less than 5 kg

 c. less than 4 kg

 d. more than 3 kg

(114) Dwarf or small breeds of rabbits includes:

 a. Netherland Dwarf

 b. Dutch breeds

 c. Polish breeds

 d. **All of the above**

(115) Medium breeds of rabbits includes:

 a. New Zealand

 b. Californian

 c. **Both a and b**

 d. Polish breeds

(116) Large breeds of rabbits includes:

 a. Grey Giant

 b. Flemish Giant

 c. Checkered Giant

 d. Chinchilla

 e. **All of the above**

(117) In induced ovulator the ova is released after how many hours of copulation?

 a. **10-13 hours following copulation**

 b. 2-3 hours following copulation

 c. 24 hours following copulation

 d. 5-7 hours following copulation

(118) In which breeding system the one breeding buck is kept with 7 to 10 does housed in special cage-housing with common corridor.

 a. Polygamous mating

 b. Harem System

 c. Cage system

 d. **Both a and b**

(119) Tyzzer's Disease in rabbits is caused by?

 a. ***Clostridium piliforme***

 b. *Clostridium spiroforme*

 c. *Escherichia coli*

 d. *Bordetella bronchiseptica*

(120) Which technique is commonly used to create knock-out mice?

 a. **Gene editing**

 b. RNA interference

 c. Polymerase chain reaction (PCR)

 d. DNA sequencing

(121) The North Temperature Region station, Garsa for development of wool type rabbits are located in
 a. Jammu & Kashmir
 b. **Himachal Pradesh**
 c. Arunachal Pradesh
 d. Uttaranchal

(122) What is the country of origin of Dutch breed of rabbit?
 a. Russia
 b. **U.K.**
 c. Netherlands
 d. Europe

(123) A mature female rabbit used for breeding is called

 a. **Doe**

 b. Queen
 c. Ewe
 d. None of the above

(124) What is the name for 10 to 12 weeks old rabbit ready for market?
 a. Broiler
 b. **Fryer**
 c. Tender

 d. None of the above

(125) In case of rabbits act of parturition is called as
 a. Calving
 b. Kidding

 c. Whelping
 d. **Kindling**

(126) What is the name for 20 weeks age young rabbit?
 a. Lamb
 b. Kid
 c. **Bunny**

 d. Broiler

(127) The diploid number of chromosome in Rhesus monkey is?
 a. 24
 b. 48
 c. 12

 d. **42**

(128) The diploid number of chromosome in Chinese Hamster is?
 a. 12

 b. 22

 c. **44**

 d. 38

(129) Which of the following lab animal is an induced ovulator?
 a. ***Oryctolagus cuniculus***
 b. *Cavus porcellus*
 c. *Mus musculus*
 d. *Rattus novergicus*

(130) Act of parturition in Guinea pig is known as?
 a. Calving
 b. Kindling
 c. **Furrowing**
 d. Whelping

(131) In Trio mating male: female ration of the mice will be?

 a. 1:3

 b. **1:2**

 c. 1:4
 d. 1:5

(132) Weil's disease in rat is caused by?
 a. *Clostridium botulism*

 b. *Eimeria tenella*
 c. *Streptococcus spp.*

 d. ***L. icterohaemorhagiae***

(133) Dunkin Hartley is a strain of?

 a. **Guinea pig**

 b. Rat

 c. Mice

 d. Hamster

(134) Buck teeth in rabbit are due to?
 a. Absence of incisor teeth
 b. **Excess growth of incisor**
 c. Excess growth of canine

 d. Absence of canine

(135) Which country is the origin of Soviet Chinchilla breed of rabbits?

 a. **Russia**

 b. U.K.

 c. India

 d. Netherlands

(136) Number of chromosome (2X) in rabbit is?
 a. 48
 b. 46
 c. **44**
 d. 42

(137) Soft tissue calcification is a disease of?
 a. Guinea pig
 b. **Rabbit**
 c. Rat
 d. Mice

(138) Scientific name of Guinea pig is?
 a. ***Cavia porcellus***
 b. *Guinea porcellus*
 c. *Cavia guineas*
 d. *Cavia cervus*

(139) One of the following is a strain of Hamster

 a. Cavy

 b. **Syrian**

 c. Alnino

 d. Wistar

(140) Germ free animal are also called as
 a. **Axenic**
 b. SPF

 c. Pathogen free

 d. Germ free

(141) One of the following is a strain of mice

 a. Syrian

 b. Cavy

 c. **Wistar**

 d. None of these

(142) Rat and mice are generally kept in
 a. Grid floor
 b. Wire cage
 c. Floor
 d. **Shoe box cage**

(143) Hopper feeder is generally recommended for

 a. Rat

 b. **Rabbit**

 c. Mice

 d. Gerbils

(144) Hutches are provided in

 a. Rat

 b. **Rabbit**

 c. Mice

 d. Gerbils

(145) Roof of laboratory animal house should be preferably

 a. **RCC**

 b. Thatch

 c. Tiles

 d. Grass

(146) Toe cuts is one identification method used in

 a. Dog

 b. **Rat**

 c. Rabbit

 d. Mice

(147) CDRI is located at
 a. Mumbai

 b. **Lucknow**

 c. Pune

 d. Bhopal

(148) Cheek pouches are found in
 a. Rabbit
 b. **Hamster**
 c. Guinea Pig
 d. Mice

(149) Young ones of Rabbit are born
 a. **Naked and eye closed**
 b. Naked and eye open

 c. With hair coat and eye closed

 d. With hair coat and eye open

(150) Nest boxes are used in rat and mice as they exhibit
 a. Aggressive behavior
 b. Coprophagy

 c. **Nesting behaviour**

 d. Cannibalism

(151) Guinea pig is also known as
 a. Sea pig
 b. Little sea pig

 c. Barbary rabbit

 d. **All the above**

(152) Average life span of mice is?
 a. 2-3 years

 b. **1-2 years**

 c. 4-6 months
 d. None of these

(153) What is the life span of a gerbil's RBC?

 a. **10 days**

 b. 40 days

 c. 120 days

 d. 19 days

(154) What is the most common cause of viral respiratory disease in mice?

 a. **Sendai**

 b. Mycoplasma pulmonis

 c. Helicobacter

 d. Pseudomonas

(155) The 3Rs principle, that is Replacement, Reduction and Refinement, was formulated by?

 a. **William Russell and Rex Burch**

 b. Brinster

 c. Herbert Boyer

 d. Stanley Cohen

(156) Which animal model is particularly useful for studying embryology?

 a. **Zebrafish**

 b. Mice

 c. Earthworm

 d. Rabbits

(157) Which of the following can influence the level and pattern of transgene expression?

 a. If the location(s) of transgene insertion is random

 b. If the number of transgene copies that integrate into the genome is random

 c. If the transgene may be inserted into a region of transcriptionally silent DNA

 d. **All of the above**

(158) Of the following, which relates to why choosing an appropriate promoter is important when developing a transgenic organism?

 a. It directs where the DNA construct will be incorprated

 b. **It regulates the level and pattern of expression**

 c. It is not important because enhancers regulate gene expression

 d. It promotes stable, reliable, genetic incorporation into the host

(159) DNA is microinjected into the fertilized egg:

 a. After the fusion of male and female nuclei

 b. **Before the fusion of male and female nuclei**

 c. At the time of fusion of male and female nuclei

 d. At any time it can be injected

(160) The expression of a transgene in the target tissue is identified by?

 a. Transgene

 b. Promoter

 c. Enhancer

 d. **Reporter**

(161)Ringtail condition in rat is caused due to**.**............. –**Low humidity**

(162) SCID mice are mainly used in........... and........... **–Xenograft studies, Tumour studies**

(163)Dog breed which is most commonly used in experimental studies.............. **–Beagle**

(164) Sound made by Guinea pigs by rapidly gnashing the teeth is known as.......–**Chattering**

(165) A chemical released by one animal, which affect the physiology and behaviour of another is known as................ –**Pheromones**

(166) High pitched sound of discontent, in response to pain or danger is........... –**Squealing or Shrieking**

(167)Native country of Hamster is............. **–Syria**

(168)Dressing percentage in rabbit meat is................... **-62%**

(169) Dunking Hartley is the............. stock of............. –**Outbred stock, Guinea pig**

(170) Tail of mice is comparatively.......... in relation to body size in comparison to the tail of rat. –**Longer**

(171) Methods used for identifying rabbits is....... and...... **–Ringing, Leg Bands**

(172) ................ are implanted subcutaneously between the scapulae for permanent identification of individual animals. **–Microchip Transponders**

(173) Crude fibre level in rabbit’s diet should be......... for proper functioning of GIT. **-6-12%**

(174)The first transgenic animal produced was.......... –**Mouse**

(175)The first transgenic animal was produced by....... and....... -**Gordon and Ruddle**

(176) Buck tooth is noticed in........... –**Rabbit**

(177) The vaginal cytology is done for the captive breeding of.......... –**Dog**

(178) The "4R" principle of animal welfare is based on the principles of......, ......., ......, and......... -**Reduction, Replacement, Refinement, Responsibility**

(179) Germ free animals are also known as.............. -**Axenic**

(180) CAR bacillus is a............ disease. **–Bacterial**