
UNIT 13 ALTERNATIVES TO ANIMAL USAGE IN TEACHING, TESTING AND RESEARCH

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13.1 LEARNING OUTCOMES

- a) **Knowledge and Understanding:** After studying this Unit, you will be able to:
 - Understand the meaning and concept of alternatives to animals' usage in teaching, testing and research.
 - Explain the arguments for and against use of animals in testing
- b) **Practical and Professional Skills:** After studying this Unit, you will be able to:
 - Describe the different alternatives to animals' usage in teaching, testing and research.

13.2 INTRODUCTION

Dear Learner,

Every year, an estimated 1,000 calves are killed in India to teach Veterinary Anatomy and Veterinary Surgery to students, and thousands of frogs, rats, guinea pigs, and rabbits suffer and die for dissection and other types of training as part of teaching various science courses (PETA, 2016). About 115 million lab animals are being used for research and testing around the world on an annual basis.

The Animal Welfare Board of India (AWBI) has taken steps to ensure that the dissections and practical demonstrations on animals in schools/colleges are replaced by models as an alternative to animal usage in teaching. The University Grants Commission (UGC) issued guidelines in 2011 for discontinuation of dissection and animal experimentation in Zoology/Life Sciences in a phased manner. The Indian Veterinary Education Regulations (VCI, 2016) also approved to end calf killing and reduce other cruelty in veterinary colleges (Box 13.1).

Box 13.1: Veterinary Education Regulations to End Calf Killing, Reduce Other Cruelty

Following the joint efforts by PETA India, Animal Welfare Board of India, and Union Cabinet Minister Maneka Gandhi, the new Veterinary Council of India Minimum Standards of Veterinary Education (Bachelor of Veterinary Science and Animal Husbandry degree course) Regulations, 2016, will change the way students are taught veterinary science in India. The new regulations phase out calf killing, introduce computer simulations, require an ethically sourced body-donation programme to be set up, and call for other humane teaching methods to be used.

The new regulations, under the anatomy practical session, state the following:

Dissection will be carried out on cadavers procured by way of donation of animals or animals obtained from post-mortem section and the donated animals should be either incurable or in terminal stages and prosected specimens should be used. Within one year each college must set up a body-donation programme or wild body programme. Computer simulation software, models, mannequins, plastinated specimens, preserved body organs and models should be used for better understanding of the subject.

The Veterinary Physiology practical, which required students to record a cardiogram of a live frog's heart and study the effects of heat and cold on the animal was also removed and replaced with *simulation experiments on nerve-muscle and heart physiology*. For Veterinary Pharmacology practical sessions, the new regulations mandate that *simulated animal experiments should be preferred over use of live animals. The lab for simulated experiments should be established within a span of one year.*

Other key reforms include extending the five-year course duration to five and half years, increasing the internship programme from six months to one year so that students have more time for practical and hands-on training, and allowing students to intern at animal-welfare organisations.

(Source: PETA, 2016)

In this unit, you will be introduced to different alternatives for the effective teaching, testing and research.

13.3 ALTERNATIVES TO ANIMAL USAGE

Non-animal methods like computer simulations, interactive CD-ROMs, films, charts, and life-like models teach Anatomy and complex biological processes well or better than many of the animal based methods. Research has shown that a significant number of students at every educational level are uncomfortable with killing live animals for dissection and experimentation, and some even turn away from careers in science rather than violating their principles. A survey conducted by PETA India among the final-year students of Bombay Veterinary College in 2013 revealed that 63% said procedures such as terminal surgery and practicing painful techniques on living animals causes distress and takes a profound psychological toll on students. In addition, 69% suggested that there should be a policy allowing conscientious objection by students to the use of live animals in favour of more modern humane techniques, 73% agreed that willed or ethically sourced body donations are effective replacements for killing healthy calves for anatomical studies, and 65% believed that non-harmful teaching methods such as simulation software, models, manikins, etc., are as effective as those achieved by animal use (PETA, 2016).

Anatomy, Physiology, Pharmacology, Surgery practical classes and Clinical internship trainings require large number of animals as part of teaching and learning. These subjects need animals for basic demonstration of the concept of handling animals, anatomical features and veterinary procedure demonstrations for skill development. The animals experience stress, pain and suffering before, during and after demonstration/handling. Therefore, we should look for some alternatives to animal usage from the animal welfare perspective.

13.3.1 Meaning of Alternatives to Animal Usage

Alternative is a choice between two or more things implying that good research may be performed without the use of live animals or good teaching using dummies rather than live animals. The use of animals in research, teaching and testing is an important welfare and ethical issue. The extent of animal use in research/teaching is often debatable and revolves around the relative value, often referred to as 'moral value', of humans and animals.

An alternative to animal usage is any procedure/method/technique/approach that are meant to replace a particular science-based procedure that may harm the interests of animals, to reduce the numbers of animals required, or to refine the procedure in such a way that the welfare of the animals in the procedure itself or in its context is optimised.

Activity 1: Reflect on your own view of 'alternative to usage of animals' in science-based procedures' that may harm the interests of animals. Which area of concern is most important for you? Discuss these concerns with friends or colleagues to see which area of concern is most prevalent and write your observations:

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Check Your Progress 1

Note: a) Use the spaces given below for your answers.

b) Check your answer with those given at the end of the unit.

1) What is the stand of regulatory bodies in adapting the alternatives in teaching?

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2) Define the term ‘alternatives to animal usage’.

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13.4 ALTERNATIVES TO TEACHING

Animals are used for teaching purposes at various levels. The use of amphibians, small animals and large animals are common in paramedical schools, veterinary and medical colleges. The examples for alternatives include:

- Models instead of dissection to teach students the principles of Anatomy.
- Avoiding normal dissection of animals to see physiological parameters (e.g. students examining their own physiological parameters such as heart rate, vision or hearing).

Although not a replacement for dissection in a strict sense, this type of models/ exercises has the following benefits:

- 1) The alternatives are both educational and stimulating.
- 2) They do not involve the harming or killing of animals and have the added benefit of providing, *albeit* indirectly, a lesson in compassion.
- 3) Alternatives are durable and usually economical - even if initially expensive, most alternatives become highly cost-effective over time.
- 4) For some alternatives, students can use them repeatedly without incurring further costs.
- 5) Most importantly, alternatives are humane and welfare friendly.
- 6) They offer educators and students numerous ways to teach and learn, respectively, all types of information without harming or killing other beings.

The following are few examples of alternatives to animal usage in teaching at various levels.

13.4.1 Plastination

Plastination is the process of infiltrating specimens with synthetic materials. It is gaining ground over other methods. Plastination technique was pioneered by Dr. Gunther von Hagens at the Institute of Plastination in Heidelberg, Germany in 1978. Dr. Gunther successfully plastinated human bodies in 1995 and attracted millions of curious visitors (<https://bodyworlds.com/>).

Gunther's method involves replacing bodily fluids with forcible impregnation of acetone followed by silicone, epoxy or polyester copolymers under vacuum. Preserving a buffalo calf in formalin is expensive and costs nearly Rs. 20,000 (about \$300) considering that six such specimens are required annually as teaching aids (Patel, et al., 2015). Therefore, plastination models are being used as low cost alternative methods to formalin preservation (Figs 13.1 and 13.2).



Fig.13.1: Sagittal section of the head of buffalo calf *Fig.13.2: Gross animal body of cat*

13.4.2 Flash Based Modules

The flash based modules are useful to the surgeons, pathologists and gynaecologists to refresh their knowledge on the interdisciplinary anatomical features. This will greatly enhance the efficiency in performing various surgical procedures. They also enhance the learning ability of students (Fig.13.3).



Fig. 13.3: Flash based methods of teaching *Fig 13.4: Video based method of teaching*

Advantages of Flash Based Modular Teaching:

- Reduction in number of animals used for dissection.
- Drop in consumption of formalin, phenol, glycerol for embalming of specimens for storage. These chemicals pollute environment and cause health hazards such as eye, and skin irritation, and are also a potential source of cancer.
- They can be used multiple times and improves the efficiency of teachers and students.
- Useful for surgeons and practitioners to have a glance on the subject before the commencement of any operation, which will minimize greatly the errors.
- Once developed can be shared by all the colleges of the country and help in uniform method of teaching.

A sample of the module preparation comprises different components under the following headings

- Schematic view:** This portion will highlight the diagram of structures such as blood vessels, nerves, location of muscles, organs etc.
- Animation:** This part will show the blood circulation, nerve supply and its function, the muscle orientation and its functional aspects such as contraction, expansion and various joints can also be highlighted with their functions.
- Text information:** Each module will be provided with text as in case of blood circulation, the names of blood vessels and the structures to which they supply, similarly the nerves as well as the names of the muscles with their orientation and the topographic position of various organs.
- Video of the actual dissection:** The blood supply, nerve supply, muscle orientation, topography of organs are actually video graphed through a dissection of an animal.

13.4.3 Models

A Model is a smaller or larger physical copy of an object or live animal. These physical models can be made up of rubber, plastic, fiber, Plaster of Paris or cement. These physical models offer 3D view to the observer.

13.4.3.1 Rubber Models

These convenient animal models can be used as alternatives in place of live animals to demonstrate some basic skills in veterinary courses, such as drug administration, suturing techniques in surgery, endotracheal intubation etc. (Fig.13.5).



Fig.13.5: Students practicing the injection on rubber model

13.4.3.2 Plastic Models

They provide visualization of anatomical features of some organs such as brain, eyes, ears, and heart, hence reducing the use of samples from live animals. These are affordable and available at the local market (Fig. 13.6).

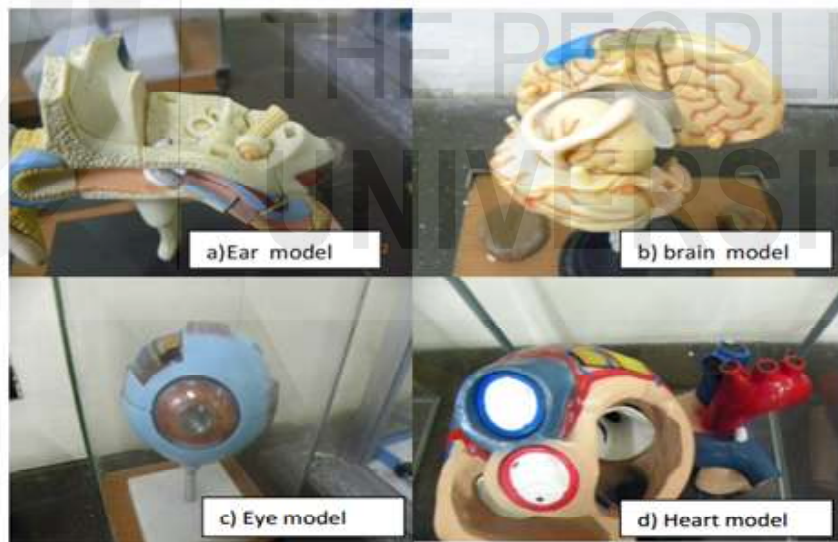


Fig. 13.6: Plastic models

13.4.3.3 Wooden Models

Wooden replica of animals and their body parts are one of the cheap, readily available, and portable alternatives to animal handling in veterinary courses. Wooden body part replicas also minimize the frequent use of live animals as they can last longer from wear and tear as compared to rubberized counterparts (Figs. 13.7 and 13.8).



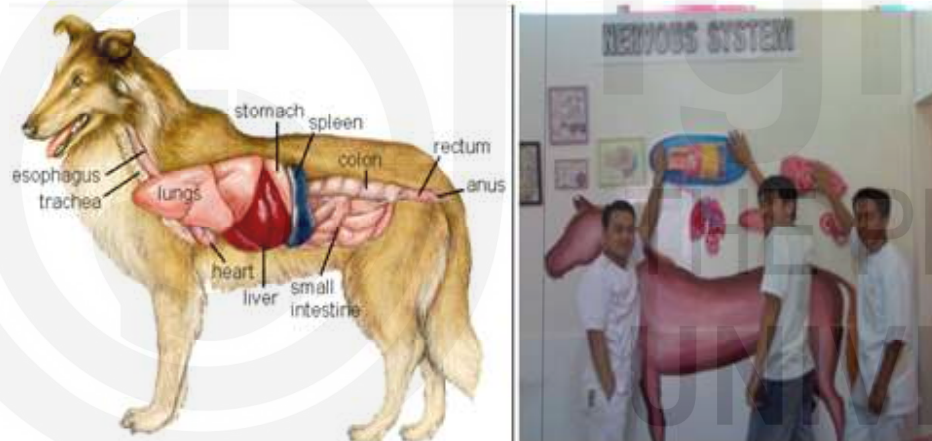
Fig.13.7: Wooden replica of rubber models



Fig.13.8: Restraining method practice in Wooden replica (Courtesy: WSPA)

13.4.3.4 Low Cost Models

Using published pictures of animal or its internal organs, little of imagination and artistic inclination of student, they can make models of internal organs or even whole animal replica using papers, clay or styrofoam. Organ sculpturing can be made as a class activity to enhance understanding of students to particular anatomical features of organs as they sculpt using recyclable materials (Fig.13.9).



A. kidney replica made from thermocol (Styrofoam)

B. Paper mache depicting small intestine

c. Clay model of a cell

Fig. 13.9: Low cost alternate models

13.4.3.5 Wire Models

Using chicken wire mesh, these models can be shaped to produce a hump or the back portion of animal and they can be used as life-size dummy for rectal palpation. The wire mesh can be covered with old newspapers thoroughly soaked in glue and glue together, one layer after another. Once the mold is hardened, it can be painted to look like a cow's hump. The inside organs such as the rectum can be made from rubber tubes with size enough to insert a hand and be able to palpate another structure that could be shaped as uterus (Fig. 13.10).



Fig. 13.10: Wire model

13.4.3.6 Specimens in Glass Containers

The use of animal replicas can also reduce the number of animals that need to be sacrificed in anatomy and physiology courses. Anatomy specimens are normally provided every year because the shelf life of the cadavers deteriorates. This can be due to improper storage of organ specimens after demonstration, hence the need for another animal to be sacrificed as specimen. Another means to preserve the specimen for longer period is by soaking the organs in 30% formalin solution for one month and placed in covered glass containers for another month without aeration. The resulting product will last for 3 years without sacrificing animals every semester. Though there is a problem of foul smell of these organs, however, after sometime, the formalin smell will also diminish (Fig.13.11).



Fig.13.11: Organs preserved through formalin soaking

13.4.4 Manikins

A mannequin (also called a manikin, dummy) is an often articulated doll used by artists, tailors, dressmakers, window dressers and others especially to display or fit clothing. The term is also used for life-sized dolls with simulated airways used in the teaching of first aid, advanced airway management skills such as tracheal intubation or animals used in computer simulation to model the behavior of the animal. These are sometimes also referred to as virtual patients (Fig. 13.12).



Fig. 13.12: Mannequin

13.4.5 Simulators

Medical simulators involve a computer connected to a plastic simulation of the relevant anatomy (Fig. 13.13). Sophisticated simulators of this type employ a life size mannequin that responds to injected drugs and can be programmed to create simulations of life-threatening emergencies.



Fig. 13.13: Pumping heart simulator

13.5 SCOPE, LIMITATIONS AND ACCEPTABILITY IN TEACHING

The use of alternatives will reduce the pain and suffering in animals that is induced during the live demonstrations. Wooden replicas minimize the frequent use of live animals as they can last longer from wear and tear as compared to rubberized counterparts. There are some apprehensions that these models cannot replace animals completely as they are unlikely to provide enough information about the complex interactions of living individuals and students may fail to learn exactly how to react with the behavioral reaction of live animals during the procedure. However, these problems can be compensated with a proper lecture that will

include details of what to expect during animal handling. Adjunct lectures such as video presentation of live animal handling can be used to provide visuals on the possible reactions of animals to such procedures. There is definitely an advantage if student can acquire the techniques/procedures through animal models. This can alleviate the student's apprehensions of handling animals and gain confidence which leads to better handling of animals during actual handling with a purpose.

In every level of learning, there is a process called adjustment and adaptation. The veterinary students are much curious on learning by handling the animals. However, once the concept of animal welfare sinks in to their consciousness, the use of alternative inanimate models can be a much acceptable part of their learning experience. Later on, they themselves develop alternative models. Though there is a need for adjustments, with the proper guidance and adjunct educational tools, students tend to adapt to these alternative models and later on learn to readjust and readapt to live models in clinical practice (Box 13.2).

Box. 13.2: Willed Body Programme - Humane Alternative in Teaching Veterinary Anatomy

Teaching Veterinary Anatomy involves sacrificing live animals, embalming and using them for dissection. A major ethical issue here is pain, suffering and discomfort to animals, instructors and students. The Department of Veterinary Anatomy and Histology, NTR College of Veterinary Science, Gannavaram, established Willed-Body Programme for the first time in the country following the VCI (2016) regulations to end calf killing and reduce cruelty. It is an ethical adaptation for teaching anatomy and is an alternative to healthy animal sacrifice. Dissection is done on ethically sourced cadavers procured by way of donation of animals to satisfy the ethical concerns. Freezers and coolers are being used to store embalmed/unembalmed cadavers in an attempt to do away with the traditional hazardous formalin storage method (Fig.13.14).



Fig. 13.14: Cadaver embalming technique for donor animals demonstrating internal organs

The concepts of animal welfare, initiation of a donor programme to ethically sourced cadavers for preparation of skeletons and sets of bones were initiated in the department in 2002–2003. The department is preparing and using alternatives to the use of animals as models for demonstration. A variety of educational instructional material viz. animated software, plastinated specimens, fibre-optic resin models, charts, laminations in addition to other audio-visual aids have been prepared and are available in the department. Innovative teakwood non-animal alternative models have been prepared as the first of its kind in the country (Fig.13.15).The anatomy laboratory is

digitized with HDMI enabled multiple monitors, sliding HD video recording facility and DLP projector for viewing live and recorded dissections.

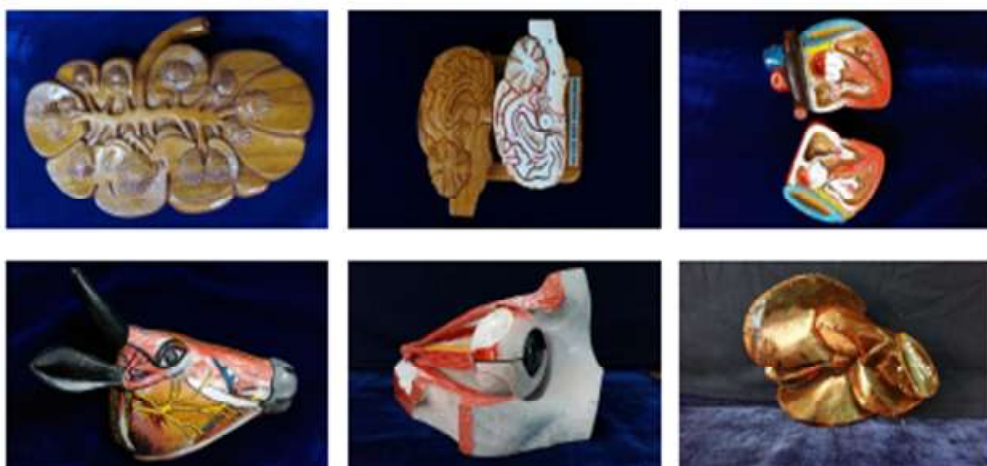


Fig.13.15: Teak wood and non-animal innovative educational models

(Source: Kishore et al., 2019)

13.6 ALTERNATIVES TO TESTING AND RESEARCH

13.6.1 Arguments for and against the Use of Animals in Testing

Are we allowed using living creature in testing to enhance our knowledge and science to improve mankind's destiny? If the answer is categorical "No", it seems that further discussion is not required, except for the consequences of such answer. If answer is "Yes", several further questions arise: Are we allowed to do it all the time or just now and then? Animals could and should be used and for what purposes?

In any ethical debate the reduction of the number of animals in testing and the possible alternative methods should be taken into account. At every level we should pay attention to the evaluation to strike a balance between discomfort/suffering and the usefulness of each test.

Arguments for and against such use of animals in testing are summarised in Box 13.3.

Box 13.3: Arguments on Use of Animals in Testing

Arguments For:

- 1) More and more tests now subject to refinement and much less suffering to animals.
- 2) Products we use are 100% safe, animal testing is assumed to be the only means of ensuring this.
- 3) Legal requirement to perform animal testing.
- 4) Not all 'cosmetics' are 'vanity products'. Most definitions include products such as sun screen, which may be considered almost therapeutic.

- 5) A ban on animal use at some point in the past could have resulted in lost opportunities for consumers and industry (a ban could equally have allowed for more opportunities).
- 6) Information is needed to help treat patients after misuse, for example, accidental swallowing of large amounts of product by children.

Arguments Against:

- 1) Consumers would rather have products not tested on animals (abolitionist view).
- 2) Testing unnecessary and the severe costs (e.g. Draize test, LD50 test, acute skin toxicity. test) to the animals outweigh the trivial benefits to humans (utilitarian view).
- 3) Enough cosmetic products are available, compounds/ingredients are known substances and no need to develop more.
- 4) Human volunteers could be used instead.
- 5) Validated alternatives such as cell cultures, synthetic skin models and computer modeling can be more effective, more efficient and more reliable than animal models.

13.6.2 Why Alternatives to Animal Usage in Testing?

- a) Welfare and Ethical Reasons
 - Animals are sentient beings
 - Large number of animals are used currently in testing
 - Societal concern
- b) Scientific Reasons
 - Questionable relevance
 - Reproducibility
 - Keep track with progress
- c) Legal/Policy Reasons
 - Animal welfare laws/policies/rules
 - Trade laws
- d) Economics
 - Costs
 - Labour intensive
 - Time consuming

13.6.3 Alternatives to Animal Usage in Research

In Unit 12 (MAW-004), we discussed the guidelines on welfare of laboratory research animals issued by the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA). In Unit 20 (MAW – 002) we discussed the 3 R's concept (Reduction, Refinement and Replacement) along

with 4th R (Rehabilitation), which provide a framework for improving the conduct and ethical acceptability of experimental techniques on research animals.

- **Reduction:** Any strategy that will reduce number of animals being used in laboratory research.
- **Refinement:** Modify experimental procedure to minimise pain and increase quality.
- **Replacement:** Methods which avoid or replace the use of animals in laboratory research with other options like 3D models.
- **Rehabilitation:** It refers to aftercare rendered to animals that have been:
 - o Bred for the purpose of experimentation
 - o Subject to any form of experimentation
 - o Retained in animal/breeding houses for further experiments or for education

The sole purpose of rehabilitation is alleviating the pain or suffering due to experimentation and to prolong the life of the animals until the point of natural death. Of late, the CPCSEA has also made it a national policy that persons using laboratory animals have a moral responsibility towards these animals after the experimental use. Costs of rehabilitation of animals after the experiments are to be part of research costs.

Activity 2 (Visit & Discussion): Visit a nearby veterinary college or any college with zoology or life science departments. Discuss with faculty/students about VCI (2016) regulations/UGC guidelines on alternatives to animal usage in teaching. What alternatives they are practicing? Discuss with them the scope, limitations and acceptability of alternatives to animal usage in teaching. Write your findings and observations.

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Check Your Progress 2

Note: a) Use the spaces given below for your answers.

b) Check your answer with those given at the end of the unit.

1) What is meant by Plastination?

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2) What do you understand by a model?

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3) What are the advantages of wooden models?

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16.7 LET US SUM UP

- The use of alternatives will reduce the pain and suffering of animals during the live demonstrations.
- Animal models can be vital alterative tools to teach basic veterinary courses.
- In the beginning, the complete acceptability of alternatives is debatable. However, once the concept of animal welfare is conceived in their thinking, the use of alternative inanimate models can be a much acceptable part of their learning experience.
- The skills that can be learned and the confidence developed during the handling of alternative animal models help students in their later professional practice. Therefore, every university should have alternative teaching models to fulfill the welfare obligations.
- In any ethical debate reduction in the number of animals in testing and the possible alternative methods should be taken into account.

- 4 R's (Reduction, Refinement, Replacement and Rehabilitation) provide a framework for improving the conduct and ethical acceptability of experimental techniques on research animals.

13.8 KEYWORDS

Alternatives: An alternative to an animal experiment/teaching is any procedure or method that is meant to replace a particular science-based procedure that may harm the interests of animals, to reduce the numbers of animals required, or to refine the procedure in such a way that the welfare of the animals in the procedure itself or in its context, is optimised.

Flash Based Modules: They help in reducing the number of animals used for dissection and consumption of chemicals like formalin.

Models: Smaller or larger physical copy of an object or live animal.

Plastination: It is the process of infiltrating specimens with synthetic materials.

Willed Body Programme: It allows people to donate animal bodies (willingly) after death for academic purposes.

13.9 BIBLIOGRAPHY AND FURTHER READING

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Web Resources

UGC Guidelines (2011) for Discontinuation of Dissection and Animal Experimentation in Zoology/Life Sciences

https://www.ugc.ac.in/pdfnews/6686154_guideline.pdf

Plastination Technique

<https://bodyworlds.com/exhibitions/animals/>

13.10 SELF ASSESSMENT EXERCISES

- 1) Write the general benefits of models as alternatives to animal usage.
- 2) Alternatives to animal usage do not involve the harming or killing of animals and indirectly provide a lesson in compassion. Comment.
- 3) Name different alternatives to animal usage in teaching. Discuss any two of them with suitable examples.
- 4) Discuss the significance of 4 R's in improving the conduct and ethical acceptability of experimental techniques on research animals.
- 5) What are the arguments for and against the use of animals in testing?

13.11 ANSWERS/HINTS TO CHECK YOUR PROGRESS

Check Your Progress 1

- 1) The UGC issued guidelines in 2011 for discontinuation of dissection and animal experimentation in Zoology/Life Sciences in a phased manner. The Indian Veterinary Education Regulations also approved to end calf killing and reduce other cruelty in veterinary colleges. The AWBI has taken steps to ensure that the dissections and practical demonstrations on animals in schools/colleges are replaced by other models as an alternative to animal usage in teaching.
- 2) Veterinary Anatomy, Physiology, Pharmacology, Surgery practical classes and clinical internship trainings in veterinary colleges require large number of animals. These subjects need animals for basic demonstration of the concept of handling animals, anatomical features and demonstrations for skill development. Animals experience stress, pain and suffering before, during and after demonstration/handling. Therefore, we should look for some alternatives from the animal welfare perspective.
- 3) An alternative to animal usage is any procedure/method/technique/approach that are meant to replace a particular science-based procedure that may harm the interests of animals, to reduce the numbers of animals required, or to refine the procedure in such a way that the welfare of the animals in the procedure itself or in its context is optimised.

Check Your Progress 2

- 1) Plastination is the process of infiltrating specimens with synthetic materials.
- 2) A model is a smaller or larger physical copy of an object or live animal. The models can be made up of rubber, plastic, fiber, plaster of Paris, or cement. These physical models offer 3D view to the observer.
- 3) Wooden replica of animals and their body parts are one of the cheap, readily available, and portable alternatives to animal handling. Wooden body part replicas also minimize the frequent use of live animals as they can last longer as compared to rubberized counterparts.