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COURSE TITLE: ANIMAL HANDLING & COMPARATIVE MAMMALIAN GROSS ANATOMY

COURSE CODE: ANA 314

QUESTIONS

1) What is comparative anatomy

2) highlight the criteria necessary to caring for laboratory animals

3) highlight the similarities and differences in the digestive system anatomy of amphibians

ANSWERS

1. What is comparative anatomy?
   Comparative anatomy is the study of similarities and differences in the anatomy of different species. It is closely related to evolutionary biology and phylogeny (the evolution of species).
   The science began in the classical era, continuing in Early Modern times with work by Pierre Belon who noted the similarities of the skeletons of birds and humans.
   Early evolutionary scientists like Buffon and Lamarck used comparative anatomy to determine relationship between species. Comparative anatomy is an important tool that helps determine evolutionary relationships between organism and whether or not they share common ancestors.
   Comparative anatomy has provided evidence of common descent, and has assisted in the classification of animals.

Two major concepts of comparative anatomy are:

I. Homologous Structures: structures (body parts/anatomy) which are similar in different species because the species have common descent and have evolved, usually divergently, from a shared ancestor. They may or may not perform the same function. An example is the forelimb structure shared by cat and whales
II. Analogous Structures- - structures similar in different organisms because, in convergent evolution they evolved in a *similar environment*, rather than were inherited from a recent common ancestor. They usually serve the same or similar purposes. An example is the streamlined torpedo body shape of porpoises and shark So even though they evolved from different ancestors, porpoises and sharks developed analogous structures as a result of their evolution in the same aquatic environment. This is known as a homoplasy

Uses Of Comparative Anatomy

Comparative anatomy has long served as evidence for evolution, now joined in that role by comparative genomics; it indicates that organisms share a common ancestor.
It also assists scientists in classifying organisms based on similar characteristics of their anatomical structures. A common example of comparative anatomy is the similar bone structures in forelimbs of cats, whales, bats, and humans. All of these appendages consist of the same basic parts; yet, they serve completely different functions. The skeletal parts which form a structure used for swimming, such as a fin, would not be ideal to form a wing, which is better-suited for flight. One explanation for the forelimbs' similar composition is descent with modification. Through random mutations and natural selection, each organism's anatomical structures gradually adapted to suit their respective habitats. The rules for development of special characteristics which differ significantly from general homology were listed by Karl Ernst von Baer

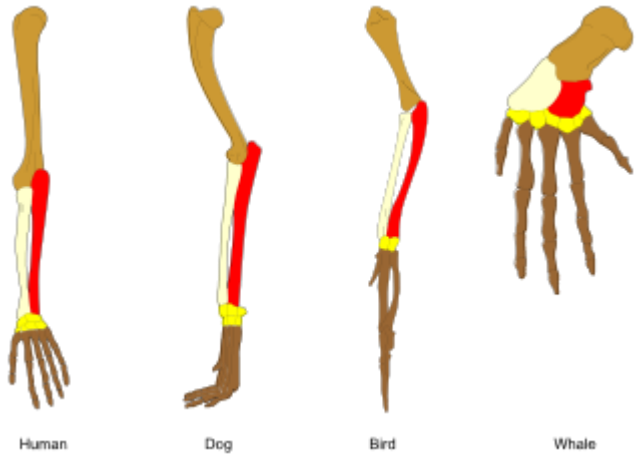

DIAGRAM SHOWING HOMOLOGOUS BONES IN THE UPPER LIMB OF VARIOUS VERTEBRATES

SOURCE:https://kenhub.com/

2. highlight the criteria necessary to caring for laboratory animals

I. HOUSING: Cages, pens, or runs should provide adequate space to allow for normal physiologic needs, permit postural adjustment, and meet requirements for species specific behaviour. Primary enclosures should be constructed of durable materials, easily cleaned and sanitized, and designed for comfort and safety.

II. TEMPRATURE: Temperature, relative humidity, ventilation rates, lighting conditions (spectrum, intensity, and photoperiod), gaseous pollutants (eg, ammonia), and noise should be carefully controlled at all times and monitored as appropriate. Unstable environmental conditions can have a profound effect on the comfort, well-being, and metabolism of animals and therefore on the quality of experimental data derived. In general, temperature should be maintained at 68°–79°F (20°–26°C) for most rodents; 61°–72°F (16°–22°C) for rabbits; 59°–64°F (15°–18°C) for ferrets; 64°–84°F (18°–29°C) for primates, dogs, and cats; and 61°–81°F (16°–27°C) for most farm animals and poultry. Within these ranges, optimal systems should maintain temperatures within ±1°F of the set point. Relative humidity should be maintained at 30%–70% for most species and preferably within 10% of the set point. Ventilation rates should be 10–15 fresh air changes/hr. Air should not be recirculated unless it has been treated to remove particulate and gaseous contaminants.

III. LIGHTING: Lighting should be distributed evenly and sufficiently intense to promote animal well-being and to allow personnel to observe the animals and to perform all husbandry and sanitation duties safely and effectively

IV. Bedding: Bedding materials should be nonirritating, absorbent, free of chemical contamination and pathogens, and unpalatable. Adequate quantities should be used to dilute and limit contact with excreta, promote air quality and other environmental factors by suppressing microbial growth, and keep animals dry and clean between changes of bedding or caging. The major types of contact bedding used are derived from ground corncobs, hardwood chips, recycled paper, heattreated softwood shavings, and virgin cellulose. Untreated softwoods are not recommended because they contain volatile oils that may alter hepatic enzyme systems and affect certain kinds of research. Depending on research requirements, bedding may be sterilized by autoclaving or irradiation before use or used as is.

V. Feeding: Feed should be of adequate quantity, palatable, free of contaminants, nutritionally adequate, easily accessible, and provided

using means that meet behavioral needs according to specific species requirements. Feed should be manufactured, transported, stored, and used in ways that minimize its deterioration, contamination, or infestation. Most small animals consume food in relation to their energy requirements as influenced by the environment and dictated by their genotype and are fed ad lib; rabbits, laboratory carnivores, swine, aquatic amphibians, and primates may be restricted to measured quantities of feed each day. As a general rule, laboratory animals minimally consume 4%–6% of their body weight in food daily. In addition to commercially prepared and usually pelleted natural ingredient diets of varying specification (eg, quality control and assurance of ingredients), semisynthetic or completely synthetic diets and all-liquid preparations can be formulated for use in certain kinds of research. Autoclavable or irradiated diets are available for rodents and can be used when sterilization of feed is desired.

VI. Water: Water quality is the most important environmental variable for aquatic species and a key determinant of health Potable, uncontaminated water should be provided in adequate quantities to meet specific species requirements. Quality assurance programs that measure pH, hardness, chemical content, and microbial load are recommended. Highly purified, deionized, acidified, chlorinated, or sterile water may be required under certain experimental or husbandry conditions. Water is usually provided ad lib in manually filled or automated watering devices. Particularly in the housing of rodents, an automated water supply enhances the advantages of ventilated caging systems and reduces operational costs/expenses, increases safety for animal care technicians, saves labour, reduces disruptions of the mice by caretakers, and provides consistently high water quality. The drawback of the use of automated drinking water supply for rodents is the risk of hypothermia, drowning, or dehydration of cage inhabitants as a consequence of failure of the in cage water delivery valve.

VII. Sanitation: Housing rooms and ancillary support space should be cleaned and sanitized as often as necessary to keep them free of dirt, debris, and potentially harmful contamination. For rodents in solid-bottom cages, usually 1–3 changes per week will suffice; for rodents, rabbits, and nonhuman primates in suspended cages over excreta pans and for mice in ventilated caging systems, cage changes every other week should be adequate. For larger animals, excreta and soiled bedding should be removed daily, and primary enclosures cleaned and sanitized daily, or at minimum every other week. Water bottles and

other watering or feeding devices should be cleaned and sanitized at least weekly. Automated watering devices on cages, racks, or in rooms should be designed and programmed to flush continually or regularly or they should be manually drained, rinsed, and sanitized at regular, frequent intervals. All caging and other equipment should be rinsed thoroughly after treatment with detergents or disinfectants.

VIII. Vermin control: Professionally directed programs to prevent, identify, and eradicate or control insects or escaped, feral, or wild rodents must be instituted, regularly scheduled, and consistently documented. The use of pesticides should be as a last resort and generally be confined to areas not used for animals or for storage of feed or bedding. If these agents are used in proximity to animals or their food and bedding, researchers should be informed of the use. Relatively inert substances, such as silica aerogel or boric acid powder, are recommended and are useful for control of crawling insects, eg, cockroaches

3. highlight the similarities and differences in the digestive system anatomy of amphibians

   Similarities between man and amphibians (Frog)

   I. They both have teeth
   II. Presence of oesophagus
   III. Presence of tongue
   IV. Presence of mouth
   V. Presence of small intestine

   Difference:

Man digestive system.	Frog digestive system
Chewing is a mechanical digestion in humans	Frogs swallow their prey without chewing.
The tip of the tongue is straight	The tip of the tongue is folded backwards
Man has a longer small intestine and the three parts of the intestine are duodenum, jejunum and ileum.	Frogs have shorter intestine and the two parts of the intestine are the duodenum and ileum.
Absorption of nutrient of man occurs in the jejunum.	Absorption of nutrients of frogs occurs in the ileum.
Elimination of undigested food occurs through the rectum.	Elimination of indigestion occurs through the cloaca.