



THE
DALLAS
WORLD
AQUARIUM

Mammals:

A Resource for Teachers

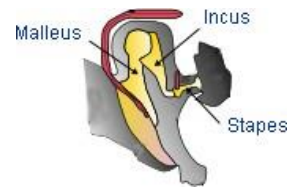
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Mammals can be found walking, running, climbing, swimming, flying or burrowing on all continents. Most mammals are terrestrial or arboreal, however, seals, whales, dolphins, porpoises, dugongs and manatees are aquatic. Mammals breathe air, even those that live in water. The frequency of breathing differs, with larger mammals breathing at longer intervals than smaller ones. Mammals vary in size from the tiny shrew to the gigantic blue whale.

Three characteristics, not found in other animals, are shared by all mammals:

1. The inner ear contains a chain of three bones: the malleus, incus and stapes. These bones allow mammals to hear sounds transmitted to their inner ear.
2. Hair, made up primarily of a protein called keratin, is present at least some time during the life of all mammals. It is found in varying amounts, locations, textures and may serve:
 - as insulation and protection
 - as sensors (whiskers or “vibrissae” that allow animals to sense contact with external stimuli)
 - to camouflage, announce the presence of an animal, communicate social information, denote gender or signal danger (color or pattern of hair)
3. The word “mammal” is derived from the Latin *mamma*, which means breast. All female mammals have mammary glands that secrete milk. Mammary glands are found in both sexes but do not develop in males. Female mammals feed newborns with milk produced by these glands that vary in number from two (as in humans) to plus twenty.



Besides the three unique characteristics, most of these warm-blooded mammals also have:

- a muscular diaphragm that separates the heart and lungs from the abdominal cavity
- four-chambered heart (air and food passages in the mouth are separated by a secondary palate)
- highly differentiated teeth
- a lower single jaw bone
- highly-developed brains
- internal fertilization
- live births (except monotremes that lay eggs instead of giving birth to live young)
- separate sexes with sex of offspring being determined by chromosomes

Based on eating habits, mammals are carnivores, herbivores or omnivores:

- Carnivores eat live or dead animals.
- Herbivores feed on plants – grasses, roots, leaves, fruits, etc.
- Omnivores feed on both animals and plants.

There are more than 5,000 living species of mammals that are often placed in 26-27 orders that are divided into three subclasses – monotremes, marsupials and placentals.



- Monotremes, like birds, lay eggs but feed their young with milk secreted through pores over an area on the chest that is without nipples. Included in this subclass are the duck-billed platypus and two species of echidnas (spiny anteaters). They are found only in Australia and New Guinea.



- Marsupials, called pouch mammals, give birth to underdeveloped and helpless young (altricial). These young remain in the pouch until they are old enough to live independently (kangaroos, opossums, koalas, wallaroos, wallabies and wombats).



- Placentals nourish their young in the mother's body through the placenta (the vascular organ that unites the fetus to the mother's uterus). The largest of the subclasses, placentals include approximately four thousand species, including those with which we are most familiar – humans and pets.

The orders, families and species listed below are represented at The Dallas World Aquarium. Many species are on exhibit, however, some may be in non-public viewing areas:

Carnivora

- Felidae - **ocelots**
- Mustelidae - **otters**

Chiroptera

- Psyllostomidae - **bats**

Diprotodontia

- Macropodidae - **kangaroos**

Hyracoidea

- Procaviidae - **hyraxes**

Lagomorpha

- Leporidae - **rabbits**

Pilosa

- Bradypodidae - **three-toed sloths**
- Megalonychidae - **two-toed sloths**
- Myrmecophagidae - **anteaters**

Primate

- Atelidae - **howler monkeys**
- Callitrichidae - **tamarins**
- Pitheciidae - **saki monkeys**

Rodentia

- Dasyproctidae - **agoutis**

Sirenia

- Trichechidae - **manatees**

CARNIVORA



The word “Carnivora” (one order of placental mammals) means “meat-eaters.” Even though the order Carnivora consists mainly of meat-eating animals, not all members of this order are exclusive carnivores and not all meat-eaters are in this order. The panda mostly eats bamboo, American coatis and kinkajous eat fresh fruit, and bears, skunks, jackals and raccoons are omnivorous.

Most Carnivora members have:

- a carnassial pair of teeth (enlarged fourth upper premolars and first lower molars that function like scissor blades to aid when eating meat)
- powerful jaws that only move up and down, with no rotary movement
- acute senses
- speed
- a simple digestive system (less complicated than that of herbivores because they do not have to break down cellulose from plants)
- large brains
- a medium-size body
- been found in all oceans and on all continents except Australia where there is only the terrestrial dingo (probably brought in by man)



Most species included in this order are recognized by their enlarged fourth upper and lower molars (fangs) used to tear meat. They are represented on all major land masses and in all oceans. Carnivores which live in and around marine habitats are in the suborder Pinnipedia -- made up of five families which include seals, sea lions, walruses, sea otters and polar bears. Carnivores which live on land are in the suborder Fissipedia.

Some carnivores, such as the lion, wolf and cheetah, are excellent hunters. These animals chase and kill their prey. Others, such as the dingo and hyena, often scavenge for carrion. Most carnivores will scavenge if dead animals are available, however, they can hunt their own prey if necessary.



Marine carnivores, known as “pinnipeds” (fin-feet), are rather large animals. Most are insulated with a layer of fat called blubber with paddle-like limbs. The terrestrial carnivores, known as “fissipeds” (paw-feet), are often divided into two main groups, caniform (dogs) and feliform (cats).

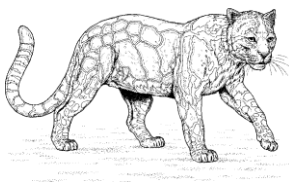
FELIDAE

Most small cats fall in the genus *Felis* of the Felidae subfamily. Big cats often fall in the genus *Panthera* of the subfamily Pantherinae. (The cheetah is sometimes separately placed in the Acinonyx subfamily but findings show it could be and often is considered part of the Pantherinae group.)

Cats (Felidae) are pure carnivores. They are probably the most specialized hunters of all mammals. As a family, felines characteristically have small skulls and short faces. The ears easily rotate to pick up sounds or to “communicate” their intentions. Strong jaws and modified molars are specialized for killing and meat-eating. The tongue has back-slanted projections (papillae) that help clean meat from the bones.



All cats walk on their toes with the back of the foot raised (digitigrade). The well-padded feet have five toes on the front and four toes on the hind feet. The first toe on the front foot (dew claw) is on the side of the leg. This toe has disappeared on the back foot. Dew claws, because they do not wear down and thus always sharp, are important in downing their prey at initial contact. Except for the Cheetah, all cats have long, sharp retractile claws. This protects the claws from excessive wear, keeps them sharp for climbing and allows the cat to draw the claws in so the paw can be used without scrapping or tearing. Because of their curved claws, cats (except Margays) are required to “back down” the trees they have climbed. Margays can climb down a tree vertically and upside down. All cats have a somewhat flexible skeletal structure that usually enables them to land on their feet when jumping down or falling. Cats, often seen sharpening their claws, depend on their claws for grabbing prey. Damaged claws usually regenerate.



Most cats have exquisite and agile bodies covered with soft fur. Feline coats are adapted for various climates, with long fur on those animals in cold regions. An important function of the somewhat loose coat is to provide camouflage. Their disruptive coloration (spots, stripes, blotches set in a lighter background) breaks up the body outline. The variations of patterns allow for appropriate camouflage, based on the surroundings for each species. Males are usually longer and heavier than females but have about the same shape and color.

Cats prey on anything not too large to kill, including mammals, reptiles, birds, fish and even large insects. Felines usually capture their prey either by stalking or patiently waiting in ambush, followed by a swift lunge or pounce. Sprinting chases by the Cheetah have been recorded at more than 65 mph (105 kmph). The combination of teeth, claws, strong jaws and powerful shoulders allows the cat to independently grab, drag down its catch and kill it with a powerful bite to the head or neck. Cats rely on sight and hearing. The pupils of the eyes contract to vertical slits during the day and expand in the dark. Their vision is binocular and colors can be detected. Smell is usually used for examining the kill. Long whiskers provide an acute sense of touch at close range. The mystacial whiskers on the sides of the face are the most important and well-developed. It is believed these whiskers help the cats find their way in the dark and give information about where to bite their prey to inflict the fatal blow. The

superciliary whiskers, located above the eyes, probably serve a protective function. Genial whiskers are those back on the sides of the face, somewhat in line with the mystacial. Carpel hairs at the back of the forelegs are also responsive to touch.

The gestation period in felines varies from 56 to 114 days, with smaller cats requiring fewer days. Female cats seek out an appropriate den where they usually give birth to between one and seven offspring. Litter size is not directly related to size of the species. Offspring are usually called kittens in the smaller species and cubs in the larger ones. Cats are born in a semi-altricial state. Their eyes are closed at birth and normally open between one and two weeks of age. Eyes of the larger species open earlier and lion cubs can sometimes see from birth. Except for the lion, the mother cat is solely responsible for the care and feeding of her young. Mothers must also teach the cubs to recognize and kill prey.



Cubs stay near their mother until approximately six weeks old, when they leave the den. Cubs must rely on their mother for food between “baby” or “milk” teeth and growth of their canines that are necessary for catching their own prey. Cubs will keep in contact with the mother for up to two years.

Communication by vocalization is quite different between the large and small cats. Based on anatomical differences of the throat, larger cats are said to “roar” and smaller ones “purr.” Cats can purr continuously while breathing both in and out. Vocalizations are used to communicate with other nearby cats. Hissing and spitting are evident when antagonized, usually followed by body language.



Other visual communication includes ear movements, arched back, crouching stance and tail movement from side to side. A “slinking” movement and flattened ears may show submission. Cats are quite territorial and scent mark their space with special glandular secretions and/or urine. Scent glands, scattered over various parts of the body, are used to communicate territory and mating stages. Larger cats often mark their space by depositing feces in strategic places. If not needed for communication purposes, larger cats, like most smaller ones, may choose to bury their feces. Scratch marks on logs are commonly left for others to see. Some carnivores (skunks) have scent glands for defense purposes. Although most carnivores are considered

solitary animals, they socialize through communication based on sight, sound and scent. Some live in groups that may be dominated by males or by females. The social organization in lions (groups called prides) may be related to food.

OCELOTS



Ocelots are known for their beautiful coats. They have a short fur that is marked with both black spots and rosettes. The base color ranges from tawny to reddish brown. Their undersides tend to be lighter or white in color. They have a single, white spot on the back of each ear and some white markings around their eyes and mouth. Two black lines run the length of either side of their face and the tail is marked with black bands. Ocelots have large reddish-brown eyes. They have retractable claws, like most cats, so the claws

remain sharp for seizing and holding prey.

They are the largest of the small spotted cats. Length is from 36 to 40 inches (80-100 cm), tail 12 to 20 inches (30-50 cm), height to 18 inches (46 cm) at the shoulder, weight 25-35 pounds (11.3-15.9 kg).

Ocelots are opportunistic feeders, taking almost any animal it can overpower, remaining in dense cover when possible. They are strong swimmers, although they do not enter the water readily. Although they seem to prefer ground hunting, they are excellent climbers and occasionally stalk monkeys, iguanas, lizards and birds in trees. Largely nocturnal, their spotted coat makes them quite inconspicuous. They usually sleep during the day in trees or hidden under cover. They move quickly and quietly in the undergrowth catching mice, rats, rabbits, pacas, agoutis, peccaries, opossums, frogs, crabs and small turtles.

These cats have a fixed territory, which they mark with excrement and scent. Their large eyes allow for acute binocular vision and good night vision, adapted for hunting. Hearing is also excellent, even though the ears are relatively short; sense of smell is also quite good. The whiskers are extremely sensitive to touch. Although they may often hunt with another Ocelot, they are considered solitary, except during mating and giving birth, sometimes “mewing” to keep in touch with each other.

Gestation varies between 79-85 days. Litter sizes are small, usually only one or two young, with the rare occurrence of three. Only the females care for the young, although males do help by bringing food for the mother. Females prepare dens for their kittens in thick brush. Mothers leave at night to hunt, but spend each day with their kittens in the den. The kittens begin hunting with their mother when they are about three months old and are independent after approximately one year, but may stay with their mother for an additional year. The kittens are darker at birth but otherwise colored like their parents. They are blind at birth, but well-furred.

Ocelots live in a variety of habitats, including mangrove forests, coastal marshes, savannah grasslands, pastures, thorn scrub and tropical forests. All of these habitats provide dense vegetative cover. They are found in southwestern U.S. (Arizona and Texas), throughout Mexico and Central America and in South America from northern Argentina and Paraguay to Ecuador, but absent from Chile.

MUSTELIDAE

Animals that belong to the family Mustelidae are called mustelids. Mustelids are native to all continents except Australia and Antarctica. They are the largest family of carnivores, with about 26 genera and 67 species. Mustelids include weasels, stoats, ferrets, fishers, tayras, wolverines, grisons, martens, otters, badgers, skunks (debatable) and others. With their differing life styles, one or more of the mustelids has adapted to almost every type of terrestrial habitat (underground to treetop) and to aquatic environments (both fresh and salt water).

Most mustelids (except for the wolverine and badger) are extremely slender and long, with rather dished-in faces. They spend most of their time hunting for food to sustain their high metabolic rates. They range in size from the cigar-sized Least weasel, smallest of all carnivores at eight to ten inches (20 - 25 cm) in length and weighing 1 - 2.5 ounces (28 - 71 gr), to the Giant otter, five to seven feet (1.5 - 2 m) in length and weighing up to 65 - 100 pounds (29 - 45 kg).

Known for their fidgety, spunky energy, mustelids are sometimes considered “fearless.” Their motions are quick, though not always graceful, with extreme endurance and strength. Their short legs are powerful and their five-toed feet are adapted for running, climbing, digging or swimming. Otters are master swimmers and can stay submerged for three or four minutes.

At the surface, three humps are characteristically shown, separated by five to eight inches (13 - 20 cm) of water. The humps are: the head, the back and the end of the tail that is curved above the water line. Maneuverability is the best swimming skill of the otter. Quick turns can be made by using the tail and hindquarters as a rudder. Otters can even swim in tight circles, dragging small fish up that have hidden under an overhanging bank.

When surfacing, the otter stretches its neck and turns its reptilian-like head from side to side before surfacing or coming out on land. They can cover as much as 16 miles (26 km) overland in a single night. Overland, they awkwardly move by humping their back, often taking a couple of bounds and sliding on their belly for several feet. On slopes, otters may glide or toboggan for some distance.

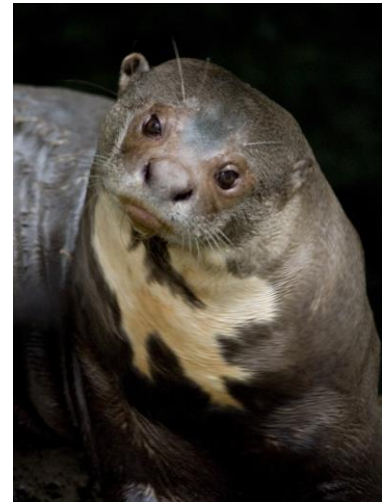
All mustelids are plantigrade (those species that place the full length of their foot on the ground during each stride, such as humans) or digitigrade (those species that walk with most of the length of their digits but not the soles of their feet, in contact with the ground) and their feet have five toes. The tail is usually long, the small ears are rounded and the eyes are usually small. All mustelids have well-developed anal glands for marking territory or using as potent weapons (skunk). Some of the finest furs are worn by the sea otter, sable, mink, marten and ermine. Exploitation of their furs varies as market values rise and fall with fashion changes.

The 13 species of otters are the most aquatic of the Mustelids. They are found in freshwater streams, rivers, lakes and coastal areas of five continents. They prefer bodies of water free of weeds and undisturbed by humans. More than half of these species are considered threatened or vulnerable by the IUCN/World Conservation Union. Otters usually are placed at the top of their food chains, but when young, they are more likely to fall prey to Jaguars, wolverines, killer whales and others. The main threats to their survival are disease and many man-made problems (fur trade, poaching, pollution, pesticides, dams, habitat destruction and fishing nets). Except for whales, manatees, dugongs and pinnipeds (seals, sea lions and walrus), the sea otter is the most aquatic of any mammal.

GIANT OTTERS

The Giant otter (*Pteronura brasiliensis*), the largest otter in the world, was discovered in 1788 by Gmelin. It is also called the Guiana flat-tailed otter, Winger- tailed otter, Margin-tailed otter and River wolf or “Lobos del Rio” in Spanish. It lives in freshwater rivers, creeks and lakes scattered through areas from Venezuela to Argentina.

During the rainy season, Giant otters will follow fish as they move into the flooded forest. During the dry season (when cubs are reared), they become less mobile. Averaging six feet (1.8 m) in length for adult species, they have been recorded at almost eight feet (2.4 m) from head to tip of the tail. They are valued for their dense brown, velvety fur.



These aquatic predators are fully adapted to swimming. Their powerful tails are muscular, wide at the base and flat at the end (semiflattened, somewhat like that of a beaver) – allowing them to move with extraordinary speed in water. The Giant otter moves through the water using different parts of the body, according to its swimming speed.

All four feet are paddled with the tail stationary when swimming slowly. If moving quickly, the tail is undulated and the feet are stationary. Otters have an elastic webbing between their toes. They also have two layers of hair, one of which is waterproof. Like beavers and muskrats, long coarse guard hairs cover and protect the short thick underfur which traps air and keeps the skin dry. Their heads are round and supported by very developed muscles and jaws that allow them to swallow large fish completely in a matter of seconds. Special muscles enable the otter to close its nostrils and small ears when underwater. The nose is completely covered in fur, with only the two slit-like nostrils visible. The eyes are large and acute, great for hunting underwater.

Each animal has a unique pattern of creamy white spots on their lips, chin, chest and neck, just like a fingerprint by which it is recognized.



Giant otters are piscivores, feeding mainly on fish which are hunted during the day. Two species of fish make up more than seventy percent of their diet – characin and cichlid. Unlike most other otter species, they hunt in groups (thus the nickname “river wolves” because they hunt in packs) with each animal hunting its own prey to eat on its own. When fish are unavailable, they will resort to crustaceans, snakes and caimans.

They rely mostly on vision but also use sound and touch when hunting for food in murky water. They eat an average of six to nine pounds (2.7 - 4.1 kg) of seafood per day. Food is either taken to shore (large prey) or eaten while floating on their back (small prey). Using its “wolf-like” teeth, water current- sensing whiskers and strong webbed forehands, it is an extremely effective water hunter. It eats all of its prey, including the bones.

The Giant otter usually lives in family groups of up to ten members. Groups are territorial and consist of a monogamous pair and their offspring from several years. Older siblings assist in taking care of the young when the parents are busy. They mark their territory with scent from the anal gland. Although territories are maintained, they are very social animals.

Most of their time is spent in the water; they gather their families and sleep in dens at night. Living areas are prepared by trampling the surface vegetation, collecting tree limbs and leaves and embedding the leaves and branches into the trampled mud patch. Large, long burrows are then constructed under fallen logs in banks of rivers and lakes. One to five communal latrines are also placed along the perimeter of the site. Parents defend the marked territory and their offspring if intruders invade their space. They also groom each other and rest together.

They communicate vocally with many different sounds. These vocalizations probably serve as warning signals against predators and as contact calls. Said to have “the gift of gab”, Giant otters constantly interact through high-pitched hums, whining squeals and screeches. When frightened or concerned, they surface out of the water, craning their necks and snort loudly. In the wild, otters can often be heard before being seen.

It is believed that peak breeding season begins in late spring and early summer, with some breeding taking place throughout the year. Mating occurs in the water, with a gestation period of 65 - 72 days. High juvenile mortality often leads to conception of a second litter of offspring (usually born from December to April). One to four altricial cubs are born in late August through early October. Each offspring weighs approximately six to eight ounces (170 - 227 gr).

The young stay in the den for up to two months before venturing out and participating in group hunts. They remain dependent on their mother's milk until they are approximately five months old. They are independent hunters and indistinguishable from their parents at 9 to 10 months. Young otters leave the group and search for a vacant territory or a mate, once they reach sexual maturity (approximately two-three years of age). The life span of the Giant otter is 10 - 13 years in the wild and 21 years in captivity.

The *Pteronura brasiliensis* has few predators but occasionally it is killed by Jaguars and pumas. Juveniles left unattended suffer greater predation. The biggest threat is habitat destruction and water pollution by humans.

CHIROPTERA

Chiroptera means "hand-winged". The Order Chiroptera is made up of flying "mouselike" mammals known as bats. Their long forearms and hands are webbed, enabling the "wings" to be used for flying. They are the only group of mammals capable of true flight. They have large ears, for echolocation, used for navigating and in some species, finding prey. In mammals, only rodents contain more species than bats.

Phyllostomidae

This Family of New World leaf-nosed bats includes approximately 150 species often referred to as leaf-nosed bats. They range from the U.S. to Argentina, in habitats from deserts to forests. Most species have a simple nose leaf on the muzzle. Their fur colors range from gray, various shades of brown to orange, red, yellow, or white.; Phyllostomatid bats are 1.6–5.3 inches (4.0–13.5 cm) long, without the tail. They usually live in small groups, however, some species form colonies of several hundred. They roost in caves, tree hollows, buildings, "tents" constructed of leaves, undersides of large palm leaves and under bridges. Their diet varies – insect eaters, carnivorous, blood, fruit, nectar and pollen.

SEBA'S SHORT-TAILED BAT

The dense fur of Seba's short-tailed bat (*Carollia perspicillata*) is usually dark brown to dark gray in older animals, although quite rare, some are rusty-orange in color.

This is one of the largest and most successful bat groups. These gregarious bats roost in groups of 10-100 in caves, hollow trees, tunnels and road culverts. Peak activity is soon after sunset.

They can be destructive to crops and are seen as pests. Short-tailed bats enter a state of torpor (a time when the heartbeat, temperature and body activities slow) when food is lacking. Two roost types are: harem (adult male with many females and their infants) and bachelor (adult and sub adult males without a harem).

Vocalizations between the males and females warn intruding males and control the females. Harem males also guard the infants while their mothers are out foraging and help to reunite the two.

The adult length is 1.8 - 2.5 inches (4.6 - 6.4 cm). Adults weigh between 0.6 - 0.7 ounce (16 - 20 gr). Adult wingspan is about 8 - 9 inches (20–23 cm). Because of its relatively small size, they are restricted to eating smaller fruits containing numerous small seeds. They favor seeds of the genus *Piper*, from the black pepper family but also eat other plants, fruit, pollen and insects. Their ability to switch food sources may be why they are so plentiful in the wild. Generally foraging close to the ground, they feed



at a number of sites during a single night. Short-tailed leaf-nosed bats have an excellent sense of smell. They use echolocation to navigate at night. Bats make a variety of sounds, both audible and ultrasonic. The audible sounds are used to communicate between mothers and their young, between roost mates, to attract mates and as alarm cries.

Seba's short-tailed bats have two reproductive periods. The larger one coincides with peak fruit productions, (June-Aug) and the other with the blooming of flowers at the end of the dry season (Feb-May). Gestation is 113- 120 days and a single infant is usually produced. Newborns weigh approximately 0.176 ounce (5 gr). Sexual maturity may be as early as nine months to one year for females and one to two years for males.

Found in moist evergreen and dry deciduous forests from northern Argentina to southern Mexico. Seba's short-tailed bat is probably the most abundant mammal living in the New World tropics.

COMMON VAMPIRE BAT

Most Common vampire bats have a small, circular, compact and muscular body that is varying shades of gray above and lighter gray underneath. The short, fine fur varies in length and attributes to a rather disheveled look.

They have fang-like incisors and a long, pointed pink tongue. Two projecting, large, sharp upper incisors are joined at the bases by impressive canines. Only the canines are pointed and sharp on the lower jaw. The small peg-like front teeth used to grasp their prey are widely spaced so the tongue can lap the blood. The vampire bat has fewer teeth than other bats.

The short neck and stub nose gives the face a "bulldog" appearance. The tail is absent with only a narrow membrane connecting the vampire's long hind legs to the rump. The rather large dark eyes are set low on the face. The ears are pointed with a triangular-shaped flap that may assist in echolocation. A deep fold in the jutting lower lip gives the appearance that the lip is split. The long thumb on the edge of the forelimb is longer than the entire hind foot. With its three sole-like pads, it serves as a front foot, allowing the vampire bat to run silently on all fours.

During the day, the nocturnal vampire bat sleeps in places with total darkness, such as crevices or caves, where it hangs upside down. It spends 80% of its time sleeping or resting. About two hours each day is spent grooming each other and feeding regurgitated blood to their roost mates (when unable to find their own food). This sharing of food usually occurs between females and young bats. Vampire bats generally live in colonies of 20-100 individuals.

The Common vampire bat is the most agile of all bats. It can fly, climb vertical walls, run, jump, hop quadrupedally and fling itself upward for flight – which is necessary for stalking and attacking its prey. Vampire bats do not usually alight on their victim, but land close by, walk to their prey and climb to the appropriate meal site.

The length of the Common vampire bat is 2.8 - 3.5 inches (7 - 9 cm); wingspan is 7-8 inches (18 - 20 cm) and common weight is 1.8 -2 ounces (51 -57 gr). It feeds exclusively on the blood of other vertebrates. The teeth slice into the flesh, making a 0.12 inch (0.3 cm) incision that is evidently rather painless, as the sleeping victim seldom awakens. It injects saliva that contains an anticoagulant chemical. Opening the wound and eating usually takes about 20 minutes. Two channels, located on the underside of the tongue, draw blood from the prey (like drinking through a straw). As the blood begins to flow, the bat sips and licks the blood, normally approximately 2/3 of an ounce (18.8 gr) or about 40-60% of its weight. Some bats will eat so much that they are unable to fly until some of the blood has been digested. However, since only red blood cells are needed, the digestive system quickly converts the plasma to urine, eliminating extra weight while eating.

Even though vampire bats are nocturnal, they have good vision and a well-developed sense of smell which helps select prey and recognize roost mates. The heat-sensing pits around the nose help the bat select warm body parts with a rich blood supply close to the surface of the skin. A good sense of touch warns the bat if prey is awakening from sleep.

Hearing is the most important and accurate sense of the vampire bat. Vampires, like most bats, navigate by echolocation. High frequency sounds are sent out that reflect off objects, with bat listening for the echoes in order to locate their prey. These bat sounds are too high to be heard by humans. Vampire bats use a low frequency for social interactions and a higher frequency for echolocation.

Common vampire bats are sexually mature at approximately nine months of age. Most females normally have one pregnancy each year. A gestation period of about seven months, usually results in a single young, but occasionally there are twins. The well-developed newborns weigh between 0.18 - 0.25 ounce (5 - 7 gr) at birth. After one month of feeding on milk from the mother, the mother regurgitates blood for the young until about four months of age, at which time they begin to hunt with their mother. Growth is normally complete at about five months of age.



Vampire bats are the only mammals that feed entirely on blood. Its saliva contains an anti-coagulant which keeps the blood vessels from contracting. Known as Draculin, the anti-coagulant keeps the wound bleeding freely for up to 30 minutes. The anticoagulant in vampire bats is twenty times stronger than any other known clotting agent. A normal wound the size of a vampire bat bite, would usually cease bleeding in 1-2 minutes. Studies are being conducted to determine how this anticoagulant might help with serious human disorders like heart attacks and strokes. It is also believed the saliva may contain a numbing

anesthetic to deaden the pain, thus keeping the host from being aware of the bite.

Because of their feeding habits, vampire bats are potential transmitters of a variety of diseases — the most noted being rabies. Any mammal, including man, can become infected by the bite of a rabid vampire bat. The usual victims are cattle and other vampire bats. The virus-containing saliva is passed onto other vampire bats when grooming, sharing regurgitated food or during social squabbles. Sudden removal of the vampire bat's regular hosts can cause attacks on humans. Bites on humans are usually on the toes, noses and ear tips, however, incidences of humans contracting rabies from vampire bats are rare.

Vampire bats are found in mines, caves, hollow trees or rock crevices throughout Mexico, Central America to northern Argentina and Chile.

DIPROTODONTIA

This large Order is made up of 117-120 marsupial mammals in 10 -11 families – kangaroos, wallabies, possums, koalas, wombats and others.

Diprotodont is Greek, meaning "two front teeth". All exhibit a large pair of incisors on the lower jaw. Most diprotodonts have three pairs of incisors in the upper jaw and some have a second pair of small incisors in the bottom jaw. They lack canine teeth, with empty spaces where these teeth should be. This dental pattern is due to their diet. Being herbivores, the sharp front teeth cut up pieces of grass and leaves for eating. Canines are usually used for tearing meat, are not needed for plant-eaters.

They can be distinguished by the following characteristics:

- Hind limbs are syndactylous. The second and third digits of the feet are completely fused together, except for the claw in diprotodonts.
- Their unique reproduction. After a short gestation period, typically between 28 and 35 days, the developing off-spring will crawl to the pouch and attach to the mother's teat where it will remain for several months.

Diprotodonts are native to Australia, New Zealand, New Guinea and surrounding islands. They can be found in a wide variety of terrestrial habitats – grasslands to forests and mountains where it snows most of the year.

Macropodidae

The family Macropodidae, which includes marsupials such as kangaroos, wallabies, tree-kangaroos, pademelons and several others. Macropod is Greek, meaning "large foot". They are herbivores and as mentioned in the characteristics of the Order Diprotodontia, they have specialized teeth for eating fibrous plants. Their digestive system is equally specialized in order to digest the plant material. There is much variation in size in this family, but the majority have large hind legs and a powerful, long tail, with exceptions to this characteristic being found in the genus *Dendrolagus* (tree kangaroos). Tree kangaroos have shorter and broader hind feet and a shorter tail and are excellent climbers.

MATSCHIE'S TREE KANGAROO

Matschie's tree kangaroos are named after Paul Matschie, a German zoologist. They are chestnut to red brown in color, with bright yellow bellies, ear edges and feet. The eyes are large and the ears are small. Their faces are yellow and white and a dark stripe runs down the back.



Their forearms are longer and stronger. But unlike primates, they do not have opposable thumbs. Nevertheless, they have dextrous forepaws: they can grasp stems in their fingers and have very flexible wrists. Their back legs and feet are short and broad with rough-textured pads and long, curved claws, to improve their grip.

They do not have the much larger hind legs like other kangaroos. They descend from trees tail first. Tree kangaroos have a way of staying dry that kangaroos in arid regions lack. The fur on their neck and back grows in a reverse angle from the rest of their coat. When waiting out a rain shower in their typical fashion – crouching with their head lower than their shoulders – their backwards- growing fur sheds water and keeps them dry.

The literal meaning of genus *Dendrolagus* is "tree hare." Long hind limbs typical of leaping kangaroos have been modified in tree kangaroos and are slightly shorter than their powerful forelegs. This gives tree kangaroos greater control and balance for climbing and moving through trees. They are extremely agile in trees, but not on the ground. If trapped up a tree, they will attempt to escape by leaping to the next tree. Unlike other kangaroos, tree kangaroos can move their hind legs independently of one another. Consisting of ten species, this is the only genus of the kangaroo family that climbs trees.



It is believed that Matschie's tree kangaroos are solitary animals. Females and males have non-overlapping home ranges but a male's range will overlap the range of several females. Researchers also believe that Matschie's tree kangaroos are polygamous and that males will interact with several females. Males, however, appear not to establish "harems," and females remain independent. The only strong social bond these animals form is between mother and offspring. They sleep 60% of the day.

Females, slightly larger than males, average approximately 17 pounds (8 kg); males about 15 pounds (7 kg). Head and body length is between 20-32 inches (52-81 cm). Tail length is 17-36 inches (43-91 cm). Tree kangaroos are browsers and 75-80% of their diet is leaves, buds and fruits. In captivity, they will eat bird eggs and young birds. They have well-developed senses of vision, touch, smell and hearing and use visual displays, touch, vocalizations and chemical cues.

The female gives birth to one offspring after a gestation period of 42-44 days, longest of any marsupial. After birth, the fetus-like young (about one inch / 2.5 cm) crawls to a teat located inside the mother's pouch where it attaches itself to nurse (lactation phase). The majority of the infant's development occurs during lactation. It remains in the pouch for about 8-10 months. The mother will clean her pouch and groom the infant often during this phase.

After the infant initially leaves the pouch (about 28 weeks), it will continue to return to the pouch to nurse. This "in and out" phase lasts for one or two months. During the final phase, the young still nurses but never climbs completely into the pouch. The young is weaned approximately one year after birth. After young Matschie's tree kangaroos are weaned, they will go off alone and establish a home range. Young Matschie's tree kangaroos are called joeys.

They can be found in mountainous rainforests at elevations of up to 6,562 feet (2,000 m). Matschie's tree kangaroos live on the Huon Peninsula of northeastern New Guinea. They are hunted for meat and their habitat is being destroyed for logging, mining, agriculture and oil exploration.

HYRACOIDEA

Hyracoidea is an order of small, hoofed mammals, made up of a single living genus, the surviving Hyrax, whose nearest living relatives are elephants and sirenians (dugongs and manatees).

Hyrax is from a Greek word meaning "shrewmouse". Some are found living in trees and others live in colonies with, at times up to 50 members. They somewhat resemble rabbits or large rodents. Their entire foot, from their toes to their heels, touches the ground (plantigrade). Pads on their feet are kept moist through a gland that secretes a fluid that helps them keep their grip on surfaces.

They have five toes on their front paws; three-toes on their hind feet (first and third toe on their hind feet have nails on them); middle toe has a long claw. Hyraxes are herbivores and live in colonies. Their kidneys allow them to retain a large amount of water, making it easier to live in their hot, dry habitats. Even though they can often be seen making a chewing motion, their multi-chambered stomach frees them from the act of chewing cud to extract nutrients from plant material. Each chamber in the stomach has symbiotic bacteria that allows them to break down plant material and also digest fiber.

All living hyraxes are members of the family Procaviidae (the only living family within the order Hyracoidea).

ROCK HYRAX

Rock hyraxes, also known as Rock dassies (*Procavia capensis*) are brownish gray on the top side and more creamy in color underneath. They resemble a large guinea pig or a rabbit with rounded ears and no tail. They are predominantly diurnal, social animals that live in small to large (perhaps as many as 50) groups. Due to poor thermoregulation, hyraxes spend much time sunning in order to keep warm. They hide among boulders and in rock crevices. Sweat glands and muscles make the rubber-like bottoms of their feet function like suction cups, helping them climb and grip rock surfaces. The toes are stumpy with hoof-like nails (four toes on the front feet and three toes on the back feet).



Head and body length of the Rock hyrax ranges from 12-21 inches (31-53 cm) and average weight is 8-9 pounds (3.6-4 kg). Rock hyraxes are vegetarians but will also eat insects and grubs. They have excellent eyesight. Eye shape is unique in that the iris extends out above the pupil,

enabling the hyrax to look more directly into the sun to watch for birds of prey by cutting off light that shines directly above its head. Adults have more than 20 vocalizations that allows communication with their young and other group members. An alarm call signals when danger is approaching.

Sexual maturity is reached at 16-17 months of age. Females give birth in a protected rocky crevice to an average of one to three young, after a gestation period of 205 -245 days. At birth, the eyes are open and the young are covered with hair.

Rock hyraxes live in rocky, scrub- covered habitats where sheltered areas are plentiful. More prevalent in Africa but also found in Egypt, Syria, Lebanon, Israel, Jordan and Libya.

LAGOMORPHA

The Order Lagomorpha is made up of two families: the Leporidae (hares and rabbits) and Ochotonidae (pikas). There are 13 genera and 80 species in these two families.

The name of the order is from the Greek lagos which means "hare" and morphe which means "form". They generally have large ears, a short tail, wide-set eyes and slit-like nostrils that they can close. The two families differ in general appearance: Leporidae are larger, have a short bushy tail, long ears and long hind legs; Ochotonidae (when compared to Leporidae) are smaller, bodies are rounded, tail is tiny and barely visible, legs are short and ears are not as obvious and are rounded.

All lagomorphs are terrestrial, occupying a wide diversity of habitats from tropical forest to tundra regions. All are herbivores, feeding on grasses and other small plants. Their continuously growing incisors are well suited for eating vegetation. This continuous growth is an adaptation to the

abrasiveness of their food and helps maintain a sharp edge on the incisors. Lagomorphs have two upper incisors on each side, with the second one being a small peg behind the large incisor in front. Lagomorphs have the ability to produce two types of fecal material, one that is wet and eaten again for further nutrient absorption, and one that is dry and discarded (coprophagy). Lagomorphs have a very large digestive system that allows them to digest the difficult-to-digest plant matter on which they feed. The digestive system has microorganisms that help break down plant material and produce proteins and vitamins.

Native populations are found on all continents except Australia and Antarctica, however, humans have introduced them many areas where they were originally not native. Lagomorphs tend to be highly reproductive, but especially among the leporids,

Leporidae

The family Leporidae, is made up of rabbits and hares, in 11 genera divided into approximately 54 species. Females are usually larger than males. Leporids range in weight from 1.4 pounds (0.6 kg) to 11 pounds (5 kg). Adult head and body length ranges from 9-28 inches (23-71 cm). Color patterns vary between seasons and species, ranging from black to reddish brown to white. Leporids are widely distributed and have adapted to a broad range of habitat types. They can be found throughout the world with very few exceptions. Habitat type affects pelage color as well as litter size. Some leporids are extremely social, living in large communal dens, while others are solitary, coming together in groups or pairs for mating purposes only.

Leporids (rabbits and hares) differ in that :

- rabbits give birth to altricial young (naked, closed eyes, requiring some time in the fur-lined nest hidden in dense vegetation, before ready to roam), live in more brushy habitats, have shorter legs, and do not run as fast, can be gregarious
- hares give birth to precocial young (born with hair, open eyes and ready to run) and do not make nests (depressions in open areas) with less postnatal care for hares and longer gestation periods, found in open habitats and can run up to 40 mph, are often solitary

Both rabbits and hares produce relatively large litters and are prodigious reproducers. Most leporid species are polygynandrous (two or more sexual partners).

DESERT COTTONTAIL

The Desert cottontail has a rounded tail with white fur on the underside. It is a light gray/brown in color, with creamy colored fur on the belly. It has long ears and large hind feet. They are like rodents in that their teeth grow throughout their life, thus necessitating constant chewing to keep them from growing too long. They can usually be seen in the early morning or late afternoon and is rather inactive in the middle of the day, preferring to spend the hottest part of the day under cover. Desert cottontails may dig a shallow depression under a bush in which to rest, but they usually rest in the burrows of other animals. They are good swimmers and can run at speeds of up to 20 mph (32 kph).



They eat grasses, cacti, bark, twigs and shrubs (90% of their diet is grass). Adults are 12-17 inches (30 - 43 cm) long and weigh up to 3.3 pounds (1.5 kg). Females are larger than males. Desert cottontails have good eyesight and good hearing. They may stomp the ground with their hind feet or raise their short tail as a warning to others of possible danger.

Females usually have two to four litters a year (although some may have as many as six each year). The gestation period is 26-30 days. One to six babies are born in each litter. They are born naked and their eyes are closed. They leave the nest at two weeks of age and usually stay with their mother for three more weeks. Sexual maturity is reached at approximately three months of age.

Their range is from southern California into the central United States, from eastern Montana to western Texas and into northern Mexico, where they can be found in woodlands, grasslands, brush and desert areas.

PILOSA

The order Pilosa (pilosus means hairy in Latin) is a group of placental mammals that includes anteaters and sloths. Although there is disagreement concerning taxonomic names and numbers of genera and species, there seems to somewhat be a consensus that the order is made up of four families, five genera and 10 species.

Anteaters and sloth are externally dissimilar but have skeletal characteristics. The families of anteaters are: Myrmecophagidae (two genera with three species) and Cyclopedidae (one genera with one species). Sloth families are: Megalonychidae (two-toed with one genera and two species) and Bradypodidae (three-toed with one genera and four species).

It is estimated that the life expectancy of sloths in the wild is 12-20 years, however, sloths in captivity have lived for more than 30 years. Three-toed sloths are more common than two-toed but because of their limited diet, they are seldom kept in captivity.

Cats and Harpy eagles are among the main natural predators of the sloth. It is believed they account for approximately 30% of the Harpy eagle's diet. Sloths are at serious risk and likely threatened where their habitats are destroyed. When forests are cut or flooded by the building of dams, sloths can be found in large numbers. They are hunted widely for meat, their claws are used for jewelry and the skin is used for saddles. Sloths are very difficult to see, and even if they are found, they usually do not drop to the ground when injured or killed. Their claws continue to hold onto the tree until the body is quite decomposed.

Sloths are considered to be the slowest land mammal in the world. The sloth's diet, low rate of metabolism and small amount of muscle mass for generating and retaining heat, all contribute to the slow mobility of the sloth. These nocturnal and diurnal animals spend most of their time hanging from branches in the middle layers and tops of trees or sitting in the forks of tree limbs. They choose trees with exposure to the sun in order to thermoregulate their bodies by more exposure to the sun when cold and moving down into the branches when hot. This lifestyle is interrupted by an infrequent trip to the base of their tree to urinate and defecate.

Because of the anatomy of their limbs, sloths have difficulty standing and are unable to walk like most mammals. On the ground, they move by dragging themselves with their front limbs. The three-toed sloths are good swimmers, with an overarm stroke.

Megalonychidae

This family contains two species, Southern two-toed sloth (*Choloepus didactylus*) and Hoffman's two-toed sloth (*Choloepus hoffmanni*). Two-toed sloths are larger, faster and more aggressive than those with three toes.

Adult Megalonychids are 24-30 inches (61 - 76 cm) long and weigh 18-20 pounds (8.1 - 9 kg). In general, two-toed sloths are darker in color than three-toed sloths. The snout of two-toed sloths is rounded and slightly protrudes. Unlike the three-toed, two-toed sloths do not have the happy-looking "grin".

Megalonychids have no incisors or canines but they do have cheek teeth. The back surface of the upper cheek tooth meets the front surface of the lower, continually sharpening their edges. The body temperatures of two-toed sloths fluctuate from 75° F to 91° F (23.8° to 32.7° C)--more variation than most other mammals. Like the three-toed sloth, the two-toed sloth travels down to the base of the tree to defecate. It is believed, unlike the three-toed sloth, they do not cover it.

Except for the brown throat found on the Southern two-toed, there are few distinguishable features between the two species of Megalonychids. The grayish brown fur is long and somewhat wavy. The muzzle is rounded and protrudes from the face. Offspring are darker brown with short, wooly fur. The teeth are sharp and canine-like. Each forelimb has two long claws (hind limbs have three claws) used for movement, foraging and defense.

Although they fill the niche of the leaf eater in their habitat, they also consume a large amount of fruit and prefer trees covered with vines and lianas. The body ranges in size from 21 - 28 inches (53 - 71 cm) with an average weight around 12.5 pounds (5.7 kg)

The two-toed sloth makes little noise but will hiss or bleat when disturbed. They will bite or slash with their long claws to defend themselves. Two-toed sloths are known to be more aggressive than other sloths. They have a larger home range than three-toed sloths.

They are solitary nocturnal and arboreal animals that eat, sleep, mate and give birth while hanging from a branch. They are somewhat more active than the three-toed sloth. Like the three-toed sloth, they select trees with exposure to the sun in order to thermoregulate their body by more exposure to the sun when cold and moving down into the branches when hot. This lifestyle is interrupted by an infrequent trip to the base of their tree to urinate and defecate.

HOFFMANN'S TWO-TOED SLOTH

The shaggy fur of the Hoffman's two-toed sloth (*Choloepus hoffmanni*) is grayish brown with a paler face that has shorter hair. The fur on the shoulders and top of the head are the darkest in color. The coarse, long wavy hair that covers the body, varies in color from blonde to dark brown. The coat often has a greenish cast, produced by algae growth on the skin during the wet seasons. The fur curves from the stomach to the back, in order to allow for rain to run off.



The mouth has only a slight smile under a protruding muzzle-like or pig-like nose. The eyes are large and may have dark circles around them. The ears are small. The fore and hind limbs are long and almost equal in length. The forelimbs have two hooked claws, the hind limbs have three. Most mammals have only seven neck bones (cervical vertebrae); the two-toed sloth has six or seven (less than the three-toed sloth) and is said to be able to rotate its head 180°.

Adults are medium-sized animals; body length between 1.8 - 2.4 feet (0.6 - 0.7 m); weight around 18 pounds (8 kg). They eat leaves, shoots, flowers, fruits and possibly even insects. They have a large, multi-chambered stomach containing bacteria that allows for fermentation and break down of cellulose into starches and sugars. It is reported that food may be digested for a month before moving into the short intestine.

More active at night, they use their acute sense of smell and touch to forage for food. Reports of “hisses” when frightened; “high-pitched” screams signaling mating season. Females reach sexual maturity at 3.5 years; males are sexually mature between the ages of 4 and 5. Gestation for two-toed sloths is about 11.5 months. They have only one offspring each time and will reproduce again in 15 - 16 months. Baby will nurse on its mother’s stomach for about six weeks.

Found in tropical forests in Central and South America, from Nicaragua to the Equator in lowland forests as well as higher altitude rainforests. Habitat is in areas of continuous canopy and correlated with mother’s home range and tree preference.

Bradypodidae

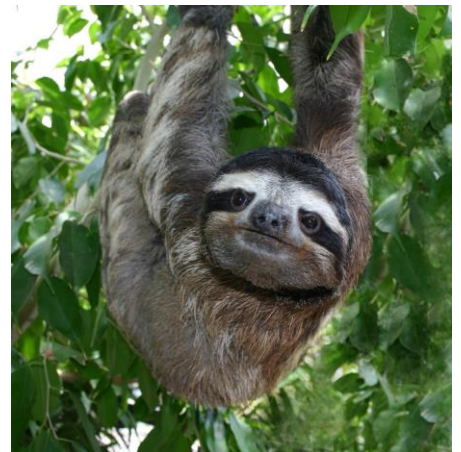
This family contains four species of three-toed sloths: Pygmy (*Bradypus pygmaeus*), Pale-throated (*Bradypus tridactylus*), Maned (*Bradypus torquatus*) and Brown-throated (*Bradypus variegatus*). Three-toed sloths are smaller than two-toed. They are mostly yellowish brown or tan in color, with contrasting markings on the head and/or neck. Bradypodids have a stout short tail.

Three-toed sloths, after descending to the ground to urinate and defecate, cling to the tree trunk while they dig a hole and cover it with their stump-like tail and hind limbs. This covering procedure may be an attempt to hide the odor so that predators cannot find them. Another suggestion is that it helps the tree absorb the nutrients from their excrement, thus contributing to the growth of new leaves for food.

Like the two-toed sloth, Bradypodids have no incisors or canines, however their cheek teeth do not occlude. Members of this family have more cervical vertebrae than most other animals. Three-toed sloths thermoregulate by warming themselves on branches exposed to early morning sunlight.

BROWN-THROATED THREE-TOED SLOTH

The Brown-throated three-toed sloth (*Bradypus variegatus*) is mostly grayish-brown in color. The round head is slightly darker than its body. The eyes are small, the black nose is blunt, teeth are peg-like and the small ears are almost invisible. This disheveled-looking animal has an off-whitish face with a darker stripe across the brow that is highlighted by brown stripes running through the eyes – giving the appearance that it is smiling. Males have a large patch of short orange fur with a brown center stripe on their backs. The front limbs are much longer than the hind ones and because of an extra vertebrae in the neck, the three-toed sloth is said to be able to rotate its head nearly 270°.



Thick, long shaggy fur grows toward the sloth's spine, allowing it to shed water when hanging upside down. Shorter, finer fur grows underneath the outer fur. Green algae grow in microscopic notches and grooves in the hair. It is believed the algae are food for certain species

of insects such as moths, beetles, caterpillars and mites living in the scraggly hair. The green appearance given by the algae help hide the sloth from predators. The three-toed sloth has three claws on the front limbs which are used for defense, if needed.

Foraging is largely by smell and touch. They primarily feed on leaves, shoots, twigs and buds of trees pulled within reach of the mouth (folivores). The Cecropia tree may be a favorite, however, many other plant species are included in their diet. They have a large, multi-chambered stomach containing bacteria that allows for fermentation and break down of cellulose into starches and sugars. It is reported that food may be digested for a month before moving into the short intestine. The sloth's stomach, (with adequate space for storing and processing large amounts of difficult-to-digest food) when full, may weigh approximately one-third of its body weight. Adults average 2-2.5 feet (0.61-0.76 m) in length; 8-14 pounds (3.6-6.4 kg) in weight.

Sloths have poorly developed senses of hearing and sight (recent studies suggest that sight may be better than previously thought). Silence is a means of protection, however, the female calls out with a shrill whistle, described as an "a-ee, aee" sound when trying to attract a mate.

Sexual maturity is reached at two to three years of age. Gestation usually lasts four to six months. A single young is born each year. Males do not participate in the care of the young. The mother sloth carries the baby on her stomach, where it nurses for about six weeks. After six to nine months, the young can feed itself and live on its own.

Found in tropical and subtropical regions of Central and South America. They can be found in many New World tropical forests, living in the canopy where they prefer trees that are highly exposed to sunlight.

Myrmecophagidae

This family of anteaters is made up of four species all living in Central and South America. They range in size from 1½ - 4 feet (0.45 -1.2 m) in length and weigh 9 - 90 pounds (4 - 40.8 kg). True anteaters are toothless.

An extremely long tongue makes it easier to reach inaccessible places for food. The tongue of the Giant anteater may be 20 inches (51 cm) long. The tongue is coated with sticky saliva that aids in catching prey. Anteaters feed almost exclusively on social insects — ants, termites, and bees. Some anteaters fold their large front claws inward and awkwardly walk on the thick pad on the outside of the limbs. Some are terrestrial and some have a prehensile tail which is used for foraging arboreally. Smell is their best developed sense. After giving birth to one offspring, the mother carries the baby on her back.

GIANT ANTEATER

The Giant anteater (*Myrmecophaga tridactyla*) has a narrow head, long nose, small eyes and round ears. It is covered with stiff gray or brown straw-like hair, which grows up to 16 inches (41 cm) on the tail. It has a white- banded black stripe running along the body to mid-torso.

Its front feet have extremely strong large claws that are used to tear open mounds for food and for defense. When walking, the claws are curled under to protect them, thus the anteater walks on its knuckles. They are also excellent swimmers.



The Giant anteater does not have teeth, however, it has a long thin tongue that can reach two feet (0.61 m). It uses its tongue to get inside ant hills and termite mounds to feed. When threatened, it will stand on its hind legs and strike rapidly with its claws or to hug like a bear.

Giant anteaters are the largest of the South American anteaters with a head/body length of 3.3 - 3.9 feet (1-1.2 m) and a tail length of 2.1-3 feet (0.6-0.9 m). They can weigh up to 90 pounds (41 kg), with the male being larger than the female.

In the wild, it eats insects such as ants, termites, beetles and insect larvae. It will flick its tongue, about 150 times per minute, to collect its food. The tongue is coated with sticky saliva during feeding to aid in getting the insects to the muscular stomach that grinds up the insects. This anteater can eat 35,000 insects in a day!

In captivity, food is a challenge, since termites and ants are often not an option. Keepers occasionally treat them to pieces of wood or tree roots that contain insects. The Giant anteater has poor eyesight and hearing, but an excellent sense of smell. There is a lot of communication, especially between young and their mothers. Snorts, sniffs, hisses and roaring can be heard when fighting.

In captivity, breeding occurs year-long. Gestation period is about 190 days resulting in a single offspring. The female gives birth standing up and then the offspring crawls onto her back where it remains until it is almost half her size, about six to nine months. When born, the offspring has a full coat of hair and adult markings. The young will nurse for two to six months and become independent after about two years. They are native to Central and South America, where they prefer tropical forests, savannas and grasslands.

PRIMATES

“Top animals” make up the order of Primates. Although there is disagreement on the classification of primates, – the family Cebidae was previously considered to include almost all of the New World monkey species, including howler and prehensile tailed monkeys (now Atelidae), night monkeys (now Aotidae) and sakis (now Pitheciidae). Marmosets and tamarins are now considered part of the family Cebidae (previously considered its own family Callitrichidae). Regardless of classification, some characteristics are common to most primates:

- general placental mammals that have longer pregnancies, with infancy periods requiring “parenting” or teaching
- pentadactyl or five-digit limb structure (some with fingers and opposable thumb that allow for grasping with help of eye-hand coordination)
- large eyes with increased visual ability (stereoscopic in upper primates)
- small snouts with decreased sense of smell
- flexible hands
- increased brain to body size ratio
- sense of touch in hands rather than vibrissae
- increased social behavior
- fewer teeth
- long life spans
- use what has been learned, more than instinct, for survival

These characteristics or adaptive changes go from less advanced (more primitive) to more advanced when moving from lower to higher primates. Most primates are arboreal and live in the tropics or subtropics (except macaques). This is probably due to their main diet being fruits, plants and insects that are scarce in certain climates.

ATELIDAE

Prehensile-tailed monkeys are the largest of the New World monkeys. There are approximately 24 species in this family, including 10 species of howler monkeys (genus *Alouatta*). Howler monkeys are well-studied by scientists.

Named for their vocal abilities, howler monkeys add sound to the New World tropics like macaws and toucans add color. Howlers are often said to be the largest of the New World monkeys, although some Woolly spider monkeys may be larger. Their position in size may be challenged, but they are the loudest of the New World monkeys.

Howlers are characterized by an enlarged goiter-like hyoid bone that gives resonance to the voice. The large larynx is covered with a thick beard, giving the howler's head a massive appearance. Howlers also have extremely large protruding jaws and high sloping, bare, black faces. The resonating chambers are larger in males than females, giving the males a louder and deeper sound.

The "dawn chorus" begins each morning as an accelerating series of low grunts by a single male who is then joined by the howls of other males. Females also contribute with their higher pitched sounds. This howling continues several minutes, in order to ensure that other troops have been thoroughly informed of the group's whereabouts, thus reducing potential conflicts. These troop spacing calls, which can be heard from distances of three to four miles (4.8-6.4 km), cease with one long resounding roar. Other troops, within hearing distance, answer with howls. Different species have somewhat different sounds and pitches. These howling sessions are also heard in the late afternoons. It is believed that one monkey of the group uses soft grunts as an alarm if danger is near.

In addition to marking their area by "howls," both male and female howler monkeys mark their territory, objects and other troop members with scent from glands on their throat and perineal area. Male howlers put out a very musky odor when upset.

All howler monkeys show some degree of sexual dimorphism. Females in some species weigh 70-75% as much as males. Howlers are between 16-28 inches (41-71 cm) long (not including a 19-29 inch or 48-74 cm tail) and weigh between 12-24 pounds (5.4-11 kg).

The prehensile tail is a continuation of the spinal column. The continuing vertebrae are joined with ligaments. The tail muscles are attached to the vertebrae by tendons. The tip of the tail curls up, like a hook, as the tail muscles contract. The somewhat flattened tail has a patch of bare skin on the underside. This patch of palm-like skin, about one-fourth of the tail length starting at the tip, increases friction. The grooves or "dermatoglyphics" found on the bare skin resemble fingerprint patterns.

Although howlers do not rely on their tails as much as spider monkeys, they skillfully use it for balancing, anchoring and swatting insects. They are adept at grasping branches and lianas as they move slowly and deliberately through the trees, however, they can speed up if necessary. Their schizodactylous hand grip allows them to grasp between the second and third digits (the missing

thumb is counted as the first digit). Howlers will hold on to one limb with their hands and grasp another limb with their tail, allowing their young to crawl over the “bridge.”

Howlers live in groups ranging between 8-20 members. A troop usually includes one male (possibly two), one to four females per male and the young monkeys. Both troop and territory

sizes depend on population density and food supply. Few groups with lots of food are farther apart in larger marked territories; more groups and less food cause home ranges to decrease in size and even overlap.

Howlers spend most of their time in the upper tree branches where they feed on large amounts of leaves, fruits and flowers. They are able to subsist on plant material that is low in energy and slow to digest. These slow-moving primates are believed to spend as much as two-thirds of the day and all of the night, lolling about and sleeping. Except for their rambunctious howling, howlers are quite lethargic and harmless monkeys.



Red howlers (*Alouatta seniculus*) are the largest of the howler monkeys. Females are 18-22 inches (46-56 cm) long; males are 19-28 inches (48-71 cm). The tails of both sexes are approximately 18-29 inches (46-74 cm). *Alouatta seniculus* are less sexually dimorphic than some of the other species of howler monkeys. The head, shoulders, limbs, tail and underparts of both male and female are a deep reddish-black to purplish-black and the sides are often bright goldish-orange. The color may vary with age and distribution of the animals.

Red howlers (*Alouatta seniculus*) have the widest geographical distribution of all the New World monkeys. They live in the middle and upper levels of the forest throughout the northern half of South America, from Colombia to Bolivia. These rather inactive monkeys usually have small territories in which they do little more than sleep and eat.

Like most Alouattas, Red howlers eat leaves, fruits and flowers. *Alouatta seniculus* have an advantage over other New World monkeys in that they are better able to subsist on foliage. They have two large sections in their hindgut where bacteria breaks down the hard-to-digest cellulose. The large gut can take up one-third of their body volume. Howlers are selective eaters and avoid leaves that are unsafe or poisonous. If available, they select young tender leaves that are easier to digest and contain more protein and sugar.



The monkey gut-passage takes about twenty hours. They are reported to relieve themselves of copious droppings immediately upon waking at daylight. This procedure is believed to be as regular as their “dawn chorus” and at about the same time. Howlers are also known for their defecating and urinating on people below when alarmed. The combination of height, gravity and accurate marksmanship, leaves impressionable messages. They will also drop branches or other matter from above.

Red howlers live in social groups of not more than ten members, with one or two of the individuals being males. Male Red howlers reach sexual maturity at approximately seven years of age; females give birth the first time at around five years of age.

Because of the unbalanced sex ratio, sexual competition between Red howler troops can be intense. Males are driven from their natal troop at sexual maturity, therefore, they must be admitted into new groups. A Red howler male often kills unweaned infants in his new group, in order to mate quickly and ensure the new babies are his own. It is believed that female Red howlers prefer groups of fewer females and are actually hostile to new female members. The bigger the number of females, the more likely they are to be the target of a new male who stands to benefit from so many females. Females try to protect their young but are not too successful; less than one-fourth of the young howlers survive a male howler invasion.

Red howlers breed throughout the year, however, it seems reduced during the early wet season. Births are usually single. Newborns are helpless at first and are carried around on their mother's stomach. A baby can use its prehensile tail within a few weeks, helping to secure itself to its mother. Mothers are not too attentive to their offspring. Females without infants, as well as adult males (after he has killed those that are not his), are attentive or at least tolerant of the infants.

Red howler monkeys live in rather cohesive groups. Unlike most primates, the grooming of each other's fur does not appear to be part of their daily routine. Grooming would probably decrease their infestations of the botfly larvae. Eggs are laid in the hair and, after hatching, larvae (bots) burrow into their flesh — the damage ranges from discomfort to death, depending on the number.

Howler populations are often ravaged by periodic epidemics of yellow fever, making them easy prey for Jaguars and Harpy eagles. Under normal conditions, Harpy eagles tend not to prey on adult howler monkeys. Loss of habitat, as with most rainforest animals, is a major threat to the Red howler monkey. Red howlers are hunted for their meat, being big enough in size to make the hunt worthwhile.

Even in rainforests teeming with life, many animals are easier heard than seen. This may be true of the Red howler monkey who probably watches humans as they scan upwards into the deep forest shade for his outline. He may not be seen, but perhaps he will be heard, for in addition to the routine morning and evening troop calls, sporadic howling occurs when it rains. Red howler monkeys howl at the sound of approaching rain or at the onset of rain and sit hunched over in the rain until it ends.

Alouattas are well known for the many scientific studies that have included their sounds, foods, behaviors and troop/territory sizes.

CALLITRICHIDAE

As with many groups, the New World monkeys have had numerous revisions in taxonomy. Marmosets and tamarins (once in the family Cebidae) are now considered by many to be included in the Callitrichidae family.

PYGMY MARMOSET

The Pygmy marmoset (*Callithrix pygmaea*) is the smallest monkey, weighing only two to five ounces (57-142 gr). The French word *marmouset* means “small boy.” Its body is 4½-6 inches (11-15 cm) long with a tail that is longer than the body, seven to nine inches (18-23 cm). They are not sexually dimorphic. Their silky fine fur is tawny or agouti in color. Long hair on the cheeks and head for a mane, somewhat hides the ears. Their color and size provide good camouflage for living in the trees and hiding from predators such as birds of prey. They are active during the day, particularly in the morning and late afternoon. Although minute in size, they can jump two or three feet (0.6- 0.9 m). The big toes have flat nails; all other digits have claws. At night they sleep in woven vines or tree holes.



Pygmy marmosets are monogamous and live in family groups containing up to four litters and as many as 15 individuals. Twins (sometimes three) are usually born twice each year. Gestation lasts 119-142 days.

The adult male or juveniles tend to the babies and carry them until about two months of age, with the mother spending her time with the young only when nursing and cleaning. After two months, the young are independent and at six months, they reach adult size.

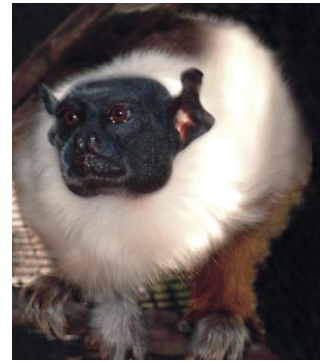
It is believed that both sexes reach sexual maturity between 15 - 17 months. Along with more than ten vocalizations (such as trills, whistles and clicks), Pygmy marmosets will also raise their hair (piloerection) and use facial expressions in their threat displays and to communicate. Sight is their primary sense but they also have well-developed senses of smell and hearing.

Sap and gums make up the majority of their diet. To aid in gnawing, marmosets have long, forward turned, lower incisors. It is estimated that two-thirds of their feeding time is spent either eating the sap and/or gum, or preparing their food source for the extraction of their next meal. They will also eat fruit and animal prey (such as insects, small lizards, spiders).

Pygmy marmosets are found in the flooded forests, river margins, floodplains and stream sides of several South American countries (Brazil, Ecuador and Peru).

PIED TAMARIN

The Pied tamarin (*Saguinus bicolor*) is white on its shoulders and front, with a striking dark brown back, hind part and upper tail. The fur lightens to a rust color on the lower belly, inner thighs and underside of the tail. The bald head has black skin and the large ears add to the distinguished appearance of this species.



The arboreal and primarily diurnal Pied tamarins usually find safety in tree tops during the night. These social animals live in family groups ranging up to 15 members. Grooming is an important part of their behavior. They are a very territorial species whose troops are led by the eldest female.

Males and females are about the same size, weighing approximately one pound (0.45 kg). They are between 8 - 11 inches long (20 - 28 cm); tail length is 14 - 17 inches (36 - 43 cm). The diet of the omnivorous Pied tamarin includes insects, a variety of fruits, plant gums and flowers but may also feed on reptiles, eggs and small rodents.

Sight is their primary sense but they also have a well-developed sense of smell. Scent-marking is used for communication in the group, but they are also reported to use a variety of vocalizations such as whistles and chirps, particularly to defend their territory.

After a gestation period of approximately 160 days, the female usually gives birth to twins. As with other tamarins, the male and older siblings tend to the babies. The geographic range of the Pied tamarin is small, found only in a small area of Brazilian rainforest, in and around the city of Manaus.

EMPEROR TAMARINS

Emperor tamarins (*Sanguinus imperator*) have a showy drooping moustache which clearly distinguishes them from other hairy-faced species. Their common name comes from the long, white mustache that extends well below their chin. They were named for Kaiser Wilhelm II of Germany. It is thought that their hair features may help to camouflage them, as well as assist in mating displays.



The dense coat is gray-black and there are tufts of hair on the ears. They usually have yellow on their back and brownish-red on the chest and tail. The tail, approximately 14 inches (36 cm) long, is not prehensile, but it does help the tamarin balance. The hands and feet are black, with claws on all digits (except for the big toes, which have flat nails). The body length of Emperor tamarins is between 9-11 inches (23-28 cm); adults weigh 12-16 ounces (340-454 gr).

Emperor tamarin groups consist of a dominant female and at least two mature males, plus offspring. The total group size averages six members. The dominant female will breed with all adult males in the group. Since it is impossible to know which male is the father, all males help in the care of the young. Twins are usually born in the spring or summer after a gestation period of 140 to 145 days. Young are weaned in approximately nine weeks; sexual maturity occurs at 20 months.

Emperor tamarins spend much of the day foraging in the treetops where they feed on fruit nectar, gum and insects. Their keen senses of sight and smell assist in locating food and avoiding predators. Communication is through a series of vocalizations to indicate location and as alarm calls. They have a wide array of facial expressions, though not as varied as that of higher primates.

Emperor tamarins are primarily found in lowland forests of Brazil and Peru.

GOLDEN LION TAMARIN

Golden lion tamarins (*Leontopithecus rosalia*) are covered in orangish-gold, silky hair. This social species is also known as the “red lion monkey” because of its bright color. In addition to its fiery color, it also has a long, striking mane on the cheeks, throat and ears, surrounding a hairless face.

The male and female Golden lion tamarins (often referred to as GLTs), are somewhat similar in size with an average weight of approximately 1.4 pounds (0.6 kg); females weigh more during their reproductive stage. They average ten inches (25 cm) in head/body length, exclusive of the tail. They have claws rather than flattened fingernails.



Golden lion tamarins are insectivores and frugivores, preferring fruits, vegetables, small birds, lizards, eggs, spiders and snails. They hunt for insects by probing with their long, slender fingers into crevices of tree bark. Food is openly shared with family members but rarely outside the family circle.

They are usually found in troops of two to eight, generally family members. The GLTs defend their areas with scent markings, vocalizations and/or staring down an intruder. Males groom themselves as well as females during the day and sleep from dusk until sunrise. There is usually only one breeding pair per troop.

Breeding season occurs during the warmest and wettest time of the year (September - March). After a gestation of 130-135 days, twins (usually) are born. At birth the infants are covered with fur, eyes are open and the majority of the child-rearing is done by the father. The baby will cling to its parents for about five weeks when curiosity takes over and the baby begins exploring. Females are sexually mature at 18 months and males at 24 months.

Endemic to Brazil, the Golden lion tamarin is one of the rarest of all mammals in the wild. Found in primary and secondary lowland forests of the Atlantic coastline, their current restricted range covers only a few square miles in the Brazilian state of Rio de Janeiro.

GOLDEN-HEADED LION TAMARIN

The Golden-headed lion tamarin (*Leontopithecus chrysomela*) is also known as “little monkey with a golden face” because of the golden orange lion-like mane around its hairless face. The body is black with golden fur on part of its tail, hands, feet and forearms. Males and females are quite similar in appearance. Like other callitrichids, claws are found on all but the big toe, which has a flattened nail.



The head and body measures ten inches (25 cm), with the tail being only slightly longer than head and body. They weigh between 1.2- 1.3 pounds (0.54-0.59 kg), with females being larger than males. The diet is mostly fruit, with some gum and animal prey. They are less dependent on gums during the dry season than other lion tamarins. Sight is their primary sense but they also have a well-developed sense of smell.

Groups range from five to eight members. A dominant male leads the group. Both multi-male and multi-female groups are known to occur. Golden-headed lion tamarins tend to travel further during the day than other species of this genus. These diurnal tamarins are active for 9 - 12 hours each day and spend the majority of their time in tropical forest at heights between 10 to 33 feet (3-10 m) and even sleep as a group, high up in tree cavities.

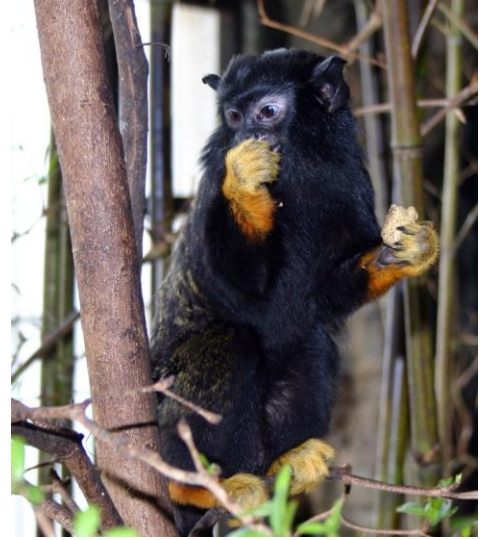
They have several categories of vocalization based on behavior and activities, such as: whines, trills, clucks, and long calls. When frightened, in danger or defending its territory, the brightly colored mane is raised, making it look bigger in size and possibly more fierce.

Females reach sexual maturity at approximately 18 months; males at 24 months. Breeding occurs mostly during the warm and wet season, September through March. The gestation period is 125-132 days. Twins are usually born, with males and elder siblings caring for and rearing the babies.

Golden-headed lion tamarins are found only in Brazil. Due to habitat destruction (their main threat), they are confined to the southern part of the state of Bahia, Brazil.

RED-HANDED TAMARIN

Also known as Golden-handed or Midas tamarin (*Sanguinus midas*), this “hairy-faced” tamarin has a mottled black body, with yellow highlighting and reddish-gold hands and feet. There are claws on all digits except for the big toe, which has the flattened nail characteristic of primates. Their average height is 7.5 - 8.25 inches (19 - 21 cm); weight is 9 - 13 ounces (255 - 369 gr), with males being larger than females.



Arboreal, diurnal Red-handed tamarins typically live in groups of 4-15 individuals, of which only one female will breed. The breeding female usually gives birth to twins twice a year, after a gestation period of 140 to 170 days. Young are weaned after about two to three months and are cared for primarily by the father and turned over to the mother only to nurse, however, the entire group helps with the care of the young.

Their diet includes insects, ripe fruits, gum, nectar, buds, flowers, frogs, lizards, nectar, snails and spiders. Red-handed tamarins live in northern Brazil, Guyana, French Guiana, and Surinam where they are found in open canopies of primary and secondary rainforests.

PITHECIIDAE

The family Pitheciidae was formerly in the family Atelidae. Pitheciidae now includes titis, saki monkeys and uakaris.

BEARDED SAKI

Red-backed bearded saki monkeys (*Chiropotes chiropotes*), as name implies, have a noticeable, thick beard that extends down from their jaws, particularly males. Hair growing on top of the head, parts down the middle and puffs out on each side, giving them a unique hair style. Their bodies are covered with dense hair that is black overall but their backs vary in color from red to yellowish-gold. The non-prehensile, bushy tail is almost as long as their body.

Bearded sakis form a large troop (20-30 members) but separate into smaller groups as they spend their days



traveling and foraging for food. Moving through the forests is easy for sakis, as their strong hind limbs allow them to jump long distances. It is believed they sleep high in the forest with the tail curled around their body.

Red-backed bearded sakis are medium-sized monkeys. The females of the species are typically smaller, with males being approximately 16-18 inches long (41-46 cm). Average weight is between 5.7- 7.1 pounds (2.6-3.2 kg). Red-backed bearded sakis are primarily frugivores, feeding on seeds, nuts and fruits but will also include arthropods.

Their sense of smell is used for foraging and social communication during mating. Sounds include whistles and twitters. Both vocalizations and body language are used to communicate. Tail wagging is used when silence is important as when warning of danger.

After an approximate five-month gestation period, the female usually gives birth to a single offspring. The tail is prehensile during its first two months after birth, allowing it to cling to its caregiver.

The bearded saki is both diurnal and arboreal and can usually be found in the upper rainforests that are located near streams or rivers. It is believed their range includes Brazil, Venezuela and possibly the Guyanas.

WHITE-FACED SAKI

White-faced sakis (*Pithecia pithecia*) are sexually dimorphic. Males are solid glossy black with a white face and black snout. Females are an agouti brown, with a black face and white stripes along the nose.

Newborns of both sexes are the color of females, with coloration beginning to change at two months of age. Both sexes possess a long, bushy, non-prehensile tail. White-faced sakis have a head and body length of 12-20 inches (30-51 cm) with males being somewhat longer. Males are significantly heavier, weigh up to 5.5 pounds (2.5 kg), while females only reach 3.8 pounds (1.7 kg). The tail may be up to 18 inches (46 cm) long.



They prefer the larger branches of the lower canopy and can be observed on the ground. They live in small family groups, consisting of the parents and two to three offspring. They use all four limbs for walking and leaping (quadrupedal). They have been observed leaping over 30 feet (9 m) from one tree to another.

Sakis feed on fruits, leaves, flowers, seeds and small other prey such as insects, bats and rodents. They have the ability to crack open hard nuts with their canine teeth. Sight is their primary sense. The White-faced saki is capable of an impressive display when threatened, its hair will rise and its whole body will shake. Their vocalizations range from shrill to roar-like.

Mated pairs of *Pithecia pithecia* usually bond for life. A single baby is born each year, after a gestation period of 163-176 days. The young are weaned after four months and are sexually mature at two to three years of age. They live in secondary, savanna and marsh forests of Brazil, Guyana, French Guiana, Surinam and Venezuela.

RODENTIA

Rodentia is derived from the Latin verb “rodere” which means to gnaw. Rodentia is the single largest group of mammals (over 2000 living species placed in about 30 families, over 400 genera and 1,800 species) with more than 40% of all species of animals, belonging to the order Rodentia. Most people are familiar with mice, rats, hamsters, and guinea pigs, which are commonly kept as pets. The Rodentia also includes beavers, muskrats, porcupines, woodchucks, chipmunks, squirrels, prairie dogs, marmots, chinchillas, voles, lemmings, and many others. Rodents, native on all continents except Antarctica are characterized by a single pair of continuously growing incisors in each of the upper and lower jaws that must be kept short by gnawing.

Dasyproctida

This family contains 13 species in 2 genera. They are restricted to tropical parts of the New World.

CENTRAL AMERICAN AGOUTI

The Central American agouti is similar in body shape to guinea pigs, however, the legs are longer. Dorsally, the coat ranges from pale orange to several shades of brown to blackish; ventrally, yellowish to white. The rump is a contrasting color. In some individuals, inconspicuous stripes may be present. The fur of the agouti is coarse, yet glossy. The tail is very small.



The basic social unit of the agouti is made up of a pair that mate with one another for life. Agoutis are diurnal and terrestrial. They will hold fruit in their front paws while eating. They are fast and agile – moving by walking, trotting, galloping and jumping. They spend much of their time grooming.

Males and females are similar in size, reaching two feet (61 cm) in length and weighing up to nine pounds (4 kg). Agoutis feed primarily on fruit and nuts. When eating, it often sits on its hind legs and holds the food in its front paws (much like a squirrel). Central American agoutis have very good vision and a highly developed sense of smell. When alarmed, agoutis will give a sharp bark like a small dog. They will stamp their feet as a threat display.

Central American agoutis breed throughout the year but the majority of offspring in the wild are born between March and July. The gestation period is between 104-120 days, with litter normally possessing two young. The female has one or two litters a year.

Central American agoutis inhabit undergrowth of rainforest and savanna from the states of Tabasco and Chiapas in southern Mexico to southern Bolivia and northern Argentina. They are usually found near water.

SIRENIA

Order Sirenia (manatees and dugongs) Family Trichechidae (manatees)
Family Dugongidae (dugongs and sea cows)

Sirenians, sometimes called sea cows, were named for the Sirens of ancient mythology. “Siren” was the term used for sea nymphs whose luring was said to cause sailors to shipwreck on dangerous rocks. It is believed that purported mermaid sightings were sirenians.

Commonly referred to as “sea cows”, sirenians are the only aquatic mammals that are herbivores. Sirenians live in warm, shallow, tropical and subtropical waters where plants can receive the necessary sunlight for growth.

Despite body shapes somewhat like that of sea lions or walruses, same habitats and similar adaptations, sirenians have no co-evolutionary relationship with other marine mammals. Common land ancestors are believed to be the elephant, armadillo and hyrax (a small animal that resembles a rodent). They are often included in the group known as “subungulates” or “almost ungulates”. The Latin word “*ungula*” means hoof.



Ungulates include the even-toed (Artiodactyla) pigs or cattle and odd-toed (Perissodactyla) zebras, rhinoceroses, tapirs and horses. The subungulates include sirenians, elephants, hyraxes and armadillos. Studies that support this common ancestry point out certain anatomical features shared by most -- identifiable dental characteristics, absence of a collar bone (clavicle) and nails or hooves rather than claws. Except for the ant/termite-eating armadillo, these animals are herbivores.

Sirenians have the following distinguishing features:

- a fusiform, streamlined body
- no external pelvic limbs
- flippers (small pectoral limbs)
- bones that are thick, solid and heavy
- no neck
- small cranial cavity and brain compared to body size
- specialized teeth
- horny pad in the mouth of most to help chew plant material
- limited body hair
- large body

Sirenians include two families — Trichechidae (manatees) and Dugongidae (dugongs). There are four living species of Sirenians:

Dugongidae

The dugong (*Dugong dugon*) is found in 43 countries throughout the Indo-Pacific region which includes the Red Sea, Indian and Pacific Oceans (Australia, India, East Africa, Persian Gulf, Philippines and other South Pacific islands). They are the most abundant of sirenians.

Dugongs (doo'gongs), usually found in salt water, are the most marine of the sirenians in their preference of habitat (on rare occasions they have been found in the mouth of rivers). They do not migrate as far as manatees. Average size is about nine feet (2.7 m) in length and 600 pounds (272 kg). Dugongs have reached 11-12 feet (3.3- 3.7 m) in length and over 900 pounds (408 kg). They usually feed at night, eating various bottom-growing seagrasses. They have incisors or tusks that can be seen, particularly in the males. Their muzzle turns downward and ends with the rostral disk (a wide flattened area). Dugongs have smooth skin, flippers with no nails and a notched tail fluke. Humans, sharks and crocodiles are their major predators.

Trichechidae

The Amazonian manatee (*Trichechus inunguis*) found in the Amazon River basin and its tributaries, is the only sirenian that lives only in freshwaters. Lowered water levels during the dry season limit the amount of available vegetation. Their lower metabolic rate and fat deposits allow the Amazonian manatee to survive for perhaps as many as 200 days without eating. The extremely dry years are often deadly for manatees due to ingestion of mud, resulting in death from bowel obstruction.

This species has no nails on its flippers and has rather smooth skin with irregular white or pink patches on its chest and abdomen. Compared to other species of manatees, Amazonians have longer front limbs, smaller teeth and a slimmer, longer rostrum (anterior part of the skull). The Amazonian manatees are the smallest of the living manatees, the larger ones being slightly more than nine feet (2.7 m) long and weighing over 1,100 pounds (499 kg). This shorter, slimmer manatee averages eight feet (2.4 m) and weighs approximately 800 pounds (363 kg). Amazonian manatees are preyed upon by man, sharks, jaguars and caimans.

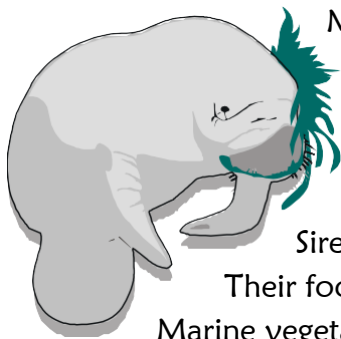
The West African manatee (*Trichechus senegalensis*) is found in the shallow coastal areas, rivers and estuaries of West Africa (salt, brackish and even fresh waters). There is very little known about this species which closely resembles the West Indian manatee. Similar in habits and appearance to the West Indian manatee, only those quite familiar with both species could probably distinguish between the two. The eyes somewhat protrude, the nose is blunter and the rostrum has less downward bend on the West African than the West Indian species. Since there is a lack of bottom vegetation available, the downward pointing rostrum is of less value for this species. West African manatees average about 10 feet (3 m) in length and weigh approximately

1,250 pounds (567 kg). Man is the main predator, however, there have been reports of shark and crocodile kills.

The scientific name of the West Indian manatee is *Trichechus manatus*. Trichechus (Latin) refers to hairs or bristles, one characteristic of all mammals. Manatus is believed to be a Carib word meaning breasts. The West Indian manatee is known in most Caribbean countries as vaca marina or manatí. They are also known as lamantin, zeekoe, amerikaanse lamantijn, sekoe, palpa and manatin.

Until 1986, the West Indian manatee (*Trichechus manatus*) was made up of a single species. At that time sufficient skeletal materials led to the naming of two subspecies — the Antillean manatee (*Trichechus manatus manatus*) and the Florida manatee (*Trichechus manatus latirostris*). *Latirostris* means “broad-faced” in Latin. In addition to the skeletal differences, the two subspecies are geographically isolated. It is believed by many scientists that deep canyons in the Gulf of Mexico keep the subspecies apart. Most manatees will not venture into water over 40 feet (12 m) deep.

SIRENS OF THE SEA



Manatees are large, gentle mammals who live their entire life in water.

They are usually found 3 - 10 feet (0.9 - 3 m) below the surface of shallow coastal waters, estuaries and slow-moving rivers where there is sufficient light for plant growth (photosynthesis).

Sirenians are the only aquatic mammals that are plant-eaters (herbivores).

Their food consists of submerged, overhanging, floating and shoreline plants.

Marine vegetation often consists of turtle, shoal, manatee and widgeon grasses.

Preferred freshwater vegetation includes hydrilla, eel grass, water lettuce and water hyacinths.

The metabolic rate of the herbivorous manatee is low compared to other aquatic mammals. When not grazing or moving about in search of food, manatees are usually resting. Manatees rest by lying on the bottom or floating near the surface of the water. Their bones are very dense, helping them dive and remain on the bottom while grazing. The deepest a manatee has been seen diving is around 30 feet (9 m). Normally they feed where plant life is available; usually no deeper than 10 feet (3 m) below the surface of the water. Manatees are not deep diving animals like dolphins or whales, therefore their muscle content is quite different from other marine mammals.

Their muscles have little of the muscle hemoglobin (myoglobin) typical of the muscles of other diving mammals. This means that manatees can not store as much oxygen as seals and dolphins, which shows in their short, shallow dives. Long bones and ribs of manatees lack marrow cavities, making their skeleton relatively heavy and dense.

Buoyancy is maintained by blubber and large lungs that are flat and long (30 - 36 inches or 76 - 91 cm). Both the lungs and diaphragm are the length of the body cavity, helping the manatee float horizontally. Each lung is in a separate cavity. One lung can be infected and the other seems to function normally.

Instead of one diaphragm like humans, manatees have “hemi-diaphragms”. Although they look fat, manatees have little body fat. Plants they eat have low nutritional value so they must eat a lot. Large amounts of intestinal gas created by microorganisms for digestion also assist in their buoyancy.

In order to accommodate the large volume of high-fiber food, the intestines are long, sometimes up to 150 feet (46 m). The bacterial breakdown of cellulose occurs in the hind-gut, meaning more of the digestive processes happen further along the intestinal tract. It takes approximately seven days for food to pass through the digestive tract.

West Indian manatees can weigh up to 3,500 pounds (1588 kg) and grow to be 13 feet (4 m) long, but their average size is 10 feet (3 m) and 1,000 pounds (454 kg). Despite their large size, these cigar-shaped mammals are quite agile and streamlined. Manatees, like two-toed sloths, have only six neck vertebrae (most mammals have seven), thus they are unable to move their heads sideways. They must turn their whole body around to see behind.

Manatees swim at speeds of 2.5 - 6 miles (4 - 9.7 km) per hour but can reach up to 15 miles (24 km) per hour for short distances. The tail helps propel the manatee through the water. Two front flipper-like limbs help steer and gather food. The fused bone structure of the flippers is similar to that of toothed whales, sea lions and seals (five digits covered with thick skin).

The skin is gray-black at birth and becomes lighter in color within a few weeks. Adults are gray to gray-brown. Their skin is wrinkled, rough and tough. Many manatees, particularly those in Florida, have “skeg” marks. Skeg is the part of a boat motor that extends below the propeller. It often hits the manatee before the propeller, inflicting a long cut. Parallel cuts are made by the propeller. Deep scars can be seen on manatees forever; superficial wounds are more difficult to see.

Bleeding stops quickly due to a chemical in the blood of marine mammals that causes the blood to clot when hit by water. This adaptation prevents manatees from attracting predators or bleeding to death. Manatees in saltwater often have barnacles attached to them; freshwater manatees are sometimes covered with algae. Single, bristly hair can be seen on their bodies with thicker whiskers growing on their blunt snout.

Antillean manatees are nocturnal and diurnal, doing the same amount of intermittent feeding and resting during the night and day. They feed on aquatic plants such as water hyacinths, water lettuce and seagrass. Antillean manatees feed on marine, estuarine and freshwater vegetation and can eat up to 10 - 15% of their body weight in wet vegetation each day.

Although they feed underwater, they exclude most of the water when they swallow, making the contents of their stomach surprisingly dry. They have large salivary glands for lubricating and assisting with digestion. Sometimes mollusks, crabs, sea squirts, etc. are attached to the seagrass and inadvertently eaten.

Most of their feeding occurs during the wet season when lush vegetation abounds in flooded backwaters. As the rivers dry up, Antillean manatees return to the main riverbeds or migrate to deeper bodies of water where there is little or no food. They may go without food for several weeks until vegetation becomes available.

It is believed that all manatees require freshwater (in addition to that obtained from the food they eat) and are often seen drinking from culverts, hoses or other freshwater sources. Their kidneys filter blood to control levels of salt and to maintain water balance. Dugongs, for the most part found in saltwater, have kidneys that are quite different from those of manatees and may be able to better eliminate salt ingested with their food.



It is believed that Antillean manatees once lived in larger herds. However, it is now unusual to see more than four to six animals in one group. Manatees are often solitary or with their young (calf). Seeing manatees in their natural habitat is difficult, particularly if the water is muddy and full of vegetation. Their presence may be given away when their nostrils break the water surface for air. Sometimes a puff or snort can also be heard as they breathe. It is believed that as much as 90% of the air in their lungs is renewed in a single breath (humans renew about 10% of the air in their lungs with each breath).

Manatees can hold their breath for as long as twenty minutes. They normally breathe every three to five minutes and more often if using much energy. Their presence may also be detected by watching the water surface for manatee droppings. Not only do they eat a lot, they also defecate a lot! Their astronomical round droppings, made up of disintegrated fiber, float to the top of the water, suggesting a manatee is nearby.

These walrus-shaped animals propel through the water by moving their paddle-shaped tails in an up-and-down (dorsoventral) motion. Manatees have rounded, horizontally flattened tails, like dolphins and whales. The peduncle is the base of the tail where it connects to the body. Forelimbs are modified pectoral flippers used for maneuvering in water and for manipulating food. Like all other manatees (except the Amazonian), Antillean manatees have three or four nails on their flippers. There are no visible hind limbs.

The brain of the manatee is very smooth and quite small for such a large animal. They do not have convolutions or “folds” on the surface of the brain that are usually associated with higher intelligence. Manatees appear to use the senses of smell, sight, sound, taste and touch. Nostrils, on top of their box-shaped snouts, are closed by valves while underwater. It is believed that olfactory tissues on small nasal bones give manatees the ability to smell.

Smell, sight or taste is used by manatees to avoid specific plants that are toxic. Although small in size (about 0.8 inches or 2 cm in diameter), the eyes of manatees are well-developed. Manatees do not have eyelids. Their eyes close in a circular motion, somewhat like an aperture on cameras. A nictitating or lid-like membrane closes over the eye for protection when under water.

Sirenians have no external ear but have extremely large ear bones and appear to have adequate hearing. The tiny ear openings are located several inches/centimeters behind the eyes.

Underwater vocalizations (described as chirps, whistles or squeaks) are used to express fear, anger, sexual arousal or to establish contact. Cows can respond to sounds of their calves from distances of more than 200 feet (61 m).

Touch and body contact seem important for manatees, particularly between a mother and her calf. The flexible upper lip is lined with coarse whiskers (vibraissae) well-supplied with individual nerve endings. These whiskers are very sensitive to touch and provide information about close surroundings.

The upper lip is split down the middle, allowing each side of the mouth to move independently. The lower jaw and upper palate are covered with horny pads that help grasp and tear apart the vegetation. Having no biting teeth, manatees use their broad, flat teeth for grinding plants. Adult manatees have no front teeth.

A manatee’s teeth (all molars) are replaced constantly throughout their life as they wear down from grinding on sediment attached to plants. Most other mammals replace only one set of teeth in a lifetime. New teeth come in at the back of the jaw and move forward, as if on a conveyor belt, as the front molars fall out. Teeth are replaced horizontally, as opposed to vertically in most other mammals. Most terrestrial mammals have vertical and discontinuous tooth replacement (only one species of kangaroo has horizontal tooth replacement). Manatees have six to eight molars in each of the two upper and two lower rows of teeth. Dugongs have a pair of exposed tusk-like teeth. These upper incisors are not usually seen in female dugongs.

Female manatees are usually larger than the males. Sex of the animals can only be determined by the position of the genital openings — close to the tail on females and near the navel on males. Antillean manatees may breed and calf throughout the year, however, it is believed that most are born during the spring and summer. The gestation period is approximately twelve to thirteen months, with one calf normally being born. There are two to five years between calves.

An Antillean manatee calf measures between 48 - 54 inches (122 - 137 cm) in length and weighs between 60 - 70 pounds (27 - 32 kg) at birth.

After birth, the calf immediately swims on its own and surfaces for air. Mothers (cows) nurse their young for an extended period. Newborns get their milk from a pair of nipples, one under each pectoral flipper. Manatees have no storage sacs for their milk glands, therefore the calf must suckle frequently for short periods of time. Calves begin to supplement their diet with plants a few weeks after birth but they often depend on their mother for up to two years. Father manatees (bulls) do not stay with the mothers as a pair and do not help care for the young.

Manatees have a slow reproductive rate. It is estimated that females become sexually mature when they reach a body length of about 8.5 feet (2.6 m); females being approximately five to eight years and males nine to ten years of age. Despite a life span of 50-60 years, deaths are occurring at a much higher rate than births. Age can be determined by the annual growth rings in the ear bones. Natural causes such as starvation, predation and disease still exist, often occurring when manatees are trapped in dried up areas. The number of calf mortalities is high and may be increasing. Antillean manatees are prey to such animals as jaguars, crocodiles, caimans and sharks.

Florida manatee deaths were catastrophic in 1996 from a different kind of predator or natural event — “red tide.” More than 150 manatees died from the tiny “blooms” called dinoflagellates which colored the water red. The toxic microscopic organisms affect the central nervous system of animals.

It is the human-related and easily avoidable causes of death or injury that are of extreme concern. Accidents related to boats, dams and fishing (lines, traps and nets) continue to kill manatees.

Manatees, being tropical or subtropical, have very little body fat, thus are highly susceptible to cold. Manatees start moving to warmer areas when the water temperature drops below 68° F (20° C). Loss of habitat is the biggest threat to the manatee. Longer dry seasons caused by the depletion of forests are threatening both the water and food supplies for manatees. Substances such as mercury used in mining, herbicides and other toxins end up in the water systems and can cause sickness and death.

Although hunting of Antillean manatees has been prohibited for many years, it continues, particularly in remote areas where manatee hunting is a skill passed from one generation to the next. One would assume that not much skill is required to catch the slow, shy and gentle manatee. It is reported that hunting practices still exist, such as harpooning, followed by the insertion of wooden plugs in the nostrils to suffocate the already injured animal.

The tough, thick manatee hide has been used for years to make clothes, war shields, belts and hoses for machinery, etc. Ribs and tusks were used as ivory. Manatees were hunted for food in

the U.S. until around 1950. Considered a delicacy by many locals, the mild flavored fatty meat (known as *peixe-boi*) is often fried in oil from the same animal. In some parts of the world, dugongs and manatees still supplement meager diets. The meat from a single manatee can reportedly taste like chicken, veal, beef or fish – depending on the cut of meat.

In November 1741, Russian Captain Vitus Bering and his crew shipwrecked on an island off the coast of a Siberian peninsula. (Both the island and surrounding sea were later named after Bering.) A crew member named Steller was credited with discovering a huge animal that was later named Steller's sea cow (included in the Dugondidae family, *Hydrodamalis gigas* meaning giant water calf). The partly submerged marine mammal stayed in shallow water looking for food. Totally unafraid of predators, the sea cow was easy prey for the men. Their meat, oil and hides kept the crew alive through the winter. After the crew left, the islands became favorite stopping spots for hunters who enjoyed the meat of the sea cows while harvesting furs. It is believed that some two thousand seacows existed when first discovered. By 1768, Steller's sea cows had all been killed.

The now extinct Steller's sea cow was huge — 30-35 feet (9.1 - 10.7 m) long, 22 feet (6.7 m) around and three to four tons (2,722-3,629 kg) in weight. Sea cows had no functional teeth and only ate marine algae. These gentle, slow-moving, totally harmless animals were eliminated by humans in only twenty-seven years. Sirenians probably existed with dinosaurs, but their future does not look encouraging.

Manatees are an “indicator species”, gauging the health of the ecosystem in which they live. These animals depend on aquatic vegetation for survival which is found in nursery and feeding areas for recreational and commercial species of fish and shellfish. The same vegetative areas help clean coastal waters by absorbing contaminants.

The Steller's sea cow is now like an imaginary creature of our past, but an excellent example of what can, and will, happen to the existing manatees and dugongs without our concern and protection. Manatees are an endangered species. Endangered species are plants and animals in danger of becoming extinct. Threatened species are plants and animals that are likely to become endangered in the near future.

USEFUL VOCABULARY

adaptation	act of changing or adjusting to fit the environment
agile	active, moves quickly
altricial	immature and dependent at birth, requiring care (as opposed to precocial that are independent from birth)
anthropoids	upper primates, simians
aquatic	living in water
arboreal	living in or frequenting trees
barnacles	marine crustaceans with feathery appendages for gathering food, they are free- swimming as larvae but fixed to rocks, animals, logs, etc. as adults
binocular	using or adapting to the use of both eyes
body language	visual communication, displaying, posturing
botfly	flies that resemble bees, larvae or “bot” are parasites that live in body tissue of animals, causing severe pain or sometimes death
brachiation	moving by swinging arm over arm from branch to branch
brackish	somewhat salty
browser	one that feeds on leaves, twigs, etc.
bull	a male animal such as a manatee
buoyant	tending to float
calf	a young animal such as a manatee
camouflage	a disguise or concealment
canine	strong pointed teeth between incisors and molars
carnassial	sharp, cutting
carnivores	meat-eaters
carpel	hairs on the back of the forelegs
carrion	dead and rotting flesh of an animal
cellulose	the chief constituent of all plant tissues and fibers
channel	a route between two bodies of water
chestnut	a deep reddish-brown color

chromosomes	organized structure of DNA and protein that is found in cells carrying genetic information in the form of genes
cohesive	act of staying or sticking together
copious	plentiful; abundant
cow	a female animal such as a manatee
cud	partly digested food returned from the first stomach of ruminants to the mouth for further chewing
defecate	to get rid of waste matter; have a bowel movement
demise	death
density	the compactness or crowding of parts: high mass per unit volume
dental comb	structure used for cleaning debris off the projecting front teeth of prosimians
dew claw	first toe on the foot of cats that is on the side of the foot
dextrous	skillful in physical movements, particularly of the hands
differentiated	changing or varying during development or existence
digitigrade	walk on toes with back of foot raised
disruptive coloration	spots, stripes or other markings that break up the body outline against the background or surroundings
diurnal	active during the day
docile	submissive, accommodating
domestic	tame, not wild
dominance	one person or group has power over another
dorsal	the back of an animal or human being
endangered	threatened; in imminent peril; at risk of extinction
estuary	mouth of a river; where river nears and meets the sea
excrement	feces
extinct	no longer in existence
felines	cats
fermenting	a process in which an agent causes an organic substance to break down
fetus	an unborn or unhatched vertebrate
fissipeds	“paw-like” land carnivores

flank	the side, between the ribs and hip
flipper	a flat, wide limb with bones that is used for swimming, steering or manipulating
fluke	one of the lobes of a whale's tail
folivorous	foliage-eaters
forage	hunt for food
freshwater	water without salt
functional	having a purpose
genial	whiskers that are back on the sides of the face
gestation period	length of time in the womb
haplorhines	upper primates, simians
harem	a group of females shared by a single polygamous male
harpooning	to catch by spearing with a sharp pointed missile attached to a rope
herbicides	chemicals used to destroy or inhibit plant growth
herbivores	plant-eaters
hyoid	U-shaped bone at the base of the tongue that supports the tongue muscles
incisor	one of the cutting teeth in mammals in front of the canines
infanticide	murdering an infant
insectivores	insect-eaters
ischial callosities	leathery sitting pads
keratin	protein that occurs in hair, feathers, nails, hooves, etc.
knuckle-walking	move on all four limbs but forelimbs are flexed so that weight rests on the finger joints (knuckles)
larynx	cavity in the throat holding vocal chords
legislative	law making
ligaments	a tough band of tissue connecting bones or supporting organs
litter	a number of young born to an animal at one time
mamma	Latin for mammary glands (the organs that secrete milk)

mammals	warm-blooded vertebrates that feed their young with milk from mammary glands, give live birth (except monotremes) and have some hair on their body
mammary glands	the organs that secrete milk
marine	of or relating to the sea
mark	define one's place or territory
marsupials	mammals that care for their young in a pouch
melanistic	black color resulting from an abnormal amount of black pigment
membrane	pliable connective tissue or lining that connects organs or cells
migration	a seasonal movement from one area or region to another
molar	one of the cheek teeth in mammals behind the incisors and canines used for grinding
monogamous	having a single mate during a period of time
monotremes	mammals that lay eggs and feed their young from a mammary gland
muzzle	forward projecting part of the head, including the jaws and nose
mystacial	whiskers on the side of the face
mythology	study of fictitious stories associated with a culture, person or thing
natal	of one's birth
New World	American continents
nocturnal	active during the night
nonaggressive	not offensive or hostile
nonterritorial	not limited to a specific area or space
Old World	those places known to Europeans before the Americas were discovered
olfactory	concerned with smell
omnivores	feeds on both plants and animals
opportunistic	feeding on whatever food is available
opposable	digits on same limbs can be brought together, like thumb and fingers in a grasping action, can hold objects
papillae	small fleshy projections
pectoral	on or near the area of the breast or chest

peduncle	the base of the tail where it connects to the body
pelage	coat; fur
pendactyl	five-digit limb structure
pendulous	bent downward
pinniped	any of a suborder (Pinnipedia) of aquatic carnivorous mammals (as a seal or walrus) with all four limbs modified into flippers
pinnipeds	“finlike” marine carnivores
piscivorous	feeding on fish
placenta	the vascular organ that unites the fetus to the mother’s uterus
placentals	mammals that nourish their unborn in the mother’s body through the placenta
plantigrade	place full length of the foot on the ground during each stride when walking, such as humans
polyandrous	female mates with more than one male in the same breeding season
polygamous	a male that has more than one female mate at the same time or same breeding season
polygynandrous	multi-male, multi-female polygamous mating system
pouch	a pocket-like bag or receptacle in an animal’s body, in which marsupials carry their young
predation	the act of preying upon others
prehensile	adapted for grabbing by wrapping around an object
primitive	relatively undeveloped, marked by lack of skill
prodigious	great in number or size
prohibited	forbidden; not allowed
prosimians	lower primates
quadrupedal	moves on four legs
resonating	sound with a vibrating amplification
resonating chamber	space where sound is reverberated
retractive	can be drawn back in
rhinarium	wet dog-like snout

rostrum	snout
scent mark	the leaving of special glandular secretions and/or urine to “mark” or communicate territory
scraggly	ragged or untidy
sediment	matter that settles or attaches to the bottom of things
sexual dimorphism	marked differences in shape, color or size between males and females of same species
simians	upper primates, anthropoids
sirens	mythical half women that used enchanting music to lure sailors to rocky islands; temptresses
social	animals that breed or live in colonies or organized communities
strepsirhines	prosimians, lower primates
sublingual	structure under the tongue used for cleaning front teeth
suckle	to nurse from a mammary gland or teat
suffocate	obstruct the air passage
superciliary	whiskers above the eye
syndactylous	an animal that has two or more toes fused together
tawny	warm sandy color like that of well-tanned skin
taxonomists	those who classify
taxonomy	classification of organisms that expresses the relativity of each to the others
tendons	band or cord of tissue connecting fleshy part of muscles
terrestrial	living on the ground (as opposed to the sea or air)
territorial	limited to a specific area or space
thermoregulate	the ability of an organism to keep its body temperature within certain boundaries, even when the surrounding temperature is very different
threatened	likely to become endangered
toilet claw	curved horny part of the toe that is used for grooming
toxins	poisons
tributaries	rivers that feed into larger rivers

troop	assemblage of animals or persons
tufts	a bunch of hair or feathers
uterus	an organ of the female mammal for containing and usually for nourishing the young during development before birth
vascular	relating to a channel for the conveyance of a body fluid (as blood of an animal or sap of a plant) or to a system of such channels
ventral	of or relating to the belly; opposite the back
vertebrates	chordates, animals having a spinal column
vibraissae	stiff, coarse, sensitive hairs or whiskers on the head and/or face of some animals
warm-blooded	having a body temperature that remains relatively constant