**Chapter 10: Laboratory animal breeding**

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**Some important terms**

**Laboratory animal**

Any non-human animal held in captivity for research or observation that belongs to the animal kingdom.

**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**

These are animals that have undergone genetic modification, allowing researchers to disrupt or replace a gene with synthetic DNA in order to render it inactive.

**Transgenic animals**

These are the animals whose genomes have been purposefully altered to contain an alien gene.

**The Bruce effect**

The Bruce effect is a phenomenon observed in some rodent species, particularly mice and rats, where the presence of an unfamiliar male can lead to the termination or resorption of a female's pregnancy. This effect was first described by Hilda M. Bruce in 1959.

**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 | Chinese Hamster | *Cricetulus griseus* | 22 |
|  | Syrian/Golden Hamster | *Mesocricetus auratus* | 44 |
| European Hamster | *Cricetulus cricetulus* | 22 |
|  | Gerbils | *Meriones unguiculatus* | 44 |
|  | Rabbit | *Oryctolagus cuniculus* | 44 |
|  | Guinea pig/Cavy | *Cavia porcellus* | 64 |
|  | 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 wks | 7-8 wks | 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 wks | 10-12 wks | 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 wks | 6-8 wks | 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 wks | 9-12 wks | 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 wks | 9-10 wks | 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 wks | 20-36 wks | 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 the result of at least 20 or more generations 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 identified in individuals of the established inbred strain that had only one distinguishing gene from the original inbred strains.

**Examples:** BALB/cj

**Cogenic strain**

They are created by selecting for a specific marker from the donar strain by backcrossing of an inbred strain. When a strain has produced at least ten backcross generations to a background strain, it is considered cogenic.

**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) In rhesus monkeys, the diploid number of chromosomes is?

 a. 34

 b. **42**

 c. 24

 d. 48

(2) Which laboratory animal is an induced ovulator?

 a. *Mus musculus*

 b. *Cavia porcellus*

 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) Female laboratory animals who experience the Whitten effect have synchronized estrous cycles as a result of the following:

 a. **Male pheromones**

 b. Female 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) The idea of "replacement, refinement, and reduction" of animal use in scientific research is credited to whom?

 a. Louis Pasteur

 b. Charles Darwin

 c. Claude Bernard

 d. **William Russell and Rex Burch**

(8) In which year the American Association for Laboratory Animal Science (AALAS) was established?

 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 kind of genetic modification enables a researcher to increase gene expression in a mouse model in an experimental setting?

 a. Knockout

 b. **Transgenic**

 c. Knockouts and knockins

 d. Knockin

(11) Which of the following models has the potential to hide the effects of genetic alteration through paralogues?

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

(12) Average life span for Guinea Pigs is?
 a. 2-4 yrs
 b. 3-5 yrs
 c. **5-7 yrs**
 d. 10-12 yrs

 (13) The birth weight of laboratory rats is?

 a. 1.5 gram
 b. **5 gram**
 c. 11 gram
 d. 16 gram

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

 (15) Induced ovulators are which of the following?
 a. Hamster
 b. **Rabbit**
 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) Which species are included in induced ovulators?
 a. Rabbit
 b. Mink
 c. Ferrets
 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. 22-25 days
 b. **30-33 days**
 c. 65 days
 d. 55 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 caused by?
 a. **Bacteria**
 b. Virus
 c. Tapeworm
 d. Nematode

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

 b. 1-2 year

 c. 3-3.5 year

 d. 4.5-5 year

(25) Which among 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 of how many days?
 a. 4
 b. **16**
 c. 30
 d. 70

(34) In order to examine atherosclerosis and epilepsy, which of the following is used?
 a. Hamster

 b. **Gerbil**

 c. Rat

 d. Mice

(35) Of the following, which isn't a laboratory dog breed?
 a. Spaniel
 b. Spaniel

 c. Mongrel

 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 species does not have monthly 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) What is the guinea pig's estrus cycle's average length in days?
 a. **16**
 b. 12
 c. 21
 d. 30

(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) How long does a guinea pig live?
 a. 5-3yrs
 b. 2-4yrs
 c. **4-5yrs**
 d. 4-6yrs

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

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

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

(51) Vero cell line is obtained from?

a. Hamster (Kidney)

 b. African Green Monkey (liver)

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

 d. Human (Lungs)

(52) Select the lab animal most suited for FMD viral typing.

 a.Weaned mice

 b. Hamster

 c. **Guinea pig**

 d. Mice

(53) What are the NK cell-deficient genetically altered mice called?

 a. Athymic mice

 b. Biege

 c. Nude

d. **All of above**

(54) Which hormone blockade is involved in the Bruce effect in mice?

a. **Prolactin**

 b. Estrogen

 c. Progesterone

 d. LH

(55) For FMD research, the experimental animal utilized is?

a. **Guinea pig**

 b. Mice

 c. Hamsters

 d. Rat

(56) What is the daily requirement of vitamin C for guinea pigs in terms of mg/kg DM?

a.102

 b. 100

 c. **222**

 d. 45

(57) Vitamin C requirement for guinea pig diet in terms of mg/kg DM is?

a.315

 b. **200**

 c. 170

 d. 800

(58) The 2n number of chromosomes are equal in

 a. **Man and rhesus monkey**

 b. Buffalo and sheep

 c. Cattle and goat

d.Sheep and goat

(59) A slit-like look that slopes slightly towards the anus can be observed by gently pressing on the guinea pig's genital area. This is indicative of
 a. Male
 b. **Female**

 c. Hermaphrodite

 d. Transgender

(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 which country
 a. Guinea

 b. **Guyana**

 c. Andes

 d. None 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. **3 in hind feet and 4 in fore feet**

 c. 2 in both hind feet and fore feet
 d. 3 in both hind feet and fore feet

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

 c. Chirping
 d. **All of them**

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

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

(73) Life span of Guinea pig is
 a. **5-7 yrs**
 b. 3-4 yrs
 c. 10-12 yrs
 d. 6-8 yrs

(74) Gestation period in Hamster is
 a. 22-21 days
 b. 25-26 days
 c. **15-16 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. 20-21 days
 b. **42-47 days**
 c. 12-17 days
 d. 15-16 days

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

 c. 20-21 days

 d. 15-16 days

(79) Normal gestation period of rabbit is
 a.65-67 days

 b. 50-52 days

 c. **30-32 days**

 d. 16-20 days

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

c. Fore 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. 15 days

 d. 7 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 which of the following
 a. Mice
 b. Rat
 c. Hamster
 **d. All of the above**

(88) Which of these is referred to as a "desert rat"?

a.Wistar rat

 b. Hamster

 c. **Gerbil**

 d. Gunn rat

(89) Which of the following describes SCID (Severe Combined Immuno Deficient) mice?

 **a. Defective B and T receptors**

 b. Defective monocytes

 c. Calcium deficiency

 d. Vitamin D deficiency

(90) When at least........ backcross generations to a background strain have been produced, counting the initial hybrid or F1 generation as generation1, a strain is considered cogenic.

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

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

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

 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-2

 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-4

(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-2, b-1, c-3, d-1

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

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

 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-1, b-3, c-2

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

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

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

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

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

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

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

(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-2

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

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

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

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

 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. CPCSEA |

 Answers:

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

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

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

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

(101) Assertion: Knockout mice play a valuable role in elucidating gene function.

Reason: The phenotype exhibited by knockout mice frequently provides insight into the function of the gene that has been disrupted.

 **(a) Both reason and assertion 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) Reason is true, but the assertion 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 reason and assertion 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 reason and assertion 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 refers to the physiological termination of pregnancy in mice triggered by the introduction of a new male.

Reason: This phenomenon is named after Hilda Bruce, who first documented it in 1959.

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

(b) **Both reason and assertion 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 generated through the process of mating between brother and sister for 20 or more successive generations.

Reason: Have increased homozygosity and reduced heterozygosity.

(a) **Both reason and assertion 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 statement regarding knock out mice is accurate?

 a. The first knock out mice were developed by Capecchi, Evans, and Smithies in 1989.

 b. They were awarded the Nobel Prize in Physiology and Medicine in 2007.

 c. **Both statements a and b are correct.**

 d. None of the statements are true.

(113) What is the typical weight range for dwarf or small breeds of rabbits?

 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) Which breeds are classified as medium breeds of rabbits?

 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) What is the cause of Tyzzer's Disease in rabbits?

 *a.* ***Clostridium piliforme***

 *b. Clostridium spiroforme*

 *c. Escherichia coli*

 *d. Bordetella bronchiseptica*

(120) What method is frequently employed for generating 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. Arunachal Pradesh
 b. **Himachal Pradesh**
 c. Jammu & Kashmir
 d. Uttaranchal

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

(123) What is the term for a mature female rabbit used for breeding?

 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) What is the term used for the act of parturition in rabbits?

 a. Calving

 b. Kidding

 c. Whelping

 d**. Kindling**

(126) What term is used to refer to a young rabbit at the age of 20 weeks?

 a. Lamb

 b. Kid

 c. **Bunny**

 d. Broiler

(127) What is the diploid chromosome number in Rhesus monkeys?

 a. 24

 b. 48

 c. 12

 **d. 42**

(128) What is the diploid chromosome number in the Chinese Hamster?

 a. 12

 b. 22

 c. **44**

 d. 38

(129) Which of these laboratory animals exhibits induced ovulation?

 *a.* ***Oryctolagus cuniculus***

 *b. Cavus porcellus*

 *c. Mus musculus*

 *d. Rattus novergicus*

(130) What is the term used to describe the act of parturition in guinea pigs?

 a. Calving

 b. Kindling

 c. **Furrowing**

 d. Whelping

(131) In Trio mating, what will be the male to female ratio of the mice?

 a. 1:3

 **b. 1:2**

 c. 1:4

 d. 1:5

(132) What is the cause of Weil's disease in rats?

 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) What causes buck teeth in rabbits?

 a. Lack of incisor teeth

 **b. Overgrowth of incisor teeth**

 c. Overgrowth of canine teeth

 d. Lack of canine teeth

(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 disease is found in?
 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) Which among 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 options below represents a mouse strain:

 a. Syrian

 b. Cavy

 c. **Wistar**

 d. None of the above

(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. Hamster

 b. **Rabbit**

 c. Mice

 d. Gerbils

(144) Hutches are provided in

 a**. Rabbit**

 b. Mice

 c. Rat

 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) Where is CDRI situated?
 a. Mumbai

 b. **Lucknow**

 c. Pune

 d. Bhopal

(148) In which of the following Cheek pouches are present
 a. Mice
 b. Guinea Pig
 c. **Hamster**
 d. Rabbit

(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. **1-2 yrs**

 b. 2-4 yrs

 c. 4-6 yrs
 d. None of these

(153) What is the duration of a gerbil's red blood cell lifespan?

 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) Who formulated the 3Rs principle, which stands for Replacement, Reduction, and Refinement?

 a. Brinster

 b. **William Russell and Rex Burch**

 c. Herbert Boyer

 d. Stanley Cohen

(156) Animal model particularly useful for embryology studying is?

 a. **Zebrafish**

 b. Mice

 c. Earthworm

 d. Rabbits

(157) What factors can impact the extent and manner in which transgene expression occurs?

 a. Random placement of the transgene insertion

 b. Random quantity of transgene copies integrated into the genome

 c. Potential insertion of the transgene into a region of DNA that is transcriptionally inactive

 d. **All of the above**

(158) Which of the following highlights the significance of selecting a suitable promoter during the development of a transgenic organism?

 a. It determines the site of DNA construct integration.

 b. **It controls the extent and manner of gene expression.**

 c. Its importance is minimized as enhancers regulate gene expression.

 d. It facilitates stable and dependable genetic integration into the host.

(159) When is DNA injected into the fertilized egg?

 a. Following the merging of male and female nuclei

 b. **Preceding the merging of male and female nuclei**

 c. Concurrent with the merging of male and female nuclei

 d. It can be injected at any point

(160) What detects a transgene's expression in the target tissue?

 a. Transgene

 b. **Reporter**

 c. Enhancer

 d. Promoter

(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) Animals can release chemicals that impact the physiology and behavior of other animals. These chemicals are referred to 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 SC between the scapulae for permanent identification of 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) Animal welfare's "4R" principle is based on the ideas of......, ......., ......, and......... -**Reduction, Replacement, Refinement, Responsibility**

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

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