Describe formation and laying of eggs in chickens. How are eggs formed? How many are in a clutch? What external factors control laying in chickens?

Vaccinations and Disease Control

Many diseases in chickens can be controlled by vaccination of breeding hens to produce disease-free chicks or by vaccination of chicks themselves. It is always best to get chicks from a breeder or hatchery that is part of the National Poultry Improvement Plan. Any drug therapy must be evaluated for its use in laying hens as it may affect use of eggs layed by treated hens or ability of the owner to use those hens for meat. Indiscriminate use of antibiotics will not consistently prevent or control disease in flocks.

Overall, to prevent disease in backyard poultry, the following steps should be taken:

- Purchase birds from breeders or hatcheries that follow the National Poultry Improvement Plan.
- Thoroughly clean the coop to remove organic materials before disinfecting; cleaning and disinfection of the coop and tools (feeding scoops, rakes, etc.) should be performed daily.
- Restrict human traffic in and out of the area where the birds roam.
- Protect the chickens from exposure to wild birds including waterfowl.
- Properly dispose of dead birds (follow local ordinances).

Diseases of concern include:

- Infectious bronchitis
- Newcastle disease
- Laryngotracheitis
- Fowl pox
- Infectious coryza
- Mycoplasma
- Fowl cholera
- Marek's disease
- Avian influenza

Infectious Bronchitis

This is probably the most common respiratory disease of chickens. It is caused by a coronavirus with variable antigenicity; new serotypes arise regularly. Signs and severity of disease vary with the specific coronavirus, age of the bird, and presence of any secondary infections. The virus is highly contagious and spreads readily between birds by direct contact, aerosol spread, or via fomites (inanimate objects). Spread of the disease through a flock is worsened by poor ventilation and overstocking of birds. Clinical signs include depression, loss of appetite, coughing, gasping, and diarrhea. This disease is best controlled by vaccination.

Newcastle Disease

This is a highly contagious disease caused by paramyxovirus-1. This is a high morbidity disease with depression, loss of appetite, respiratory signs, twisted neck (stargazing), and leg paralysis. The disease is transmitted between and within species of birds, via aerosols, and by

fomites including visitors to the facility. This disease is best controlled by vaccination.

Laryngotracheitis

Infectious laryngotracheitis is caused by a herpesvirus with variable pathogenicity. Spread between birds is slow but the disease can be spread between farms by fomites or aerosol spread. Signs include gasping, coughing up of mucous and blood, and ocular and nasal discharge. The hallmark clinical sign for this disease is "pump handle respiration", which is where the bird is trying to breathe in such a way that its head goes up and down, looking like an old well pump handle. Control is through vaccination if the disease is enzootic (regularly present in a population) or epizootic (a sudden widespread outbreak) in an area. Sick birds that recover and vaccinated birds should be housed separately from susceptible birds. Infectious laryngotracheitis is a reportable disease in Minnesota.

Fowl Pox

Fowl pox is a pox virus that manifests as skin lesions and pharyngeal plaques. Fowl pox can have both dry and wet forms. Respiratory signs are evident only with the wet form. The wet form of this disease can present very similarly to infectious laryngotracheitis. Spread through a flock is slow. Transmission is through skin abrasions or by the aerosol route; birds, mosquitoes, and fomites may transmit the virus. The disease is more common in male chickens because of their greater tendency to fight and suffer skin wounds, and in areas where there are biting insects. Birds will be sick for about 2 weeks and there is no effective treatment. This disease is best controlled by vaccination.

Infectious Coryza

This is a chronic, highly infectious disease of chickens caused by *Avibacterium* (formerly *Haemophilus*)

paragallinarum. There is rapid transmission through direct contact between birds in a given flock. Signs include swelling of the face and wattles, purulent ocular and nasal discharge, sneezing, and dyspnea. Various antibiotics may be used for treatment but the disease is best controlled by stocking birds only from known disease-free breeders or hatcheries. Vaccinations may be used in areas of high incidence.

Mycoplasma

Chronic respiratory disease due to *Mycoplasma gallisepticum* or *Mycoplasma synoviae* may be seen in chickens. The organism can be spread through aerosols, airborne dust or feathers, or by direct contact. Recovered birds remain infected for life and may express disease when stressed. Birds show respiratory signs as described above and also may show arthritis. Treatment with some antibiotics is possible; secondary disease conditions must be addressed and the environment cleaned. The disease is best controlled by stocking birds only from known disease-free breeders or hatcheries.

Fowl Cholera

Pasteurella multocida is the bacterial cause of this highly contagious, high mortality disease in chickens. Transmission is through direct contact with nasal exudate or feces of infected birds, or via fomites including contaminated soil, equipment, and workers. Clinical signs include loss of appetite, ruffled feathers, coughing, ocular and nasal discharge, swollen face and wattles, arthritis, and diarrhea. Risk of disease is worsened if concurrent infections are present or if birds are overstocked. Treatment with antibiotics is possible but disease may redevelop after medication is stopped. The disease is best controlled by vaccination.

Marek's Disease

Marek's disease is caused by a herpesvirus that has several manifestations. Neurological disease may be evidenced as paralysis of the legs and wings. The visceral form is evidenced as growth of tumors in the cardiac and skeletal muscle, lungs, and reproductive tissues. The cutaneous form is evidenced as tumors in the feather follicles. Peripheral nerve enlargement and "Marek's eye" also may be seen. Mortality in affected chickens is 100%. The route of infection is through the respiratory tract and transmission may occur through exposure to affected feather dander or via fomites. There is no treatment. The disease is best controlled through vaccination of chicks. A combination of vaccines commonly is used to ensure broad immunity is induced. Genetic resistance exists and breeders may select for stock with increased frequency of the gene that confers this protection. Again, chicks should be purchased through breeders or hatcheries that provide vaccinated birds.

Avian influenza

Avian influenza is caused by a influenza type A virus and can infect domestic and wild poultry and waterfowl. Low pathogenicity avian influenza is commonly carried by migratory waterfowl. It can infect domestic poultry but rarely causes illness. Highly pathogenic avian influenza (HPAI) is extremely infectious, spreading rapidly between flocks, and causes serious illness or death. Clinical signs of chickens infected with HPAI include depression; difficulty breathing; swelling or purple discoloration of the head, comb, and wattle; decreased egg production; and sudden death. Avian influenza is a reportable disease in Minnesota. Owners of backyard flocks are recommended to protect their flock from HPAI by avoiding attracting wild birds, especially waterfowl by enclosing feed and reducing standing water, limiting movement of chickens to and from

the property (for example, to attend shows or sales), and limiting visitors to the property that interact with the birds. Good information is available from the University of Minnesota Extension Service and the USDA.

External Parasite Control

External parasites found in birds include:

- Biting lice
- Feather and leg mites
- Red mites and northern fowl mites

Biting Lice

Lice are spread by direct contact between birds and from infested litter. Life cycle of the parasites is about 3 weeks. Rapidly moving insects will be visible at the base of the feathers on the abdomen or around the vent. Clumps of eggs (nits) may also be visible at the base of the feathers. Various powders and sprays are approved for application on birds including malathion and pyrethroids. Treatment may need to be repeated as not all life stages of the parasite are killed by these drugs. Prevention involves inhibiting exposure of chickens to wild birds and regular removal of infested litter.

Feather and Leg Mites

These parasites cause chickens to pull out feathers and cause thickening of the scales on the legs. Mites are visible on scrapings but not with the naked eye. Conditions may be treated by dipping the affected part in a parasiticide or by applying mineral or vegetable oil. Prevention involves inhibiting exposure of chickens to wild birds. In small

flocks with ongoing problems, culling of affected birds might be considered.

Red Mites and Northern Fowl Mites

These are blood-sucking mites that may transmit diseases including fowl cholera. The grey or red mites may be visible to the naked eye. Affected birds are restless and may have pale combs and wattles. Young birds may die from anemia. Control of mites in the environment and on the birds is vital for treatment and control. Pyrethroids, organophosphates, and carbamates may be used, and other treatments include use of citrus extracts, mineral oil, and vegetable oil. The environment must be thoroughly cleaned and fumigated. Cracks in the environment should be filled in and the birds and environment regularly monitored so disease can be controlled before birds are severely affected.

Internal Parasite Control

Internal parasites found in birds include:

- Coccidia
- Gapeworm
- Roundworms
- Cecal worm
- Tapeworm
- Hairworms or capillary worms

Coccidia

Coccidia are protozoan parasites. Various species of coccidia infect different regions of the intestinal tract. Affected chickens are depressed, and have ruffled feathers

and poor appetite. They may have diarrhea and show depigmentation. Chickens commonly are provided with coccidiostatic drugs, such as sulphonamides or amprolium, in their feed or water.

Gapeworm

Syngamus trachea is a nematode parasite that infects the trachea of chickens. Infection is via the oral route by ingestion of earthworms, slugs or snails, or by direct ingestion of gapeworm eggs. The condition is more common in birds maintained on soil or kept on pasture. The birds stand with their mouths agape and show dyspnea and loss of appetite. The condition is treated and prevented by administration of drugs such as flubendazole in feed.

Roundworms

Roundworms are nematodes of the *Ascaridia* species. Infection is via ingestion of roundworm eggs. Affected birds may be asymptomatic or may show poor growth, depression, and diarrhea. Treatment with various anthelmintics is curative. Prevention involves keeping feeders and waterers clean of droppings and rotating on which pastures birds are housed.

Cecal Worm

Heterakis gallinarum is a nematode that infests the ceca of chickens that feed off the ground. The worm itself is not that pathogenic but it may carry a protozoan parasite, *Histomonas meleagridis*, that causes blackhead disease. Transmission of cecal worms may be by direct ingestion of worm eggs or by ingestion of earthworms that have ingested the eggs. Treatment is possible using various anthelmintic drugs. Chickens may be housed on hard surfaces or hardware cloth placed over soil to prevent ingestion of earthworms.

Tapeworm

Tapeworms are regularly transmitted through

invertebrate hosts such as earthworms or beetles and are therefore more common in birds housed on soil. Most birds show no clinical signs of disease but may show lack of weight gain or unthriftiness. Treatment with various drugs is possible but care must be taken to evaluate withdrawal times.

Hairworms or Capillary Worms

Hairworms are nematodes of *Capillaria* species that may infest the esophagus or crop. Infection is via ingestion of eggs; transmission through ingestion of earthworms also is possible. Most birds show no clinical signs but birds may show unthriftiness or die acutely. Treatment is with anthelmintic drugs. Prevention is through control of exposure to earthworms and thorough cleaning of the environment.

Describe as you would for a client general considerations to control internal and external parasites in chickens.

Behavior

Aggression, including pecking out the feathers or pecking at the vent of another bird, are not uncommon behavior problems in flocks of chickens. Any underlying causes of stress including overcrowding, unsanitary conditions, and presence of disease, should be identified and addressed. Observation of the flock may identify one individual that is particularly aggressive; that individual may need to be removed. Beak trimming may prevent the problem but does not address underlying stresses and is considered unethical in some countries.

Backyard birds value enrichment. Physical forms of enrichment include changes in the environment (for example, creating areas for birds to perch or fly to such as arrangements of logs and branches) and dust baths (shallow pans of sand / soil birds roll around in as a way to clean their feathers and control parasites). Nutritional forms of enrichment include anything that makes them work for their food, such as pushing a stick through an apple and sticking it into the ground for them to peck at, making a hole through a cabbage and hanging it up for them to peck at, freezing fruits and vegetables in water in a pan and then turning it out – this is a particularly good form of enrichment on hot summer days – or dropping a pumpkin from a height and letting the birds find all of the seeds and broken bits.

Biosecurity

Diseases of concern that can be passed from chickens to people include bacterial diseases such as salmonellosis, psittacosis, and tuberculosis; viral diseases such as influenza; fungal diseases such as histoplasmosis; and parasitic diseases such as giardiasis. Humans can decrease likelihood of contracting disease from chickens by wearing dedicated clothing to clean, feed, or handle the chickens; always washing hands after handling birds or equipment used with the birds; never eating or drinking in the area where the birds roam and never allowing birds into areas where human food and drink is prepared or consumed; and minimizing contact of live birds with the very old, the very young, and any immunocompromised people. The CDC has recognized a series of *Salmonella* outbreaks in

backyard chickens since 2015. They reported the following in 2019 regarding these outbreaks:

- There have been 1003 ill people reported from 49 states; 175 of these people have been hospitalized. Two deaths have been reported, one in Ohio and one in Texas. Most people infected with *Salmonella* develop diarrhea, fever, and stomach cramps, are ill for 4-7 days, and recover without treatment.
- An increase in *Salmonella* infection linked to live poultry usually is seen in the spring and summer, when more people are purchasing chicks. People who got sick in the 2019 outbreak reported getting chicks from places such as agricultural stores, websites, and hatcheries.
- People can get sick from *Salmonella* after touching poultry or the places where they live and roam. Birds carrying the bacteria may appear healthy and clean.

The following are their recommendations for backyard flocks and their owners:

- Do not snuggle with or kiss birds or touch them anywhere near your mouth.
- Do not permit poultry into the house.
- Remember that backyard poultry are not like family dogs, no matter how much you love them.

Some clients may ask whether or not they can slaughter

their chickens when they are no longer laying. Live slaughter is not permitted at a residence anywhere in the Twin Cities. There are processors to which you can refer these clients, for example, Long Cheng – Hmong Livestock and Meat Processing plant in South Saint Paul.

Nutrition

It is recommended to feed a commercial ration to ensure proper nutrient balance. Make sure that young birds are fed a starter or grower ration and not a layer ration, which is much higher in calcium and could cause improper bone growth or renal failure if fed to young birds. Laying hens must be fed a layer ration and can also be provided with supplemental calcium. Birds can be provided with scratch grains (cracked, rolled or whole corn, oats, barley, or wheat) but this should be less than 10% of the total food provided daily. Grains may be soaked to make them easier to digest. Grit also may be provided if scratch grains are offered, to help birds break down these grains. Birds on grass or pasture also may eat grass and insects. Other sources of food for chickens include greens (fruits and vegetables) and mats of oats or wheat grass. Chickens will also eat mice (they can be good mousers in a farm setting) and frogs.

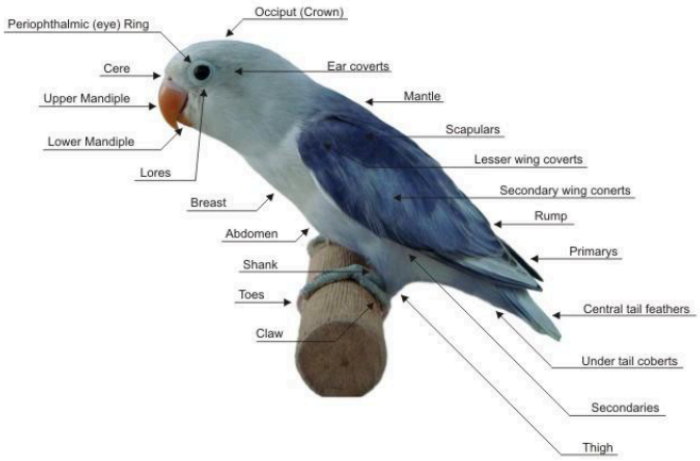
All feed must be maintained in containers that are airtight and watertight and that cannot be accessed by rodents.

Fresh water must be available at all times and in winter, care must be taken that water does not freeze.

Describe differences in rations between young birds and laying hens.

CAGED BIRDS

Unique Anatomy – External



"Standard bird body parts of a psittacine (parrot-like) bird", http://www.sciencepartners.info/module-6-birds/bird-anatomy-bones-muscles/bird-anatomy-from-the-outside-in/

Many caged birds are parrot-like, but you also may work with finches, doves, and other types of caged birds.

Two specific parts of the head we talk about in caged birds are the lores and the cere. The lores are the spaces between the top of the beak and the eye. The cere is a fleshy mass at the top of the beak within which the nostrils are located. All birds have lores and a cere but the cere is especially prominent in psittacines. Species of birds show differences in size and structure of the beak dependent on their primary diet.

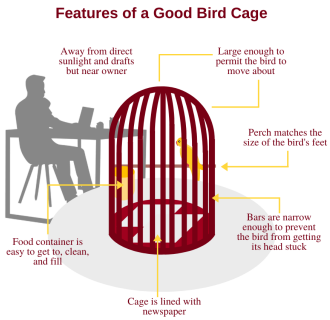
What are the lores? The cere?

Unique Anatomy – Internal

Internal anatomy of caged birds is generally very similar to that of chickens with the exception of the reproductive tract. Depending on the species, it may be unilateral (as in chickens) or bilateral. In most species of caged birds, females have a unilateral reproductive tract on the left side. Knowledge of specifics of the reproductive tract is valuable as direct observation of the gonad of a bird by laparoscopy (surgical sexing) is one method of determining sex of birds from species that are not sexually dimorphic.

Specifics of anatomy and other information about caged birds can be found in the Manual of Exotic Pet Practice, pp 250-298.

Housing



Most companion birds will be caged for the majority of the day. The cage should be placed away from direct sunlight and drafts. Exposure to natural light is important in some species of birds as it may alter molting, egg-laying, and singing behaviors. Many birds appreciate placement of the cage where they can see and interact with their owners. Cages generally should not be put in a kitchen or in any area of the house where chemicals or any other products that give off strong vapors are used or stored. Cages must be large enough to permit the bird to move about and spread its wings. The bars of the cage may be made of a variety of metals and may or may not be painted / powder-coated. Birds often chew at their enclosures so only non-toxic and durable products should be used. Bars of the cage should be narrow enough to prevent the bird from sticking its head through and getting caught. The cage should be easy to clean completely, with water and food containers that can easily be filled and an easy way for the owner to clean the floor of the cage. Cages often are lined with some sort of disposable material, such as newspaper, to facilitate removal of feces; this should be changed at least every 2-3 days. Any spilled seed or seed hulls should also be cleaned from the cage every 2-3 days to prevent insect infestation. Perches should be appropriate for the size of the bird's feet and should be cleanable. Any toys or other enrichment should be appropriate for the size

of the bird. For example, toys for budgerigars should be not given to large parrots, who may chew them apart and ingest small pieces.

Vaccinations and Disease Control

While there are a variety of viral diseases that can infect caged birds, the only one for which a vaccine is available is polyomavirus. This disease causes death in birds ≤ 4 months of age. Prevalence of the virus in adult birds, who are asymptomatic, is considered to be high so there may be little use in vaccinating birds other than those used for breeding or in facilities with a known problem.

Parasite Control

Caged birds rarely can be infected with internal parasites including roundworms, tapeworms, and *Giardia* sp. Intestinal parasites can be identified by fecal flotation or direct inspection and are treated as in other species. More commonly in birds, parasite concerns are due to infestation with external parasites, usually mites causing feather picking and hyperkeratosis of the beak and legs. Mites can be identified by direct inspection or by skin scraping or by microscopic evaluation of skin and feather debris collected with cellophane tape. Mites are treated on the bird and in its environment with sprays or other direct formulations.

Behavior

See Behavior chapter.

Biosecurity

There are very few zoonotic diseases of concern. Psittacosis (*Chlamydia [Chlamydophila] psittaci*) is the most common, with fewer than 100 cases reported in the United States annually. Affected birds generally are not clinically ill.

Nutrition

All birds require a source of clean water at all times. Nutrition varies with the species of birds, as some require primarily a seed-based diet (for example, canaries) and others do better with a pelleted diet and fresh fruits and vegetables (for example, budgerigars). Fruit should be offered no more than 2-3 times weekly. Dark green, red, and orange vegetables can be offered daily. Fresh fruits and vegetables should be offered in a separate dish from pelleted food; pelleted food can be available at all times but the fruits and vegetables should be offered for only 30-60 minutes and then removed to prevent spoiling. Birds should never be given avocadoes, onions, garlic, fruit pits or seeds, high-sugar or high-fat foods, or chocolate. Seeds or pellets should be purchased as fresh as possible to minimize loss of nutrients in storage and should be stored to prevent infiltration of insects, especially seed moths. Most caged birds do not require a calcium supplement unless they chronically lay eggs, but calcium supplementation in the form of cuttlebone is inexpensive and also provides enrichment.

Describe as you would for a client the nutrition requirement for a parakeet (budgerigar).

FISH

Unique Anatomy and Classification

There are over 20,000 species of fish and over 1000 have been kept in captivity. Fish can be separated into fresh water, brackish water, and salt water species. Among the freshwater fish, there are temperate and tropical species. Temperate species are sport or game fish, such as sturgeon, pike, walleye, bass, trout, sunfish, and eels. These generally are not kept as pets. In Minnesota, game fish can be kept in a tank legally if they are purchased from a dealer that is licensed by the Department of Natural Resources. The fish maintained in the tank count toward the state angling possession limit for that species.

Freshwater tropical fish are those most commonly maintained in home fish tanks.

FAMILY	COMMON EXAMPLES
Characins	Tetras
Cyprinids	Goldfish, carp (koi are an ornamental mutation of
Catfish	Catfish
Killifish	—
Rainbowfishes	—
Gouramies	Bettas
Livebearers	Mollies, Guppies
Cichlids	Angelfish

Bony fishes are covered with scales and an overlying mucous coat. These serve to protect the fish from trauma and from invasion of pathogens. The scales also provide camouflage or are used for signaling behavior within or between species. When handling fish, it is good to minimize loss of scales or mucous.

External anatomy of a fish, http://www.aquatic.uoguelph.ca/fish/intro/morphology/external.htm

Fish have paired pectoral and pelvic fins, and single dorsal, anal, and caudal fins. The dorsal fin is made of two parts in some species. Fins are used for steering, balancing, and braking.

The primary respiratory organs are the gills. The gills are covered by the bony operculum. The gills absorb oxygen, excrete ammonia and carbon dioxide, and regulate

absorption and excretion of ions and water. Fish have a simple 2-chambered heart. The lateral line is a mechanosensory structure that permits the fish to sense changes in sound waves and water pressure. There is great variation in the gastrointestinal tract of fish by species. Carnivorous species have a much shorter GI tract than do herbivorous species. Not all species have a stomach. Some species have pyloric cecae that secrete digestive enzymes. Fish have a large liver and a single large kidney with anterior and posterior segments. Another abdominal organ is the swim bladder or air bladder; this is a gas-filled single or double sac that enables fish to maintain depth without expending energy by swimming.

Housing

The environment provided for fish is a miniature ecosystem within which the fish, the water, the substrate, and anything else added to the tank all play a part. Tanks are preferred to bowls for fish as it is easier to create a stable environment for the fish in a larger volume of water. In general, larger tanks are better for the fish than are smaller tanks. Required temperature in the tank varies with the species of fish. Some require very warm water but that is not true of all tropical fish. Fish can tolerate a variation in temperature of about 10°F. Type of light required again varies by species but in general, full spectrum fairly bright light with a 12-hour dark:light cycle is appropriate. Filtration of the water to remove wastes is required. The filter often also contains a system for aeration of water to ensure oxygenation. The substrate in the tank is part of the overall ecosystem. Gravel is easy to clean. Development of a healthy bacterial community within the tank is important

and can be managed either with artificial introduction of bacteria (often through a filtering mechanism) or by permitting development of a fine sediment component to the substrate. Addition of artificial plants, tiny deep-sea divers, treasure chests and other inert objects provide places for fish to hide. Make sure they are approved for use in fish tanks so no unexpected compounds are added to the water and do not add so many that it overcrowds the tank. Live plants are more work to establish in the tank but provide shelter and security for the fish, add oxygen to the water, and compete with algae for nutrients, keeping down the development of algae within the tank. Algae also can be controlled by adding an algae-eating species of fish or snail to the tank.

High water quality is vital for health of the fish. Some pet stores provide free water quality testing. At-home kits can be purchased and commercial laboratories also provide water testing. Components of concern are concentration of waste products (ammonia, nitrites, nitrates), pH, and oxygenation. New tanks should be tested daily until the system stabilizes. Fish should be added very gradually to new tanks and stabilization permitted before new introductions. If a tank is set up with a large number of fish at once, acute mortality of all fish may result. In established tanks, 10-20% of the water should be replaced every 1-3 weeks and water quality should be evaluated intermittently.

Nutrition

Fish may be herbivores, omnivores, or carnivores. Most fish require a high percentage of protein in their diet and need dietary fat as a source of energy. Fish digest carbohydrates poorly and require very little carbohydrate

in their diet. Fish must be fed food that is appropriate for their species.

Vaccinations and disease control

Vaccinations are not commonly used to control disease in hobby fish tanks; vaccines are used in some commercial fish farming operations. Discussion of fish farming is beyond the scope of this course.

Parasite control

Preventive diagnosis and treatment of parasites is rarely done in hobby fish tanks except at the time of introduction to the tank (see Biosecurity).

Behavior

Fish may hide, dart around quickly, or spend time on the bottom of the tank as normal behaviors. Fish may fight and some fish naturally eat other fish. Attention must be paid to which species will not readily co-exist in a tank. Fish acting listless, swimming erratically, or gasping at the surface may be suffering from poor water quality or illness.

Biosecurity

New fish should be quarantined before being added to the tank. Length of quarantine varies with where the fish were purchased or captured; wild-caught fish are more likely harbor parasites or infectious diseases. Fish should

be checked for external parasites and other signs of disease and potentially treated for internal parasites before being added to a tank.

REPTILES

Many states prohibit ownership of venomous reptiles and large constricting snakes.

Many of the concerns we see as veterinarians are because reptiles are not fed and housed properly. A colleague from the class of 2022 offers the following suggestions to pass along to clients who tell you they are interested in getting a reptile as a pet:

- It is widely reported that the majority of pet reptiles (75-90%) die within the first year after purchase due to poor husbandry. Thoroughly research your reptile of interest before bringing them home and have their habitat ready to go before you purchase your new pet.
- Find a veterinarian who will see your reptile before purchase. In many rural areas, there are few to no veterinarians readily available with training and equipment or interest in caring for pet reptiles. Reptiles, like all pets, benefit from regular visits to a veterinarian.
- The majority of the reptile cases seen by veterinarians have problems due to inadequate

husbandry. When you take your reptile to a veterinarian, be prepared to answer questions about the ambient temperature, lighting sources, humidity level, and feeding protocol you use.

- It was once widely believed that reptiles could be euthanized at home by putting them in the freezer. It has been found that this is actually a very painful process for the reptile and is not considered an appropriate form of euthanasia due to animal welfare concerns. If you believe your reptile needs to be euthanized, that should be done by a veterinarian.

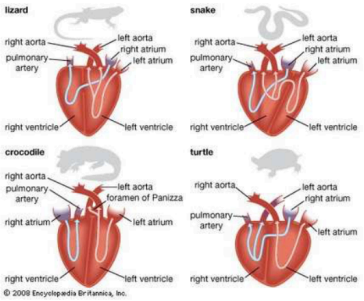
Unique Anatomy and Classification

The reptiles are a diverse group of animals. There are four orders of reptiles. The order Testudines includes turtles and tortoises. The order Squamata includes the suborders Serpentes (snakes) and Lacertilia (lizards). The order Crocodilia includes crocodiles, alligators, caimans, and gavials. The order Rhynchocephalia contains one or two species of tuatara from New Zealand. Most pet reptiles are from the orders Testudines and Squamata and that information will be the focus of this chapter.

Reptiles have an opening caudal to the tongue called the glottis that only opens when they are breathing. Snakes can extend their glottis laterally to permit them to breathe while eating. They have a trachea that bifurcates into two lungs. Reptiles do not have a diaphragm but do have ribs and breathing is controlled by the intercostal muscles with assistance from the muscles of the trunk and abdomen and smooth muscle in the lungs. There are significant

variations in the cardiorespiratory tracts of underwater species.

Reptiles are ectothermic (cold-blooded; depending on external heat sources to regulate body temperature). Like amphibians, reptiles have a preferred optimal body temperature that alters cardiac and respiratory function. This in turn will alter the absorption, metabolism, distribution, and excretion of drugs. Squamates (lizards) and chelonians (turtles and tortoises) have a three-chambered heart with a single ventricle; this ventricle does contain an incomplete septum that can permit the heart to function as if it has four chambers. Functionally they have a dual system that always has a potential of mixing oxygenated and deoxygenated blood. Crocodilia have a 4-chambered heart.



"Types of reptilian hearts", https://www.britannica.com/animal/reptile/Circulatory-system

Reptiles also have a renal portal system where blood from the caudal half of the animal (dorsal body wall, hind limbs, tail, urinary bladder, cloaca and reproductive organs) passes through the kidneys prior to returning to circulation. This allows for tubular excretion of nitrogenous waste during dehydration. This is of clinical significance when administering drugs.

All reptiles naturally are covered with scales. Some reptiles also have a specialized feature called osteoderms, which are bony deposits located within their scales or skin. This is of special consideration during imaging, surgery,

and injections. Some reptiles have been selectively bred to be scaleless, and extra care is required for these animals as they are more sensitive to dehydration and temperature fluctuations. With reptiles and amphibians, different color variations have been selectively bred and are referred to as morphs in the hobby. The care for these animals is often the same, but there can be genetic diseases that are strongly linked to certain morphs.

Snakes and lizards have teeth and may have more than one row of teeth on the maxilla and mandible. Tortoises and turtles do not have teeth and instead have a hard beak used for pulling apart their food; an appropriate diet is important to prevent beak overgrowth. Reptiles generally do not chew their food. Species that swallow their food whole have a highly distensible esophagus. Reptiles do have ureters and a urinary bladder and do produce liquid waste. Liquid and solid waste both are passed through the cloaca.

Reptiles may or may not have eyelids. In general, turtles and lizards have eyelids but some geckos do not. Snake eyes are protected with a transparent scale, called a spectacle, which is replaced when snakes shed. The tongue-flicking behavior of snakes and lizards reflects the use of the tongue to capture chemical cues from the environment that are then applied to the animal's vomeronasal (Jacobson's) organ to permit them to identify prey and dangers.

Snakes shed their scales in a normal process called ecdysis. Snakes have small overlapping scales on the dorsum and sides and have ladder-like short, wide scales on their ventrum, called scutes. New scales form over the entire animal under the old scales. Lymphatic fluid accumulates between the new and old scales, dulling the appearance of the skin and markings, and making the

spectacles (the scales over the eyes) opaque. The skin clears about 3-4 days before shedding begins. The snake will rub to start the shed and generally will shed the whole skin in one piece.

Specifics of anatomy and other information about all orders of reptiles can be found in the Manual of Exotic Pet Practice, pp 112-249.

Housing

Reptiles are solitary animals and prefer to be alone. A majority will fight or resource guard if another animal is present, especially if it is of the same sex. Sometimes this fighting will result in death or serious injury. Having more than one animal in the same enclosure causes undue stress on both, but especially on the less dominant animal. For these reasons, reptiles should be individually housed.

Nearly all reptiles need to be kept in enclosures with tight-fitting lids, with either weights or a lock to prevent escape. A screened lid is often used to permit ventilation, and can be partially covered to aide in proper humidity. Glass tanks work well for smaller animals. Larger animals, however, may require specially built structures. Many commercial reptile cages are made of plastic or glass making them easy to clean and sanitize. Cages need to be cleaned frequently to avoid buildup of waste and bacteria. Chlorine bleach solutions can be used for disinfection, however, cages need to be thoroughly rinsed and dried before the animals are returned to the environment. The size and shape of the habitat is dependent on the species, number of animals, activity requirements, and necessary enrichments. For example, a tree-dwelling (arboreal) snake

requires a higher enclosure than a burrowing (fossorial) snake.

The best guide for reptile habitat is to create one that closely mirrors its natural environment, including considerations of appropriate temperature and humidity. There are three types of habitats that meet the needs of most reptiles and amphibians. Aquatic habitats are appropriate for animals that are wholly aquatic. Semi-aquatic habitats are appropriate for animals that live on land and in water. They may be swimming species that come up on land for food or to sun themselves. Terrestrial habitats are appropriate for species that spend their lives on land.

Aquatic Habitats

Very few reptiles are fully aquatic, but many amphibians are fully aquatic during their larval stage of life. A typical setup includes a filtration and aeration system. This is especially important for tadpoles that cannot breathe air at the water surface. Mudpuppies prefer well-aerated tanks in which they can remain on the bottom and use their gills. Filtration is important because amphibians, like fish, generate ammonia as a waste product. Turtles are especially dirty, and require double the filtration power. Aquariums without filtration systems will need water changes every 2-3 days to prevent buildup of excrement and loss of oxygen. Substrate that cannot be ingested is ideal for the bottom of the tank. Large river stones or slate slabs are much better than sand or gravel, as there is no risk of impaction. Tap water must be treated before adding it to the tank as it often contains heavy metals in addition to chlorine. Chemicals used to treat the water for fish will work for reptiles and amphibians if the directions are followed. Allowing the water to sit in open containers for 48 hours to allow the chlorine to evaporate will get rid

of the chlorine, but not the heavy metals. Plants, rocks, and tree branches provide hiding places and mimic the natural habitat.

Semi-aquatic Habitat

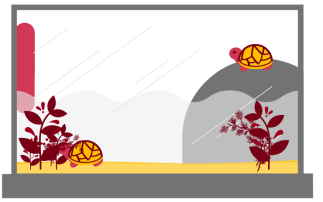
All animals kept in a semi-aquatic habitat need to have access to an area that allows them to leave the water completely and dry off if they so desire. Many turtles do well in a tank that is aquatic but has spots that allow them to exit the water completely and dry off. Depending on the species, you may wish to create a split tank. You can create a split tank by dividing an aquarium with a plexiglass wall, using silicon caulking to make each section water tight. In the dry area, create a terrestrial habitat, ensuring that you use substrate that the animal cannot ingest. Add leaves, bark, branches, and plants to make it more like a natural habitat. Ensure that the animal can easily go between the water and the terrestrial side. The water side should be similar to

Aquatic Reptile Habitats

Appropriate for animals that are wholly aquatic, especially amphibians, such as tadpoles

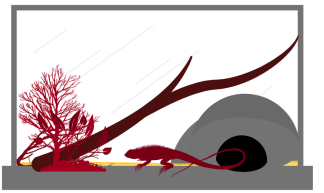
Semi/Aquatic Reptile Habitats

Appropriate for animals that live on land and in water, including swimming species that come up on land for food or to sun themselves



Terrestrial Reptile Habitats

Appropriate for species that spend their lives on land alone, including most lizards and many species of snakes



the aquatic habitat. The water side will need a strong filter with a guard, as the animals often drag substrate into the water.

Terrestrial Habitat

Many of the commonly kept reptiles require a terrestrial habitat. This entails a substrate that the animal cannot ingest, with a shelter and water bowl. Cage decorations such as fake plants and logs can be added to make the animal feel more secure. Be sure to include a bowl of water that the animal can submerge itself in if it so desires. The animal should be able to crawl into and out of the bowl freely.

Reptiles are ectothermic (cold-blooded; depending on external heat sources to regulate body temperature) and so require a heat source. When temperatures are too low, metabolism and activity decrease, leaving animals more susceptible to infections. Heating pads that lie under the tank and heat lamps are recommended. Heating pads should be connected to a thermostat to reach the desired temperature and reduce the risk of thermal burns or fire. Direct sources of heat, for example heat rocks, increase the risk for burns. Timers can be used to provide sufficient light and heat during the day with a decrease in temperature towards nightfall that mimics the natural environment. Aquatic and semiaquatic tanks will also need a way to heat water. A temperature gradient within the tank is important because these animals engage in behavioral thermoregulation to avoid overheating. The heat must be provided in a manner that permits the animal to move towards or away from the heat source to find their preferred optimum temperature zone (POTZ). Humidity must also be addressed as low relative humidity increases risk for dehydration and may impair normal shedding while too high relative humidity may predispose to skin infections.

A good way to address humidity is to provide a humid hide. This is a shelter filled with a moist substrate that the animal can access when required, such as before a shed. It can be as simple as a piece of Tupperware filled with damp sphagnum moss with an access hole cut into it. Species from tropical rainforests may need sprinkler or misting systems to replicate daily rainfall of their natural environments.

Fresh water should always be available. Most lizards will drink from a water bowl. Water should be changed daily because some lizards soak in or defecate in their water dishes. Some lizards do not recognize standing water as they lap dew in the wild, like chameleons. These animals should have systems that mist the vegetation in their cages in addition to water bowls. Daily misting can also be done by hand using a spray bottle.

Reptiles should only be kept on a substrate that they are not able to ingest. There are commercial sands available that contain calcium, but these become rock-hard when they have contact with water. Many reptiles suffer from impaction while being kept on substrate that they are able to fit in their mouth like sand or gravel. They are not precise hunters, and oftentimes ingest their substrate as they eat their food. A way to avoid this is by feeding the animals in a separate enclosure that has no substrate.

What are differences between the aquatic, semi-aquatic, and terrestrial habitat types?

Vaccinations and Disease Control

There are no vaccines recommended for control of infectious disease in reptiles. Any animal that has been kept in captivity should not be released into the wild, as they can transmit foreign diseases to local populations. Only animals raised and licensed for reintroduction should be released into the wild.

Parasite Control

Mites and ticks are not uncommon in wild-caught reptiles and are less common in healthy, captive-raised reptiles. The most common ectoparasitic mite to infest snakes and lizards is the snake mite *Ophionyssus natricis*. These mites are often vectors for diseases in reptiles and can be hard to eliminate. These mites tend to accumulate in the folds or indentations of the animal and often are found around the eye and the vent. Owners may be able to feel the mites crawling on them after handling their pet, or see the mites themselves; the mites are about the size of ground pepper. Clinical signs include decreased activity and abnormal shedding. Animals often will soak in water more than usual in an attempt to drown the parasites. The dead mites may be found in water dishes.There is a permethrin anti-parasitic agent that is approved for use in reptiles and other drugs, such as ivermectin, also have been shown to be safe and effective in some species. Ticks are readily visible and can be removed by hand or treated with medications as described above. Ticks may be associated with bacterial infections or anemia, which may require treatment as well.

All types of internal parasites are found in reptiles, although some are commonly associated with a given type

of reptile. For example, trematodes are most common in turtles and snakes while tapeworms and nematodes are found in all species. Clinical manifestations of disease are most common in animals housed in crowded or unsanitary conditions. Diagnosis is by fecal flotation or direct inspection and treatment varies with the type of parasite identified.

Behavior

Specifics of behavioral concerns in the many species of reptiles will not be addressed. Veterinarians are encouraged to work with owners to ensure they know the normal feeding, shedding / molting, and hibernation / estivation behaviors of their animals, so they can tell the veterinarian if something atypical is happening. It is suggested that the owner keeps a record book of when the animal is fed, what it was fed, what vitamins and minerals were provided, the weight of the animal, when the animal shed, when the animal defecated, and any abnormal behaviors noted.

Biosecurity

In order to prevent parasites like snake mites infecting other animals, it is advised to quarantine all newly acquired animals. The animal should be placed in a quarantine tank, which is the bare minimum of requirements in a simple set-up. This allows for easy observation of the animal and any treatment that it may require. This tank should be isolated away from other animals and cleaned daily after all other cages. The animal should be quarantined for a minimum of 30 days; 60-90 days is ideal.

Transmission of bacteria, most notably *Salmonella* sp.

between reptiles and humans is a very real concern, possible with many species but particularly of concern with small turtles, to the extent that since 1975, sale of turtles less than 4″ has been banned by the FDA. In 2020, the CDC identified an increase in human cases of *Salmonella* sp in owners of bearded dragons. If possible, the cage and accessories and tools should be cleaned with a 1:10 solution of bleach and water, outside the home if possible. Anyone handling a reptile or any part of its housing, including food and water dishes, should thoroughly wash their hands afterward, ideally not in a kitchen sink or anywhere food for humans is prepared. Children, immunocompromised individuals, and the elderly should be particularly cautious. No one should kiss or snuggle reptiles and everyone who handles or feed reptiles should immediately wash their hands.

Nutrition

There is tremendous variety in diet of reptiles and this may vary with life stage. For example, some lizards that are primarily carnivores or insectivores as juveniles need a primarily herbivorous diet as adults, for example, bearded dragons and iguanas. Failure to change the diet appropriately with age of the animal may result in disease.

All snakes are carnivorous. Since snakes eat whole prey, they often do not have nutritional issues. Their main prey item will be species specific, as some are insectivorous and other will eat such things as lizards, mice, or other snakes. Many snakes kept in captivity have been transitioned to eating such prey items as mice, rats, or rabbits. A snake should not be offered a prey item whose circumference is larger than the thickest part of the snake’s body. A live

prey item should never be left with the snake, as snakes do not constrict in defense. Oftentimes, they suffer bite wounds or death from fighting with the prey. Insects may be fed live but other live prey should be avoided as they can kill the snake while defending themselves. Frozen prey can be purchased for feeding. An owner should transition the snake from live prey by offering it freshly killed prey items. There are many resources online on how to transition a snake from live to frozen prey. The snake should defecate after a meal before being fed again; with this provision, young snakes generally can be fed every 2-7 days while adult snakes can be fed every 7-21 days. Some species of snakes, like a ball python, will go for weeks without eating. If the snake begins to lose weight it should be seen by a veterinarian. Snakes that are going to shed will go off feed beforehand and become dull in color. Their eyes will turn cloudy blue when they are close to shedding, which will temporarily blind them. The snake should be left alone at this time.

Each species of reptile has its own unique dietary requirements that often require vitamin and mineral supplementation. This is especially true for tortoises, turtles, and lizards. Many of these supplements are now commercially available and tailored for some species. The frequency and types of supplementation that the animals require will change depending on species, so you will have to search for reputable sources. A good supplement will list what vitamins it provides, but also the source. Some reptiles cannot use vitamins unless they come from the correct source. Most reptiles require a calcium supplement in their diet to prevent metabolic bone disease. To properly use the calcium in their diets, reptiles require vitamin D3. This can be supplemented in the diet but is best provided through natural sunlight that is not filtered through glass

or plastic as that eliminates the UVB rays they require. If that is not possible, a reptile UVB bulb should be provided. This bulb will need to be changed every 6 months to make sure it is providing not just light but also the UVB rays that reptiles require to metabolize calcium.

Always research the proper diet for the specific species of animal. For example, animals that are primarily herbivorous should not be fed high-protein dog or cat food, which makes the animal feel full without providing sufficient non-digestible dietary fiber and other components of a plant-based diet. The diet for each species will vary in protein, protein sources, and plant matter. Standard captive raised insects are not nutritionally complete enough for healthy reptiles. These prey items need to be fed a nutritious diet before being fed to a pet reptile. In addition, they should be supplemented, often through dusting with appropriate calcium and vitamins. Iceberg lettuce should be avoided, as it is devoid of nutrients. Spinach should also be avoided, as it binds calcium easily, further increasing risk of metabolic bone disease.

Diet for Lizards, Turtles, and Tortoises

- Protein Sources
    - Good staple insects: Dubia roaches, crickets, locusts, mealworms, superworms, earthworms, red worms
    - Mice can be given as a treat, but they are high in fat
    - Eggs, chicken or quail
    - Grocery store smelt
    - Feeding goldfish and rosey reds can

be dangerous because it blocks thiamine absorption and destroys vitamin B1 in the animal in large quantities

- Plants
    - In general dark leafy greens can be a majority of the diet. Yellow, red, and orange vegetables like bell peppers can also be included. A good diet is often composed of a mix of collard greens, beet greens, mustard greens, broccoli, turnip greens, alfalfa hay or chow, bok choy, kale, parsley, Swiss chard, watercress, clover, red or green cabbage, savory, cilantro, kohlrabi, bell peppers, green beans, escarole, and dandelion. Fruit should be given sparingly as a treat, as it is a poor source of minerals.

What is the POTZ? Why do reptiles need an external source of heat?

AMPHIBIANS

Unique Anatomy and Classification

There are three orders of amphibians. The order Caudata is made up of newts and salamanders. The order Anura includes frogs and toads. The larval form is called a pollywog or tadpole. Tadpoles have tails and internal gills. Metamorphosis is a sudden transition from this larval stage to the adult stage. Frogs have smooth skin and long hind legs adapted for swimming. Toads do not have smooth skin and have stubby bodies and short back legs. Frogs and toads are tailless amphibians. The order Gymnophiona consists of caecilians, burrowing amphibians that resemble earthworms or snakes.

Amphibians spend their larval phase in water and the adult phase partially or completely on land. Their skin is thin and moist. Amphibians can absorb oxygen through their skin by diffusion. Amphibians do not have a diaphragm or ribs but do have sac-like lungs. Air can be drawn into the lungs through contraction of the floor of the mouth.

– *"Digital illustration showing thumbnail dartfrog Ranitomeya imitator (Varadero) and its development in life stages",* *http://blog.illustraciencia.cat/2015/04/ranitomeya-imitator-varadero-mattias.html*

Amphibians are ectothermic (cold-blooded; depending on external heat sources to regulate body temperature). They have a three-chambered heart with a single ventricle.

Amphibians do not have scales. They can absorb water through their skin and lose water from the skin through evaporation. Amphibians that live in drier areas have thicker skin that helps them conserve moisture. The skin of most amphibians is covered with fluid-secreting glands that produce a slimy mucus. The mucus helps conserve moisture, prevents too much water from being absorbed into the body, and helps the animal escape predators. Some amphibians also have toxin-producing glands in their skin. The toxins produced can be deadly to predators, including humans.

Tongues of different kinds of amphibians vary considerably. Some have alterations of the hyoid apparatus that permit their long, sticky tongues to be ejected to capture prey and some do not have tongues at all. Amphibians either have no teeth or have very small teeth in the upper jaw only. They crush their prey with their jaws and swallow it whole.

Unlike birds, amphibians do have ureters and a urinary bladder and do produce liquid waste. Liquid and solid waste both are passed through the cloaca.

Amphibians generally do not have good eyesite. Their lens is fixed, decreasing ability to focus. They do not have external eyelids and instead protect the globe of the eye by pulling it back into the socket and covering it with a third eyelid, or nictitating membrane.

Specifics of anatomy and other information about amphibians can be found in the Manual of Exotic Pet Practice, pp 73-111.

Housing

Amphibian housing is similar to the housing in the above reptile section. Most should be kept individually as well to prevent stress and cannibalization of smaller cage mates. There is a wide variety of species of amphibians and an accompanying wide variety of appropriate habitats. The best guide for an amphibian habitat is to create one that closely mirrors its natural environment, including considerations of appropriate temperature and humidity. Amphibians are sensitive to chemicals, so care should be done to thoroughly wash any décor that is placed within their enclosure. Tap water must be treated before adding it to the tank as it often contains heavy metals in addition to chlorine. Chemicals used to treat the water for fish will work for amphibians if the directions are followed. Allowing the water to sit in open containers for 48 hours to allow the chlorine to evaporate will get rid of the chlorine, but not the heavy metals.

The tank and associated equipment and tools used should occasionally be cleaned with dish soap or a dilute

bleach solution. The animals must be removed from the tank and the tank must be thoroughly rinsed with water before the animals are returned. Because amphibians are directly exposed to anything in their environment through their skin, it is vital that the environment be kept scrupulously clean and that the animals not be exposed to chemicals used for cleaning.

Vaccinations and Disease Control

There are no vaccines recommended for control of infectious disease in amphibians.

No animals kept in captivity should be released into the wild. The spread of chytrid fungus, a fungus that is currently causing global amphibian extinction, has been linked to the release/escape of animals from the medical and pet trade into the wild.

Parasite Control

Amphibians can carry internal and external parasites but this is an uncommon concern in pet amphibians. Because many parasites have indirect life cycles, life cycle of the parasite cannot be completed in captive housing so the parasite population dies out. Disease is most commonly seen in stressed or immunocompromised animals, particularly those maintained outside of their POTZ.

Behavior

Specifics of behavioral concerns in the many species of amphibians will not be addressed. Veterinarians are

encouraged to work with owners to ensure they know the normal feeding, and hibernation behaviors of their animals, so they can tell the veterinarian if something atypical is happening.

Biosecurity

Good general hygiene should offset any concerns about passage of disease from pet amphibians to humans.

Nutrition

Amphibians are carnivores. They eat anything that will fit into their mouths, including smaller amphibians. Immediately separate if fighting occurs. Larger amphibians may consume small birds, mice, and small rodents. Tadpoles and aquatic species feed on vegetation and dead animals in the wild. In an aquarium tadpoles can be fed algae or tadpole powder available from pet stores. They can also be fed boiled lettuce, flake fish food, and fish hatchlings. As they begin to metamorphose into frogs, their diet should change to crickets, mealworms, waxworms, and other insects that are in the recommended food for reptiles. Smaller amphibians can be kept with springtails and isopods, which will clean the cage and also be a source of food. Feeding pelleted reptile food is not recommended. Amphibians are also prone to metabolic bone disease so supplementation with calcium and vitamins is required. Amphibians also are prone to hypovitaminosis A, which causes their tongue to keratinize and inhibits their ability to eat. This is also referred to as Short Tongue Syndrome. Any supplements that they receive should contain vitamin A. Some amphibians can only use vitamin A from select

sources, so consult with an expert to figure out the proper supplements for the amphibian in question.

List your five (5) take-home points – What are things you want to remember from this chapter as you progress through the curriculum and into your career?

EXTRA RESOURCES

- Disease control in chickens (National Poultry Improvement Program): (poultryimprovement.org).
- Infectious and non-infectious disorders of amphibians: http://www.merckvetmanual.com/exotic-and-laboratory-animals/amphibians
- Infectious and non-infectious disorders of reptiles: http://www.merckvetmanual.com/exotic-and-laboratory-animals/reptiles
- Breathing in birds: https://www.whfreeman.com/BrainHoney/Resource/6716/SitebuilderUploads/Hillis2e/Student%20Resources/Animated%20Tutorials/pol2e_at_3101_Airflow_in_Birds/pol2e_at_3101_Airflow_in_Birds.html

- Laryngotracheitis disease in birds: http://www.veterinaryworld.org/2008/July/Common%20Respiratory%20Diseases%20of%20Poultry.pdf
- Fowl pox: https://www.hyline.com/aspx/redbook/redbook.aspx?s=5&p=35
- Marek's disease in birds: https://www.merckvetmanual.com/poultry/neoplasms/marek%E2%80%99s-disease-in-poultry
- CDC recommendations around salmonellosis in backyard chicken flocks: https://www.cdc.gov/features/salmonellapoultry/index.html
- Specifics of anatomy and other information about various animals can be found in the Manual of Exotic Pet Practice http://www.sciencedirect.com/science/book/9781416001195

15.

Mammals I

Learning Objectives

- Describe unique anatomy and physiology of mice, rats, hamsters, gerbils, guinea pigs, and chinchillas
- Describe sexing of the above species
- Describing housing considerations for the above species
- Describe control of diseases and parasites for the above species
- Describe normal behaviors for the above species
- Describe nutrition for the above species
- Describe dentistry for rats, hamsters, gerbils, guinea pigs, and chinchillas

MICE

Unique Anatomy and Biology

Biology of Mice

LIFE SPAN	2 years
TEMPERATURE	98-101°F (36.5-38.0°C)
PULSE	325-780 beats/minute
RESPIRATION	40-80 breaths/ minute
REPRODUCTIVE MATURITY	♀ puberty 28-40 days, ♂ breeding initiation 50 days

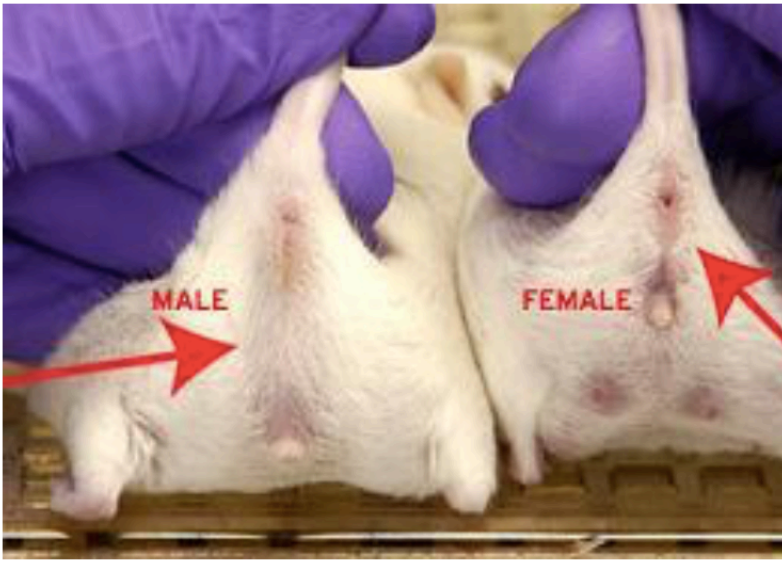
House mice are 2.5-3” (6.5-7.5 cm) long and weigh 0.5-1 oz (20-40 gm). Mice sold in the pet trade are descended from house mice and have a slightly different appearance. Mice have a small head with a long, narrow snout. House mice are usually gray-brown with a light to white underbelly but pet mice can come in a variety of colors. They have large, round, black or red eyes, and large ears. Anatomy includes only 2 open-rooted (continuously growing) incisors with nerves only at the base, ability to draw the cheek folds into the diastema (space between the incisors and molars), and large masseter muscles that attach rostrally, giving them increased ability to gnaw. All rodents are obligate nose breathers.

Appearance of Mice

"Mouse", https://en.wikipedia.org/wiki/Mouse

Gender identification is through assessment of the anogenital distance, which is about twice as long in males as in females.

Gender Identification in Mice



"Male vs. female mice", *https://hubpages.com/animals/Why-Rats-and-Mice-Make-Better-Pets-Than-Hamsters-or-Gerbils*

Specifics of anatomy and other information about mice and rats can be found in the Manual of Exotic Pet Practice, pp 326-344.

Housing

Suitable homes can be purchased or made. The bottom

should be plastic or another material that will withstand gnawing and it should have closely spaced bars to prevent escape. Aquariums are excellent choices for mice. Mouse cages must have a lid or cover because mice are excellent climbers. The enclosure must be large enough for the mouse or mice, food and water, and enrichment, such as an exercise wheel. Mice also appreciate somewhere in the cage where they can hide. Appropriate bedding materials include wood shavings, ground corn cobs, pelleted sawdust, newspaper, and straw. Cedar and pine wood shavings sold as small animal bedding contain phenol that can be toxic or cause airway damage. Bedding should be replaced and the cage thoroughly cleaned 2-3 times per week. Mice don't drink a lot of water, but water should be available at all times. Open containers become contaminated with urine and feces quickly. Vacuum-type bottles with sipper tubes are ideal. Temperature, humidity, and lighting can be as that for the rest of the house.

Vaccinations and Disease Control

There are no vaccines recommended for control of infectious disease in mice.

Parasite Control

Internal parasites of mice include protozoa, pinworms, and tapeworms. These can be identified on fecal flotation or by direct inspection. Treatment varies with specific worm identified. External parasites are uncommon in captive-bred mice. Fur mites and lice can be seen, and are associated with pruritus to the point of self-mutilation and hair loss. Diagnosis is by direct inspection. Treatment is

dependent on parasite identified; ivermectin is a common therapy.

Behavior

Mice are primarily nocturnal in habit but pet mice, feeling safe around humans, may come out during the day. Mice are outgoing, social creatures. They prefer the company of other mice. Male mice housed together may be territorial, and fight. Another abnormal behavior of mice housed together is barbering, the chewing away of the whiskers and the hair on the face of a submissive mouse, often by a dominant female mouse. Mice are fastidious groomers and early signs of disease often include a scruffy hair coat. Enrichment is an important component of housing to promote normal behaviors.

Dentistry

While many species of rodent require dentistry to correct or prevent overgrowth of their continually growing incisors, this is not a common problem in most mice. If malocclusion is present, the overgrown incisors easily can be identified on physical examination.

Biosecurity

Good general hygiene should offset any concerns about passage of disease from pet mice to humans; handwashing after handling rodents is essential. Many pet store mice do test positive for lymphocytic choriomeningitis virus, which

can pose a risk to the unborn baby if a pregnant woman contracts the disease.

Nutrition

A commercial mouse feed that is complete and balanced with at least 14% protein is most appropriate. Treats specifically prepared for mice can be purchased. Other foods that can be offered but that should never make up any significant percentage of the animal's total food intake include leafy greens, broccoli, apples, celery, carrots, and dry bread. Mice should never be fed chocolate, peanuts, alcohol, onions, garlic, or citrus fruits.

RATS

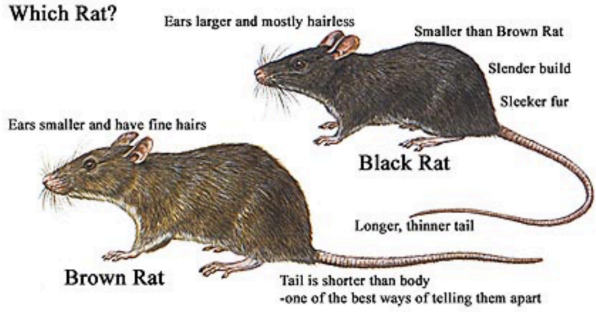
Unique Anatomy and Biology

Biology of Rats

LIFE SPAN	2-3 years
TEMPERATURE	99-101 °F (37-38°C)
PULSE	250-450 beats/ minute
RESPIRATION	70-115 breaths/ minute
REPRODUCTIVE MATURITY	♀ puberty 65-110 days, ♂ breeding initiation 65-110 days

Of the 78 species of rats, only two have been domesticated as pets and for use in research, the black rat, also called the roof rat, and the brown or Norway rat. The body and head of the black rat is 5-7” (13-18 cm) long with a tail longer than its body. They weigh 4-12 oz (115-340 gm). The ears of the black rat are large and they have black or dark gray fur with a brown or gray-white underside. The brown rat is larger, with a body and head 7-10” (18-25 cm) long and a tail that is shorter than its head and body.

They weigh 7-17 oz (200-400 gm). The ears of the brown rat are smaller in relationship to its head than those of the black rat. Their fur is usually dark brown to gray-brown with a lighter brown or gray underside. Pet rats descended from these two species come in a variety of colors and coat patterns.



"Rat features", https://www.the-piedpiper.co.uk/th1.htm

Other unique anatomy is as for the mouse.

Gender identification is through assessment of anogenital distance, which is about 1.5-2 times longer in males than in females, or by direct observation of descended testes or extrusion of the penis. If the testes are not visible between the anus and genital papilla, gentle pressure on either side of the genital papilla in a male will

result in extrusion of a small, red penis. Nipples are more prominent in females.

Gender Identification in Rats

"Female vs. male rats", https://ratsinaction.weebly.com/how-to-keep-your-animals-healthy-and-happy.html

Specifics of anatomy and other information about mice and rats can be found in the Manual of Exotic Pet Practice, pp 326-344.

Housing

Wire mesh cages with solid bottoms or pull-out trays are recommended for rats. Cages can be constructed from wood and wire mesh, but materials must be thick enough to withstand gnawing. Glass aquariums work well for rats because they're easy to clean and are escape-proof with a lid. Larger cages are recommended because rats are active and benefit from environmental enrichment like ladders, ropes, and exercise wheels. Like mice, rats need a place to hide in their cage. Appropriate bedding materials include wood shavings, ground corn cobs, pelleted sawdust, newspaper and straw. Cedar and pine wood shavings sold as small animal bedding contain phenol that can be toxic or cause airway damage. Bedding should be replaced and the cage thoroughly cleaned 2-3 times per week. Rats need access to water at all times. A bottle with a sipper tube suspended from the cage is the best option. Temperature, humidity, and lighting should be as for the rest of the household.

Describe as you would for a client appropriate housing for mice and rats.

Vaccinations and Disease Control

There are no vaccines recommended for control of infectious disease in rats.

Parasite Control

Internal parasites of rats include protozoa, pinworms, and tapeworms. These can be identified on fecal flotation or by direct inspection. Treatment varies with specific worm identified. External parasites are even more uncommon in captive-bred rats than in mice.

Behavior

Rats are primarily nocturnal, however, those kept as domestic pets are active all day and can be handled by owners. Rats are agile climbers, particularly the black rat. They use their tails for balance. They can jump up to two feet and are excellent swimmers, able to stay submerged for up to 3 minutes. They're curious and will climb a cage or stand on their hind legs to see their environment. Rats are intelligent and will learn their owner's voice and come when food or interaction is offered. Social and outgoing, rats do best when kept with other rats. Animals raised together will usually get along but, as with any animals, introducing a new rat may lead to fighting and rat fights can result in injury or death. Rat fighting should not be confused with wrestling behavior, which is affiliative play. When upset, rats can be imposing. They stiffen their bodies, arch their backs, wag their tails, and begin shaking with their hair standing on end to make them appear larger. Enrichment is an important component of housing to promote normal behaviors.

Dentistry

Because they have continuously growing incisors, if the teeth are not worn down by normal activity or if malocclusion is present, the incisors can overgrow, causing significant oral disease. This is easily identified on physical examination. Because the teeth have no nerve except at the base, they can be trimmed as needed by a veterinarian using a dental disc. Repeat trimming may be required if the underlying cause of the malocclusion cannot be resolved.

Biosecurity

Good general hygiene should offset any concerns about passage of disease from pet rats to humans.

Nutrition

Commercial pellet rations containing 20-27% protein formulated for small mammals are ideal because they are nutritionally complete and balanced. Treats specifically prepared for rats can be purchased. Other foods that can be offered but that should never make up any significant percentage of the animal's total food intake include apples, bananas, strawberries, melon, broccoli, carrots, squash, lean cooked meats, whole wheat bread, cooked beans, and yogurt. Rats should never be fed chocolate, alcohol, cabbage, high-fat or high-sugar human foods, or citrus fruits.

Describe appropriate diet for mice and rats.

HAMSTERS

It is illegal in Hawaii to own a hamster. In California, it is illegal to own hamsters unless they are of the domesticated species (Syrian or dwarf hamster) and the laws are unclear regarding whether or not even those may be illegal in some municipalities.

Unique Anatomy and Biology

Biology of Hamsters

LIFE SPAN	18-24 months
TEMPERATURE	99-101 °F (37-38°C)
PULSE	310-471 beats/ minute
RESPIRATION	38-110 breaths/ minute
REPRODUCTIVE MATURITY	♀ puberty 42-70 days, ♂ breeding initiation 70-98 days

The most common hamster in the United States is the golden or Syrian hamster. They are 5-7" (13-18 cm) in length, with an average body weight of 4 oz (120 gm). Like mice, hamsters have 2 open-rooted (continuously growing) incisors with nerves only at the base, ability to draw the cheek folds into the diastema, and large masseter muscles that attach rostrally, giving them increased ability to gnaw. They have large cheek pouches that can be used for storage of food and bedding. They are obligate nose breathers.

All hamsters have sebaceous glands on their flank, brown patches covered with fur that may appear wet and matted, especially in sexually aroused males.

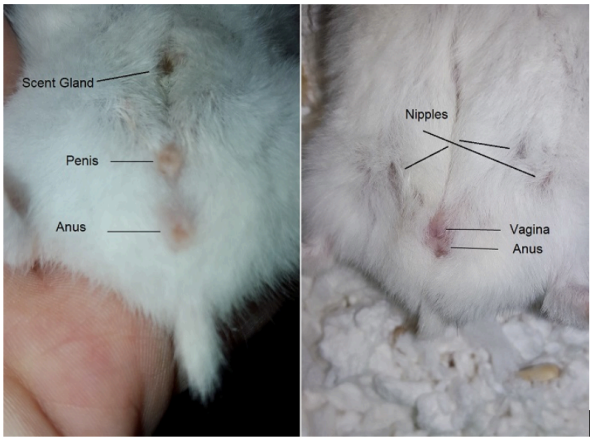
Appearance of Hamsters

"Syrian hamster", *https://hamsterpetcare.com/hamsters-care/types-of-hamsters/syrian-hamster-detailed-overview-9710.html*

Gender identification is through increased anogenital

distance in males, the presence of testes in males between the anus and genital papilla, and prominence of nipples in females.

Gender Identification in Hamsters



"Sexing dwarf hamsters", http://dwarfhamsterhome.com/sexing-dwarf-hamsters/

Specifics of anatomy and other information about hamsters and gerbils can be found in the Manual of Exotic Pet Practice, pp 406-432.

Housing

Hamsters are best housed alone. Hamster cages should be

large enough to allow room for an exercise wheel and a place for the hamster to hide also should be provided. Simple wire cages are available in pet stores. Aquariums and custom-made hamster homes are also available; all cages should be gnaw-proof, as for other rodents. Clean fresh bedding can be paper confetti, paper strips, wood chips or shavings, ground corn cobs, hay, or straw. Corn cobs and wood shavings usually work the best because of their absorbency. Cedar should be avoided because the fumes may cause respiratory problems. Hamsters naturally hoard food; the cage should be cleaned 2-3 times per week to prevent the hamster eating old, moldy feed. Water bottles should be hung on the outside of the cage with a drinking tube extending into the cage through the side bars. This prevents the hamster from gnawing on the bottom of the water bottle and frees up space within the cage. If the water bottle is stored in the cage, it should be kept in a protective wire hanger. Hamsters prefer moderate temperatures around 70°F. If the temperature goes above 80°F, they go into a deep, sleep-like state known as estivation. This is how hamsters originally survived the hot, dry desert environment. If the temperature goes below 50°F, hamsters will hibernate. Lighting should be as for the rest of the household; a 12 hr light:dark cycle is preferred for most hamsters.

Vaccinations and Disease Control

There are no vaccines recommended for control of infectious disease in hamsters.

Parasite Control

Internal parasites of hamsters include protozoa, pinworms, and tapeworms. These can be identified on fecal flotation or by direct inspection. Treatment varies with specific worm identified. The most common external parasite of hamsters is the demodectic mange mite. Clinically normal hamsters can carry a small number of mites. Clinical disease may be seen as a secondary problem in older hamsters with other disease conditions. The signs of demodectic mange are a non-pruritic alopecia and scaling and crusting over the back and rump. Demodectic mange can be treated with ivermectin.

Behavior

Hamsters are nocturnal. Hamsters tend to be territorial and protective of food and it's not uncommon to see hoarding behavior in hamsters. They will hide food at one end of their habitat and reserve the other end for urinating and defecating. Hamsters are solitary creatures. Young can usually be kept together until they are about 5 weeks old; then they will begin to fight and need to be separated. Cannibalism may result if litters are left together for longer periods of time. Females only tolerate the male for breeding. Enrichment is an important component of housing to promote normal behaviors.

Dentistry

Because they have continuously growing incisors, if the teeth are not worn down by normal activity or if

malocclusion is present, the incisors can overgrow, causing significant oral disease. This is easily identified on physical examination. Because the teeth have no nerve except at the base, they can be trimmed as needed by a veterinarian using a dental disc.

Biosecurity

Good general hygiene should offset any concerns about passage of disease from pet hamsters to humans.

Nutrition

The best way to feed a hamster is to purchase commercially prepared pellets that contain a minimum of 16% protein and 4-5% fat and are complete and balanced for hamsters. Other foods that can be offered but that should never make up any significant percentage of the animal's total food intake include most fruits and vegetables, cooked brown rice, and toast. Hamsters should never be fed chocolate, alcohol, onions, garlic, high-fat or high-sugar human foods, almonds, or citrus fruits. Uneaten soft-type foods must be removed before they spoil. Soft foods may get lodged in the cheek pouches of a hamster and become spoiled causing infection and illness.

GERBILS

Because they can damage crops and out-compete indigenous wildlife, it is illegal to have gerbils as pets in the state of California.

Unique Anatomy and Biology

Biology of Gerbils

LIFE SPAN	24-39 months
TEMPERATURE	100.4-102.2°F (38-39°C)
PULSE	260-600 beats/minute
RESPIRATION	85-160 breaths/ minute
REPRODUCTIVE MATURITY	♀ puberty 65-85 days, ♂ breeding initiation 70-85 days

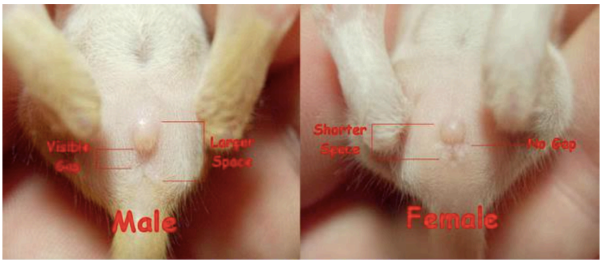
The best known species is the Mongolian gerbil. On average, the Mongolian gerbil is 6-8" (15-20 cm) from tip of the nose to tip of the tail. Their bodies are 3-4" (7.5-10 cm) long and they weigh 3-4 oz (85-114 gm). Gerbils do not sweat and produce extremely concentrated urine. Gerbils have a hairless patch on their midventral abdomen that is a scent gland.

Appearance of Gerbils

"Gerbils", https://www.omlet.co.uk/guide/gerbils/getting_a_gerbil/needs

Gender identification is by anogenital distance, which is longer in the male; by dark pigmentation of the scrotum; and by increased size of the scent gland in males and increased prominence of nipples in females.

Gender Identification in Gerbils



"Male vs. female gerbils",
http://gerbilforum.proboards.com/thread/23303/gerbil

Specifics of anatomy and other information about hamsters and gerbils can be found in the Manual of Exotic Pet Practice, pp 406-432.

Housing

Most hamster housing is also appropriate for gerbils. Because of their highly concentrated urine, the ideal habitat for gerbils is an aquarium. It is important that the enclosure have a lid to prevent the gerbil from jumping out. Gerbils require enrichment like hamsters but caution should be used with exercise wheels, which may be associated with degloving injuries of the tail or limb fractures. Running wheels should be solid, not mesh. Gerbils also may use a sandy area in a cage for environmental enrichment. Gerbils are social animals and can be housed in pairs or family

groups. If necessary, gerbils can get most of their daily water requirement from their food. Although they can survive without, free access to water is recommended. Temperature and lighting are as for hamsters. Relative humidity is best kept at less than 50%.

Vaccinations and Disease Control

There are no vaccines recommended for control of infectious disease in gerbils.

Parasite Control

There are virtually no clinically significant internal parasites routinely diagnosed in gerbils. Gerbils can suffer from demodectic mange as described for hamsters.

Behavior

Mongolian gerbils are diurnal, active during the day. Gerbils are very quiet animals. The young can be heard making squeaking noises, but the sounds diminish as they age. Gerbils communicate by drumming or pounding with their rear feet. This sound is also used as an alarm and by the male during mating. Gerbils commonly leave their scent behind by rubbing their abdomen along an object or area. Enrichment is an important component of housing to promote normal behaviors.

Dentistry

Because they have continuously growing incisors, if the teeth are not worn down by normal activity or if malocclusion is present, the incisors can overgrow, causing significant oral disease. This is easily identified on physical examination. Because the teeth have no nerve except at the base, they can be trimmed as needed by a veterinarian using a dental disc.

Biosecurity

Good general hygiene should offset any concerns about passage of disease from pet gerbils to humans.

Nutrition

The best way to feed a gerbil is to purchase commercially prepared pellets that contain a minimum of at least 20% protein and 4-5% fat and are complete and balanced for gerbils. Other foods that can be offered but that should never make up any significant percentage of the animal's total food intake include apples, pears, bananas, carrots, celery, peas, cucumbers, cooked potato, and plain popcorn. Gerbils should never be fed chocolate, alcohol, spinach, lettuce, or citrus fruits.

What are best things to feed a hamster? A gerbil? What are things you should never feed a hamster or a gerbil?

GUINEA PIGS

Unique Anatomy and Biology

Biology of Guinea Pigs

LIFE SPAN	5-7 years
TEMPERATURE	99-103.1° F (37.2-39.5°C)
PULSE	240-350 beats/minute
RESPIRATION	40-150 breaths/ minute
REPRODUCTIVE MATURITY	♀ puberty 6 weeks, ♂ breeding initiation 10 weeks

Adult guinea pigs reach a length of 8-10” (20-25 cm) and weigh 1-2 lb (450-900 gm). Males are larger and have larger, more rounded heads than females. The body of the guinea pig is short, stocky in build, with short legs. The nose of the guinea pig is short, blunt, and rounded. They have a small mouth with a split upper lip. There are long whiskers on the sides of the upper lip that function in the same way that cat whiskers do, allowing the animal to travel in dim light. The ears are short with little fur. Guinea pigs have very sensitive hearing and can detect frequencies beyond the range of the human ear. All of their teeth are open-rooted including the molars. Like all other rodents, they are obligate nose breathers.

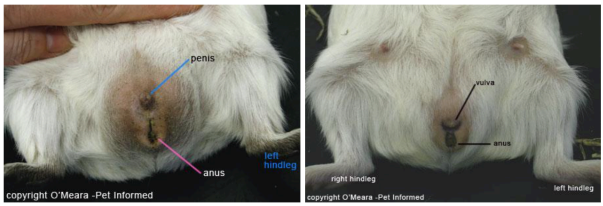
Appearance of Guinea Pigs

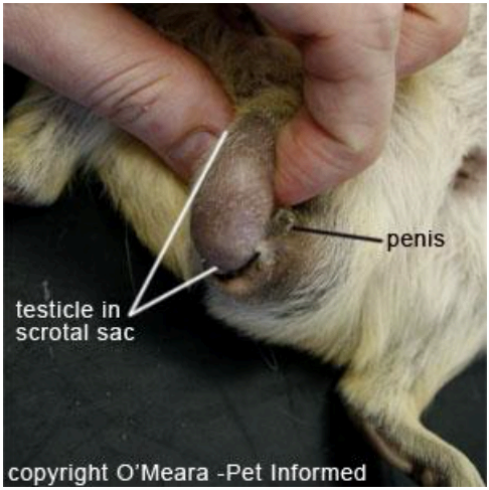
"Guinea pigs", https://www.vetcarepethospital.ca/beginners-guide-to-guinea-pig-care/

Gender identification done in several ways. Methods include determination of anogenital distance as in other species, examination of the genitalia itself (urethral opening a single point and area raised in males, urethral

opening a slit and area flush with the surrounding skin in females), and identification of large testes to either side of the anus.

Gender Identification in Guinea Pigs





"Male vs. female guinea pigs",
http://www.pet-informed-veterinary-advice-online.com/sexing-guinea-pigs.html

Specifics of anatomy and other information about guinea pigs can be found in the Manual of Exotic Pet Practice, pp 456-473.

Housing

A typical cage has a solid bottom that is 3-4" deep with vertical bars made of wire. The plastic bottom should be removable for cleaning. Deeper trays keep animals from scattering bedding or shavings out of the cage. Cages do not need covers or tops because guinea pigs don't usually climb. Appropriate bedding includes recycled newspaper products, shredded paper, and aspen shavings. Cedar and pine shavings should not be used as they may be a respiratory irritant. Cages should be cleaned 1-2 times weekly and sanitized at least once every 2 weeks. Guinea pigs will defecate into their feed and water. For this reason, an elevated feeder and vacuum-type water bottle are recommended. In the summer, guinea pigs can be kept outside once temperatures are above 50°F. Small houses, like dog houses, can be constructed to keep animals safe and protected from the elements. Outdoor housing should be portable so it can be moved when grass becomes trampled or eaten. Guinea pigs should never be housed in areas with temperature greater than 80°F or in areas of high humidity as they are susceptible to hyperthermia.

Vaccinations and Disease Control

There are no vaccines recommended for control of infectious disease in guinea pigs. However, if guinea pigs are kept in households with dogs or cats, vaccination against *Bordetella bronchiseptica* is recommended as they are susceptible and are exquisitely sensitive to contracting it.

Some husbandry that can help prevent disease in guinea pigs includes brushing and nail trimming. Guinea pigs

should be brushed regularly. A guinea pig with rosettes and long hair will need to have the hair combed out in addition to brushing. Long-haired animals may also need their hair clipped around the rear to prevent matting and soiling. Guinea pigs can be bathed with a mild shampoo, for example baby shampoo. Guinea pig toenails grow constantly and need to be trimmed with regular pet toenail clippers.

Parasite Control

Internal parasites, including roundworms and coccidia, are found uncommonly in guinea pigs. External parasites, including mites, lice, and fleas, may be more commonly seen and are easily identified by inspection and treated as in other species.

Behavior

Guinea pigs are neither completely diurnal nor completely nocturnal but instead show periods of activity and sleep throughout the day. Guinea pigs may be housed in groups but two males are unlikely to live peacefully in an enclosure. In general, guinea pigs are social and respond to the activity around them with a variety of vocalizations. Enrichment is an important component of housing to promote normal behaviors.

Dentistry

Because they have continuously growing incisors and molars, if the teeth are not worn down by normal activity or

if malocclusion is present, the teeth can overgrow, causing significant oral disease. Teeth can grow at a rate of up to 2 mm/week. The open-rooted molars also are predisposed to dental caries and subsequent infection. This is easily identified on physical examination but complete evaluation may require sedation and treatment requires general anesthesia. Dental radiographs may be required for complete evaluation and treatment may include trimming as in other rodents or floating to remove sharp points, as is done in horses.

Biosecurity

Good general hygiene should offset any concerns about passage of disease from pet guinea pigs to humans.

Sterilization

Elective ovariohysterectomy or ovariectomy may be performed in female guinea pigs (sows) for reproduction control. The surgery is performed as in dogs and cats, with specific care taken to avoid the large cecum on entering the abdomen, and not to tear the ovarian vessels by placing undue tension while attempting to exteriorize the ovaries. Elective orchiectomy (castration) is performed in male guinea pigs (boars) either for reproduction control or to minimize reproductive behaviors. The surgery is performed as in cats and it is required that the inguinal canal be closed on each side to prevent herniation of abdominal contents. Skin incisions are closed with suture or tissue glue.

Nutrition

High-quality hay should be available at all times. Alfalfa hay is appropriate for young guinea pigs and for pregnant sows. Timothy hay and orchard grass are appropriate for grown animals. A commercial pelleted diet formulated specifically for guinea pigs should be provided as well but should not be the primary diet as that commonly causes obesity. Fresh vegetables should make up the rest of the diet. Fruits and grains also can be provided but should never be more than 10% of the diet. Good supplementary foods for guinea pigs include bell peppers, parsley, kale, broccoli, Brussels sprouts, romaine lettuce, carrots, dandelion greens, apples, cantaloupe, and oranges. Guinea pigs cannot manufacture their own vitamin C. Vitamin C in pelleted food or offered in water breaks down quickly and provision of foods high in vitamin C or vitamin C supplements is recommended. Foods you should never give to a guinea pig include beans, rhubarb, dill, flowers, and the pits, cores or seeds of fruits.

Describe as you would for a client the ideal diet for a guinea pig. What specific nutrient do you need to provide in the diet for guinea pigs?

CHINCHILLAS

Unique Anatomy and Biology

Biology of Chinchillas

LIFE SPAN	8-10 years, with some pets recorded to live up to 20 years
TEMPERATURE	100.5-102.2°F (38-39°C)
PULSE	100-200 beats per minute
RESPIRATION	40-80 breaths/ minute
REPRODUCTIVE MATURITY	♀ puberty 7-9 months, ♂ breeding initiation 7-9 months

Chinchillas resemble small rabbits with short ears and a short, bushy tail. Chinchillas range from 9-15” (23-38 cm) long with a tail of 3-10” (7.5-25 cm), and weigh from 1 to 2 lb (400-700 gm). Their thick, shiny fur is about 1” long; the most common color of chinchillas is blue-grey. The softness of the fur is due to the fewer number of guard hairs as compared with those of fur-bearing animals. Chinchillas usually shed about every 3 months. New growth starts at the neck and progresses toward the rear of

the animal. The head is broad with large ears and eyes. They have very long, stiff whiskers.

Appearance of Chinchillas

"Long-Tailed Chinchilla", https://en.wikipedia.org/wiki/Long-tailed_chinchilla

Gender identification is through anogenital distance, which is much longer in males than in females. The male below is shown on the left.

Gender Identification of Chinchillas

"Male vs. female chinchillas",
http://furrytails-en.blogspot.com/2011/07/sexing-1-day-old-chinchilla-kits.html

Specifics of anatomy and other information about chinchillas can be found in the Manual of Exotic Pet Practice, pp 474-492.

Housing

Chinchillas require a relatively large enclosure with specific areas for eating, sleeping, exercising, and urinating / defecating. An area for animals to hide should be included. Dust baths should be made available as described below in the behavior section. Enclosures may have more the one level with ladders to encourage exercise. Cages

should be made of metal and wire; plastic and wood will be quickly chewed through. Wire mesh is not recommended for flooring. Wood shavings and ground corn cobs are ideal bedding. Hay and straw should not be used as they may become moldy or stain fur. The enclosure should be cleaned twice weekly. Clean water should be provided in glass sipper bottles. Temperature should be kept at less than 80°F and humidity at a comfortable level for humans, as chinchillas suffer heat prostration / hyperthermia if maintained in higher environmental temperatures, especially if humidity is high.

Vaccinations and Disease Control

There are no vaccines recommended for control of infectious disease in chinchillas.

Parasite Control

Endoparasites are uncommon in pet chinchillas. Chinchillas can carry *Giardia* sp. without signs of disease. Chinchillas can be infested with fleas and mites but this is uncommon in pets. Diagnosis is by direct inspection and treatment is as in other species.

Behavior

Chinchillas are nocturnal in the wild but can adapt to a diurnal lifestyle as pets.

Chinchillas need regular baths to remove excess moisture and oil. They do not bathe in water, but in finely ground powder. In the wild, chinchillas bathe in volcanic

ash of the Andes Mountains. A similar powder is available for purchase from pet stores. Chinchillas can be bathed in a small pan with 2-3" inches of powder. The pan needs to be large enough for the animal to roll around in. The powder can be used several times.

Fur chewing is a common problem of chinchillas. The animal chews the fur on the flanks leaving patches of short hair. Poor nutrition, small cages, drafty conditions, boredom, and high humidity are thought to play a role in fur chewing. Providing enough space and environmental enrichment along with a balanced diet should resolve fur chewing. Enrichment is an important component of housing to promote normal behaviors.

Describe dust baths in chinchillas.

Dentistry

Because they have continuously growing incisors and molars, if the teeth are not worn down by normal activity or if malocclusion is present, the teeth can overgrow, causing significant oral disease. Teeth can grow at a rate of up to 2 mm/week. The open-rooted molars also are predisposed to dental caries and subsequent infection. This is easily identified on physical examination but complete evaluation requires sedation and treatment requires general anesthesia. Dental radiographs may be required for complete evaluation and treatment may include trimming as in other rodents or floating to remove sharp points, as is done in horses. The open-rooted molars also can overgrow into the

jaw, causing pain and inappetance. Radiographs are used to diagnose this progressive condition, which has a very poor prognosis.

Biosecurity

Good general hygiene should offset any concerns about passage of disease from pet chinchillas to humans.

Sterilization

Elective ovariohysterectomy or ovariectomy may be performed in female chinchillas for reproduction control. The surgery is performed as in dogs and cats, with specific care taken to avoid the large cecum on entering the abdomen, and not to tear the ovarian vessels by placing undue tension while attempting to exteriorize the ovaries. Elective orchiectomy (castration) is performed in male chinchillas either for reproduction control or to minimize reproductive behaviors. The surgery is performed as in cats and it is required that the inguinal canal be closed on each side to prevent herniation of abdominal contents. Skin incisions are closed with suture or tissue glue.

Nutrition

Various pelleted foods are available today for chinchillas. These pellets consist primarily of ground alfalfa hay, corn gluten, corn tailings, wheat germ, and bran, with 16-20% protein, 2-5% fat, and 15-35% fiber. Commercially prepared foods are nutritionally complete. Chinchillas can be sensitive to dietary changes and any changes should

be made gradually. Chinchillas are “hind gut” fermenters, producing cecal pellets that are reingested (coprophagy). Chinchillas also can be offered high-quality timothy or orchard grass hay and dark leafy vegetables, such as romaine lettuce and collard or mustard greens. Very occasionally, chinchillas can be offered dried or fresh apple, banana, peach, or pear, prunes, and carrot. Chinchillas should be not offered high-fat or high-sugar human treats, chocolate, corn, or acidic fruits.

List your five (5) take-home points – What are things you want to remember from this chapter as you progress through the curriculum and into your career?

EXTRA RESOURCES

- Common disorders of rats and mice: http://www.merckvetmanual.com/exotic-and-laboratory-animals/rodents/mice-and-rats-as-pets
- Common disorders of hamsters: http://www.merckvetmanual.com/exotic-and-laboratory-animals/rodents/hamsters
- Common disorders of gerbils: http://www.merckvetmanual.com/exotic-and-

laboratory-animals/rodents/gerbils

- Common disorders of guinea pigs: http://www.merckvetmanual.com/exotic-and-laboratory-animals/rodents/guinea%20pigs
- Common disorders of chinchillas: http://www.merckvetmanual.com/exotic-and-laboratory-animals/rodents/chinchillas
- American Fancy Rat and Mouse Association: http://www.afrma.org/caresheet.htm
- California Hamster Association: http://www.chahamsters.org/newsletter.html
- American Gerbil Association: http://www.agsgerbils.org/
- American Cavy Breeders Association: http://www.acbaonline.com/
- Guinea Pigs Club: http://guineapigsclub.com/
- National Chinchilla Society: http://www.natchinsoc.co.uk/
- The Manual of Exotic Pet Practice: http://www.sciencedirect.com/science/book/9781416001195

16.

Mammals II / Marsupials

Learning Objectives

- Describe unique anatomy and physiology of ferrets, rabbits, hedgehogs, and sugar gliders
- Describe sexing of the above species
- Describing housing considerations for the above species
- Describe control of diseases and parasites for the above species
- Describe normal behaviors for the above species
- Describe nutrition for the above species
- Describe dentistry for rabbits and ferrets

FERRETS

California and Hawaii prohibit importation and possession of ferrets as pets. Other states may require special permits. Some local governments prohibit ownership of ferrets including New York City, Dallas/Fort Worth, and Washington, DC. Potential owners should check local and state laws before adopting or purchasing ferrets.

Unique Anatomy and Biology

Biology of Ferrets

LIFE SPAN	5-8 years
TEMPERATURE	100.0-104.0 °F (38-40°C)
PULSE	180-250 beats per minute
RESPIRATION	33-36 breaths/minute
REPRODUCTIVE MATURITY	6-12 months; virtually all pet ferrets in the United States are neutered

Ferrets are mustelids, with long, lean, slender, muscular bodies with short legs. Ferrets have oval-shaped heads and pointed snouts. Their ears are small and rounded. Ferrets have bright, clear eyes, but their sight is not well-developed. They have highly developed senses of hearing, smell, and touch. Both sexes develop a strong musky odor at maturity. Spaying or castrating, along with removal of the anal glands, can help reduce the odor; virtually all ferrets available for sale as pets in the United States are spayed / castrated. Glands in the skin also cause a musky scent.

Ferrets are unable to sweat and use changes in body posture in the environment to dissipate body heat. The

fur of ferrets is dense and very soft. They change coats completely twice a year.

The heart is connected to the sternum with a ligament that often contains fat, which gives the heart a raised appearance on a lateral radiographic view. The trachea is large and the lung capacity is increased, with an increase in airway length commensurate with total body length. The intestinal tract is relatively short and the liver is relatively large.

Gender identification in ferrets is as in dogs. Male ferrets (hobs) have a penis on the ventral midline of the abdomen; the penis contains a small bone, the os penis. Female ferrets (jills) have a vulva caudal and ventral to the anus. Males are usually about twice the size of females, with the average male weighing 2.2-4.4 lb (1-2 kg) and the average female weighing 1.1-2.2 lb (0.5-1 kg). Ferrets are about 18” (45 cm) in length.

Specifics of anatomy and other information about ferrets can be found in the Manual of Exotic Pet Practice, pp 345-374.

Housing

An indoor cage can be provided, preferably with a solid or wire floor and wire sides, not glass. Ferrets can be housed individually or together. Ferrets need a place to hide and sleep and a place to urinate / defecate. Ferrets can be taught to use litter boxes. They prefer relieving themselves in corners. A litter box should be placed in the corner of the cage away from the food and sleep areas. Whenever left out of the cage, a litter box should be available in the room.

Ferrets are curious and can get into surprisingly small spaces. If ferrets are permitted to roam free, areas that

should be blocked off include behind large appliances or immovable pieces of furniture and inside recliners.

Ferrets can be maintained outdoors but cannot tolerate temperatures below 20°F or above 90°F (< -6°C or above 32°C).

Describe housing for a ferret, in and outside of an enclosure.

Vaccinations and Disease Control

Ferrets should be vaccinated against canine distemper virus and rabies virus. Specific vaccines approved for use in ferrets are available in the United States. Ferrets are vaccinated against distemper no earlier than 8 weeks of age, and again at about 12 and 16 weeks of age, and then annually. Ferrets are vaccinated against rabies at 12-16 weeks of age and then annually. Vaccines can be given subcutaneously; some municipalities require that rabies vaccines be given intramuscularly.

Ferrets have non-retractable claws that require regular trimming.

Parasite Control

Intestinal parasites are uncommon in pet ferrets. Ferrets presenting with diarrhea should be checked for coccicia and *Giardia* sp. and treated appropriately. Ferrets housed outside may become infested with fleas; diagnosis and treatment is as in other species. Ferrets also can pass ear

mites between themselves. These are evidenced by presence of heavy brown discharge in the ears, which can be examined microscopically to identify the mites. The ears are cleaned and treated topically. Ferrets housed outdoors also may be more susceptible to heartworm, as it is carried by mosquitoes. Advantage Multi is a parasite control product recently approved by the FDA for use in ferrets that can be used as a heartworm preventative.

Behavior

Ferrets are not nocturnal but do sleep about 75% of the time. Ferrets have tough skin and while playing often bite one another. This playful bite can be painful to humans. Discipline for play biting should include a firm "no" until the ferret learns the behavior is not acceptable. As described under housing, ferrets are curious and should be carefully supervised when not enclosed. Enrichment is an important component of housing to promote normal behaviors.

Dentistry

Ferrets will develop dental tartar with subsequent gingivitis. This may be more common in ferrets fed primarily a soft diet and should be addressed with a dental cleaning by a veterinarian.

Biosecurity

Good general hygiene should offset any concerns about passage of disease from pet ferrets to humans. Ferrets are

susceptible to influenza, so humans sick with the flu should avoid contact with their ferrets until they are no longer contagious. Ferrets are considered to be more susceptible to infection with COVID-19 than many other species but the CDC does not consider ferrets to pose a significant transmission threat to humans.

Nutrition

Ferrets are carnivores. Ferret food should be high in animal protein (30-40%), high in fat (18-30%), and low in fiber. Dry commercial ferret food is recommended. If a commercial ferret food is not available dry kitten chow can be used. Regular dog and cat chow, which often contains a high percentage of plant-based protein, should be avoided. Treats should be given in moderation and should be meat based. Meat baby food, cooked meat scraps, jerky, and cracklings are appropriate. Although ferrets love raisins, dates and other sugary treats, they should not be given to ferrets because they promote tooth decay and can lead to pancreatic dysfunction. Bones should never be given as treats. Ferrets prefer to eat multiple small meals per day and will hide excess food.

Ferrets require about three times as much water as dry matter. Fresh water should be offered in more than one location and, ideally, in more than on manner. For example, water may be offered in a sipper bottle in the cage and in a crockery bowl elsewhere.

RABBITS

Unique Anatomy and Biology

Biology of Rabbits

LIFE SPAN	6-13 years
TEMPERATURE	100.0-103.0° F (38-39°C)
PULSE	130-325 beats per minute
RESPIRATION	32-60 breaths/minute
REPRODUCTIVE MATURITY	♀ and ♂ sexual maturity 4-5 months for small breeds, 5-8 months for large breeds

There are many breeds of rabbit. Rabbits can be classified by size, by fur type, or by body type. Small breeds, those weighing less than 4-5 lb (2 kg), include the Netherland dwarf, mini-lop, and Dutch breeds. Medium breeds, those weighing 5-10 lb (2-5 kg), include the rex, English, Angora and Belgium breeds. Large to giant breeds are those weighing more than 10-11 lb (5 kg) and include New Zealand whites, English lops, British giants, and Flemish giants. Body types also can be used to classify breeds of rabbit. The commercial body type is most commonly seen in production and meat animals. These rabbits grow fast and tend to have large meaty loins. An example of this type is the New Zealand. The compact body rabbits are similar to the commercial type, only smaller. Example breeds are the American fuzzy lop and the small or dwarf breeds. There is only one representative of the cylindrical body type recognized by the American Rabbit Breeders Association, the Himalayan. The British Rabbit Council also recognizes a second breed, the Vienna. Cylindrical shaped rabbits show a straight top line with no arch. The profile shows no taper. Fully arched rabbits are built for agility and speed and resemble hares, which is where most of the bloodline comes from. The arch starts at the neck and goes right down to the tail. When viewed from the side, there's space under the belly. The semi-arch body type is common in the largest of rabbit breeds including the Flemish giant.

Rabbits have very delicate skin that can easily be torn when clipping, as for pre-operative preparation. Rabbits do not have footpads but instead have thick fur on their feet to protect them from the environment.

Rabbits' large ears are used for hearing and for thermoregulation. Rabbits have good vision but cannot see

directly below their nose, relying on their stiff whiskers to identify things in the area of their mouth. Rabbits are obligate nose-breathers and have a relatively small thoracic cavity.

The skeleton of rabbits is very light and they are very muscular. This predisposes them to vertebral injury and long bone fractures. Unlike rodents, rabbits have four maxillary incisors, two large central incisors with two smaller incisors, the peg teeth, behind them. Dentistry is described below.

The large cecum of rabbits provides anaerobic fermentation of plant foods; the cecum has a capacity roughly ten times that of the stomach in rabbits. Cecal pellets are passed through the rectum and immediately re-ingested for further breakdown (coprophagy). Rabbits excrete excess calcium through the kidneys and so may have turbid urine. Color of the urine varies from yellow to red, depending on their diet.

Describe the unique anatomy of rabbits that predisposes them to vertebral injury.

Gender Identification in Rabbits

Gender identification is by protrusion of the penis in males. Hold the rabbit as shown below. Hold the tail with two fingers and put pressure beneath the anogenital orifice with the thumb. Pull on the tail

gently but firmly and press downward on the area of the vent.

In the picture below, the tubular structure with a circular opening is the penis. In adult males, there also will be grayish areas running parallel to the long axis of the bunny on either side of the vent; these are the scrotal sacs. Inguinal canals are open throughout the male rabbit's life, so the testes can readily be drawn back into the abdomen.

The picture below is a doe; pressure on the vent causes minimal protrusion of tissue, with a slit on it.

"Male vs. female rabbits", http://www.raising-rabbits.com

Specifics of anatomy and other information about rabbits can be found in the Manual of Exotic Pet Practice, pp 375-405.

Housing

The size of the hutch depends on the size of the rabbit and should include areas for sleeping, eating, and urination / defecation. If rabbits are to be housed in the hutch with no outdoor exercise, the hutch must also be large enough to permit the rabbit to exercise within it. The cage should be tall enough for the rabbit to sit upright without its ears hitting the top of the cage. Wire cages, including wire floors, can be used for most breeds, however, heavier rabbits should be kept on solid floors to prevent injury to the feet. Wire mesh should be an appropriate size to ensure that the rabbit's toes are not caught within mesh on the floor. All cages should include an area of solid flooring for resting. Hutches with solid floors where the rabbit will directly contact the bedding should contain timothy or grass hay, or another absorbent material. Wood shavings generally are not recommended. Urine and feces should be cleaned from the hutch daily and completely fresh bedding provided once or twice weekly. Rabbits can be trained to use a litter box. Fresh water should be available at all times in a sipper bottle or heavy crockery dish that cannot be tipped.

Rabbits are best housed at an ambient temperature from 60-75°F and humidity from 30-60%. They can tolerate colder temperatures if acclimatized and provided an enclosed shelter, however, they do not tolerate heat well.

Vaccinations and Disease Control

There are no vaccines recommended for control of infectious disease in pet rabbits.

Parasite Control

The most common endoparasite of rabbits is coccidia, of the *Eimeria* sp. These can be diagnosed on fecal examination and treated as in other species. Rabbits housed outside may become infested with fleas; diagnosis and treatment is as in other species. Ear mites also are common if the hutch is at ground level as the rabbit may have contact with wild rabbits.

Behavior

Rabbits prefer to eat in the afternoon and evening and should drink a fair amount of water every day, up to 100 ml/kg/day. Rabbits unsupervised indoors will chew and may damage furniture and woodwork or chew on electrical cords.

Male rabbits kept together may fight. Female siblings maturing together show less aggressive behavior towards one another than other rabbits. When fearful or aroused, rabbits may thump with one rear foot and may spray urine. Rabbits may pull fur from themselves or others and chew it. Fur-chewing is thought to be caused by boredom, a low fiber diet, or some unidentified nutritional deficiency. Increasing fiber seems to be effective in preventing fur chewing. Enrichment is an important component of housing to promote normal behaviors.

Dentistry

Rabbits are predisposed to dental disease by congenital malocclusion or by poor diet, without adequate wear on the continuously erupting incisors. Signs of dental disease include lack of appetite, dropping food from the mouth while chewing, and drooling. Overgrowth of incisors is easily visible on physical examination but overgrown cheek teeth require additional examination techniques. Because rabbits have a small oral cavity, complete evaluation of cheek teeth may require the use of an otoscope with a large diameter cone, sedation and passage of a speculum, and/or dental radiographs. Overgrown incisors and molars can be corrected as in other herbivore species, using a high-speed trimming dental burr or dental disc. Malocclusion is seldom "cured" by trimming and additional visits for further dental care may be needed for the life of the animal.

Biosecurity

Good general hygiene should offset any concerns about passage of disease from pet rabbits to humans.

Sterilization

Anesthesia in rabbits may be difficult due to problems with placement of endotracheal tubes for gas anesthesia. Elective ovariohysterectomy or ovariectomy may be performed in female rabbits (does) for reproduction control. Elective ovariohysterectomy should be performed in does before they reach 2 years of age to decrease

incidence of uterine adenocarcinoma, a common and high morbidity tumor in many rabbit breeds. The surgery is performed as in dogs and cats, with specific care taken to avoid the large cecum on entering the abdomen, and not to tear the ovarian vessels by placing undue tension while attempting to exteriorize the ovaries. Does have a cervix at the caudal end of each uterine horn; each horn generally is ligated and transected just cranial to the cervix. Elective orchiectomy (castration) is performed in male rabbits (bucks) either for reproduction control or to minimize reproductive behaviors. The surgery can be performed either as in dogs or cats and it is required that the inguinal canal be closed on each side to prevent herniation of abdominal contents. Skin incisions are closed with buried suture or tissue glue.

Nutrition

The primary component of a rabbit's diet should be high-quality timothy or grass hay, which should be offered ad lib. Rabbits also should receive a small amount of commercially-prepared, timothy-hay rabbit pellets (less than 18% protein and 18-22% fiber) and about 1 cup of dark leafy greens daily. Types of greens includes romaine lettuce, unsprayed dandelion greens, parsley, and the tops of carrots, beets, and turnips. Rabbits do not naturally eat root vegetables and should not be given carrots, beets, or other root vegetables, which are relatively high in sugar.

Describe as you would to a client the ideal diet in ferrets. How does it differ from the ideal diet of rabbits? Provide details of diets for both species.

HEDGEHOGS

Ownership of hedgehogs is illegal in the states of Arizona, California, Georgia, Hawaii, Maine, and Pennsylvania and in Washington DC and all five boroughs of New York City.

Unique Anatomy and Biology

Biology of Hedgehogs

LIFE SPAN	3-8 years
TEMPERATURE	97-99° F (36-37°C)
PULSE	180-280 beats per minute
RESPIRATION	25-50 breaths/ minute
REPRODUCTIVE MATURITY	♀ puberty 6-8 months, ♂ breeding initiation 2-6 months

The most common hedgehog variety kept as a pet in the United States is descended from African species and is called the African pygmy hedgehog. These animals are 7-10” (18-25.5 cm) long and weigh 9-25 oz (255-708 gm). They have a long snout, four digits on each foot, and 36 teeth. They have unique musculature that permits them to

roll into an almost complete ball with the spines facing outwards, for defense.

Appearance of Hedgehogs

"Hedgehogs", https://www.chamblyveterinaire.com/en/uncategorized/hedgehogs/

The most notable characteristic of hedgehogs are the

spines that the animal has developed as a means of defense. The spines cover the back, sides, and the crown of the head; the face, forehead, chest and underside are covered with hair. The spines are modified hairs made of keratin. Each hedgehog has from 5,000 to 7,000 spines. The outside of the spine is solid and the inside is filled with soft air pockets. Spines are soft at birth and harden within hours, with an even stiffer set of spines emerging at about 2 days of age.

Gender identification is by anogenital distance. The genitals of the female are adjacent to the anus while the penis of the male is well away from the anus, on the ventral midline, and often looks like a big belly button.

Gender Identification of Hedgehogs

"Male vs. female african pygmy hedgehogs", https://www.factzoo.com/mammals/african-pygmy-hedgehog.html

Specifics of anatomy and other information about hedgehogs can be found in the Manual of Exotic Pet Practice, pp 433-455.

Housing

Hedgehogs are best housed individually. Aquariums, large plastic tubs, and plastic dog or cat carriers can be used as enclosures for hedgehogs. The enclosure should have smooth, high walls and a lid to prevent escape. Larger habitats are recommended to allow room for a litter pan, nest box, and exercise wheel, and to give the hedgehog room for exercise; in the wild, hedgehogs wander long

distances in search of food and mates. A nest / sleeping box should be provided for the hedgehog. It should be a little longer, wider, and taller than the animal. The animal should be able to enter, turn around, and exit the box easily. Aspen or other non-aromatic shavings are recommended as a floor covering and should be changed 1-2 times weekly. Sawdust may cause respiratory problems and it can also cling to the anal and genital areas of the animal. The cage should have a solid floor. Hedgehogs can injure their legs and feet if they get caught in wire floors. Hedgehogs are clean animals and prefer to urinate and defecate in a dedicated area. A litter tray should be put in the cage. Plastic is preferred because it's easy to clean. Non-scoopable, dust-free clay cat litter can be used in the litter box. The litter tray needs to be cleaned daily and the litter should be changed weekly. Food bowls should be sturdy and non-moveable. Hedgehogs should also have a sipper water bottle. Ambient temperature should be 75-80°F. At much lower temperatures, hedgehogs will hibernate and at much higher temperatures, they estivate.

Vaccinations and Disease Control

There are no vaccines recommended for control of infectious disease in pet hedgehogs.

Parasite Control

The most common parasite of pet hedgehogs is mites. Animals may carry the mites with no signs or may show pruritus and quill loss. Diagnosis is by microscopic examination of skin scrapings and treatment is with ivermectin or permethrins.

Behavior

Pet hedgehogs generally are most active at dawn and dusk; in the wild, hedgehogs are nocturnal. Hedgehogs are solitary. They make a variety of sounds include clicking and hissing, and make and hear sounds well above the range of human hearing. One of the most peculiar and least understood behaviors of the hedgehog is the process of anointing. When the animal comes across a new smell or object, it licks at the smell or object, producing a flow of foamy saliva. The animal will then stiffen its front legs and swing its head from side to side. Using its tongue it spits and smears its spines with the saliva. The reason for the behavior is not known. Enrichment is an important component of housing to promote normal behaviors.

Biosecurity

The Center for Disease Control and Prevention reported an outbreak of salmonellosis in humans in 2019 that was traced back to hedgehogs. No single supplier of pet hedgehogs was identified as problematic. The CDC strongly encourages people to wash their hands after handling a hedgehog and any of its toys or anything in its enclosure. Never to put a hedgehog near the face or kiss a hedgehog. The very young, and very old, and immunosuppressed people are at greatest risk of infection.

Nutrition

Nutritional requirements of hedgehogs have not been well defined. The base of the diet for captive hedgehogs should

be a commercial insectivore diet for their species or dry, low-calorie cat or dog food. Other foods that can be provided include invertebrates such as earthworms, mealworms, waxworms, and crickets; vegetables such as spinach, kale, carrots, and yams; fruits such as apples, bananas, papayas, and melon; and occasional treats of cooked egg, cottage cheese, or meat baby food. Caution must be used to ensure hedgehogs do not become obese. Foods that should not be given to hedgehogs include grapes, raisins, onion, garlic, and dairy products.

What should you never feed to hedgehogs? To rabbits? To ferrets?

SUGAR GLIDERS

Sugar gliders are not legal to keep as pets in Alaska and California. Special permits are required for ownership in Massachusetts and Pennsylvania.

Unique Anatomy and Biology

Biology of Sugar Gliders

LIFE SPAN	12-15 years
TEMPERATURE	96.5-98.0°F (36-37°C)
PULSE	200-300 beats per minute
RESPIRATION	16-40 breaths/ minute
REPRODUCTIVE MATURITY	♀ and ♂ puberty 3-4 months

The total body length is 10-12” (25-30 cm). The tail is usually equal to the body length. They weigh 3-5 oz (85-140 gm) with males being slightly larger than females. They have a triangular head with a short muzzle, rounded nose, and large eyes. They are soft gray in color with cream undersides. Sugar gliders have five toes on each forefoot which end with short curved claws. The inner toe on the hind foot is clawless but enlarged or bulbous which helps them grasp and hold on to branches. The second and third digits on the rear feet are fused together and have two claws.

One of the most distinguishing features of the sugar glider is the patagium, a thin, furred membrane that stretches from the wrists to the ankles. When not gliding, the membrane appears as excess skin on the side of the animal. When gliding the animal extends all four legs, which stretches the membrane out and allows the animal to glide up to 150 ft.

Appearance of a Sugar Glider

“Sugar Gliders”, https://en.wikipedia.org/wiki/Sugar_glider

"Gliding Sugar Glider", https://mashable.com/2016/01/10/sugar-glider-instagram/

Male sugar gliders have a scrotum on their midline abdomen. The penis is bifurcated but is rarely seen extruded. Adult males have a distinctive diamond-shaped bald spot on top of their head which corresponds to a scent

gland. Females have a small pouch, which appears as a ½" slit, on their abdomen.

Housing

The enclosure needs to be large enough to house more than one animal and to allow them to explore, climb, exercise, and glide. Large bird cages or aviaries may be used for housing sugar gliders. To prevent escape, the openings between wire bars should be quite small, especially if babies are present.

Tree branches or limbs should be added to give the cage a more natural environment and to encourage foraging and exercise. Branches from non-toxic woods like apple, pear, plum, or willow are recommended; conifer branches should not be used.

Cages should include a nest box and safe bedding. A cloth pouch high in the cage will be used as a place to curl up and rest. Aromatic wood shavings should not be used for bedding. Toys used for birds like swings, ladders, and bells can be enjoyed by sugar gliders. They also like pieces of PVC pipe or cardboard paper towel rolls for exploring.

Food should be placed in heavy bowls that can't be tipped over. Water can be supplied in heavy bowls or bird dishes fastened to the side of the cage. Bowls need to be cleaned daily. Food bowls should be placed high up in the cage where the gliders will feel more safe and secure. This also will prevent feces and urine from falling into them and contaminating the contents.

Ambient temperature should be 64-75°F at a minimum. At temperatures greater than 88°F, sugar gliders may suffer from hyperthermia.