Adaptations for Survival

Animals live in a variety of unique environments. Through natural selection, animals have modified, over time, both their behavioral and physical characteristics to better equip themselves for survival in their environments. As environments change, animals must adjust to survive by either adapting or migrating. Animals have characteristics that work for their environment, but not always what works best. The process of adaptation continues today.

Why Should Animals Adapt?

- **Feeding**: pressure from predator/prey interactions and competition for limited food sources have led to the evolution of many adaptations. Giraffes eat acacia trees. The acacia exudes a bitter chemical through its leaves. The giraffe moves on. The tree is not overgrazed and is available as a food source later. Kudu also eat acacia and exhibit the same behavior.
- **Defense**: protect themselves and their young from predators, pests and weather. This would include things as protective coloration, heavy coats and small ears in cold climates, or eyes on the side of the head for prey animals.
- **Locomotion**: animals must be able to move throughout their habitat. Feet have morphed into fins for swimming or arms that have evolved into wings.
- **Reproduction**/perpetuation of species: must recognize their own species, attract a mate and raise young. Cats (excluding lions) are solitary that occupy different but overlapping territories. Both sexes scent mark their territories. The male constantly checks these scent messages as he roams his territory. When he encounters an estrous female, he will track her down. A non-estrous female may shun him.

Types of Adaptations

- **External Physical Features**
  - Color: color or patterns can be used as camouflage or for identification.
  - Size: an animal's size or shape enables it to reach food, keep cool or warm, or be streamlined in wind or water.
  - Features: specific parts, like eyes, hands, tongues, ears or toes, can serve a special purpose, how an animal moves, large paws of predators, large snouts for good sense of smell, large ears for hearing, large eyes for seeing, etc.
- **Internal Physiological Adaptations**
  - Light skeleton for flying, large lungs or heart, multiple stomachs to ease digestion, tolerate higher body temps to reduce water loss, specialized kidneys, delayed implantation, etc.
- **Behavioral Adaptations**
  - Social behaviors (living in groups or alone), vocalizations, nocturnal, grooming, facial or body gestures, maternal care, rolling in mud to protect skin from sun and insects, dominance, territorial, etc.

SF Zoo Animal Adaptations

Children's Zoo

Black-Tailed Prairie Dog

Habitat: open plains and plateaus

- Have relatively large eyes on the side of their head giving good peripheral vision when looking for predators. Will stand on hind legs when looking for danger.
- Molars are low-crowned and pointed which is characteristic of herbivores. Grinding motion of jaws akin to herbivores.
- Ever growing incisor teeth characteristic of rodents.
- Short stout body and short legs allow them to be close to the ground and hence their food supply
- Good sense of smell. Prairie dogs are quadrapedal with a prominent nose, allowing them to put their nose to the ground and sniff for food.
- Tend to be in large groups foraging for food. Larger numbers akin to herbivores. There is safety in numbers.
- Cheek pouches to carry food back to the burrow.
- The uniform pale tan to cinnamon-buff pelage provides excellent camouflage from their predators.
- Prairie dogs have short ears and which are often hidden in the fur. This protects them from dirt when burrowing.
- Use sharp bark or yip when danger approaches to warn other individuals.
- Prairie dogs have highly organized societies (coteries), living in burrows, which provide them with a refuge and a place to rear their young. Prairie dog colonies, or towns, may contain hundreds of individuals living within a very restricted area. Within the town there are neighborhoods, or coteries. Burrows have inner connected chambers for specific uses like a listening room, sleeping room, nursery and a latrine.
- Dominate male provides protection and does most of the defending.
- Grooming important to protect from insects and disease.
- Altricial young. Pup comes above ground at 6 weeks.
- # young 2-10, gestation 28-35 days, sexual maturity 2-3 yrs.

Meerkat

Habitat: Semi-arid, hard or stony open country, savanna and grasslands

- Color is light grizzled gray to camouflage against the dry dusty earth.
- Dark color surrounds eyes to help protect them and are "natural sunglasses". They can stare hard into bright sky and spot birds of prey at great distances.
- Have eyes on the side of their head giving good peripheral vision when looking for predators. Will stand on hind legs when looking for danger. Meerkats have sharp eyesight and good color vision.
- Pupils are elongated horizontally to give a wide view of the surroundings for both spotting predators in the sky and prey on the ground.
- Forefeet have four non-retractable long strong claws, which are good for digging.
- Slender body enables them slip quickly into their burrow when danger threatens.
- Elongated snouts indicate a highly developed sense of smell that can help them search for food in the earth.
- Long tail is used like the third leg when standing upright for long periods on sentry duty providing them balance.
- Carnivore dentition helps them catch, kill and eat prey. Canines for gripping and tearing. Their diet consists of: scorpions, beetles, spiders, centipedes, millipedes, worms, crickets, small mammals, small reptiles, birds, eggs, tubers and roots.
- Immune to scorpion venom, so they can eat them.
- Ears close up while digging.
- Get most of their water from their food.

- Live in mobs in an underground network of tunnels with small rooms that are shared with up to 30 animals. No true leader, instead they take turns doing jobs that benefit the whole group (baby sitters, sentries, hunters and teachers). These burrows are not permanent homes. Every few months they move around.
- Sentry scout. When a sentry spots danger, it gives a shrill cry alarm that warns the others to seek the burrows for safety.
- Grooming important to maintain social bonds.
- Cooperative hunting groups to help in killing success.
- To frighten off predators or other meerkat groups, they create a dust screen and play-act a "mock" attack in hope of scaring off the intruder. When faced with a predator, the group may also move close together and stand on their hind legs to look like one larger animal in the hopes of scaring off the intruder.
- Meerkats hunt in different areas each day so as to not deplete their food source in one area.
- Play fighting behavior helps establish social hierarchy and help develop hunting/fighting skills.
- They can learn and are adaptable, so they can adjust to their changing surroundings.
- Grooming is important for maintaining social bonds and keeping their pelage free from insects and disease.
- Very territorial. They scent mark their territory by urinating and using their scent glands.
- Altricial young. Eyes and ears are closed at birth. Others protect the young while the mother leaves to hunt.
- Alpha male and alpha female do most of breeding.
- # young 2-4, gestation 11 wks, sexual maturity 1 yr.

Red Panda

Habitat: temperate forests between 7,200 - 15,700 ft altitude, prefers mixed deciduous and conifer forests with dense understory of bamboo

- Long non-prehensile tail for maintaining balance in the trees and to cover themselves in the winter to keep warm.
- Thick fur on their footpads allow them to stay warm in snow-covered areas or on ice and also prevents them from slipping on the wet branches.
- Their coloring provides excellent camouflage against its habitat of moss- and lichen-covered trees.
- Semi-retractable claws allow them to climb trees, stability and strike out when threatened. Allowing the claws to retract keeps them sharp when needed.
- They rotate their ankle joints to descend headfirst down a tree, allowing sharp, curved hind claws are able to grasp tree. This allows them to descend more quickly and to see any danger as they descend. They are able to go up and down the tree quickly and hit the ground running when descending.
- Have a small, bony projection (radial sesamoid bone) on their wrists that helps them grip bamboo stalks. (giant pandas also have this adaptation). It functions almost like a thumb and greatly aids their grip and increases forepaw dexterity.
- Mate on the ground.
- Usually forage on the ground after dusk in the safety of the darkness. Sleeps in trees during the day for safety.
- Territorial and scent marks with droppings, urine and releasing a musky secretion from its anal glands and glands on the pads of their feet. Have Jacobson organ for smell discrimination.
- Communicate between one another using short whistles and squeaks.
- Extremely low metabolic rate. Bamboo is low in nutrition. Teeth are modified for crushing leaves; molars have extra cusped crowns for crushing and grinding. Cellulose is hard to digest. They also chew the bamboo thoroughly and have large salivary glands.
- Red pandas have a short digestive tract like carnivores. They have large teeth and their guts are not specialized to handle plant matter. In fact, red pandas only extract about one quarter of the nutrients from bamboo, and food passes through their digestive tract quite quickly. They must consume a large volume and high-quality (tender leaves and shoots) bamboo to survive as they have difficulty digesting cellulose.
- Strong, tough jaws, which they use to chew on bamboo and break it down. Large masseter muscle for chewing. Dental Formula: **I** 3/3, **C** 1/1, **P** 3/3-4, **M** 2/2
- Red Panda also has long, white whiskers on its snout, which help it to navigate through the dense vegetation in the darkness of night, when it is most actively foraging for food.
- Nocturnal. Red Pandas spend the daylight hours sleeping in the branches high in the tree canopy with their long, bushy tail wrapped around them to keep them warm.
- Will stand on their hind legs to make their selves appear larger and use the sharp claws on their front paws to defend themselves if they feel like they can't run away.
- # young 1-4 usually 2, gestation 135 days, weaned 5 mos , sexual maturity 18 mos.

Woverine

Habitat: boreal forest and subarctic and alpine tundra

- Short appendages an adaptation of a cold winter habitat. Provides retention of heat. Males do not hibernate.
- Females hibernate to give birth. Provides warm area for young and weaning is times with spring and plentiful resources
- Mostly nocturnal. Eyesight is poor but have a keen sense of smell.
- Sharp claws enable them to climb steep cliffs and snowy slopes or to bring down prey and defend territory.
- Powerful jaws with 90^0 rotated upper molar, allows wolverine to tear off frozen meat and chew through bone.
- Anal scent gland produces musk for marking territory and sexual signaling.
- Solitary except for the breeding period. Need a large territory to provide food. Opportunistic feeders.
- Delayed implantation. Because they are solitary, breed when find mate and then wait to time birth with plentiful resources.
- # young 2-3 average 2, gestation 30-50 days (delayed implantation), weaned 10 wks , sexual maturity 2 years

Coscoroba Swan

Habitat: shallow areas of fresh water, such as ponds, lagoons, canals and swamps with sufficient vegetation for cover

- Long neck for reaching vegetation eliminating the need to dive for food. Swans feed by immersing their head and neck and sometimes "tipping up".
- Long, thick, strong bill for feeding on plants. The bill has serrated comb-like structures called lamellae, which help filter food. Swans scoop up water and food, hold it in their mouth and squeeze out the water through the lamellae.
- Inside the upper bill is a hard, horny tip (known as the "nail") that assists with breaking open mollusks.
- Webbed feet for aiding in swimming. The webbed feet can help the swan save energy so it can swim farther.
- Swans mate for life, nesting in the same territory year after year. They nest in the center of the lake and rebuild each year.
- Swans have long and thick, strong bills for feeding on salt tolerant water plants.
- Both parents perform incubation duties.
- Swans have 25 vertebrae in the neck, while humans have only seven; this allows for much greater neck flexibility.

- Waterproof plumage for staying warm in a wet environment.
- A light skeleton and wings allow the bird to fly in search of food and to escape predation. Swans require long running start for flight. In flight, swans do not have maneuvering ability and often collide in mid-air.
- The young, called cygnets, are able to fly two months after hatching. Flying sooner provides greater chance at survival.
- Migrate in lines or "V" formation, which conserves their energy. Each bird flies slightly above the bird in front of him, resulting in a reduction of wind resistance. The birds take turns being in the front, falling back when they get tired. A flock flying in formation can move faster and maintain flight longer than any one bird flying alone.
- # eggs 4-7, incubation 35 days, fledging 3 – 4 mos.

Spectacled Owl
Habitat: Dense tropical rainforest with mature, large trees, including forest edges. They prefer to live near water.
- Strong, hooked beak and large powerful talons help in holding on to prey and success in hunting.
- The beak of the owl is short, curved and downward-facing. The beak is typically hooked at the tip for gripping and tearing its prey.
- Nocturnal. Retina of their eyes is densely packed with rod cells that help them see in dim light, but they can also see well in daylight too by adjusting their pupils to limit the light entering their eyes and striking their sensitive retina.
- A light skeleton and wings allow a bird to fly in search of food.
- Good Binocular vision with large eyes fixed in their sockets. Owls can rotate their heads and necks in either direction for a total of about 270 degrees.
- Hunting strategy depends on stealth and surprise. The dull coloration of their feathers can render them almost invisible under certain conditions and the serrated edges on the leading edge of owls' remiges muffle an owl's wing beats, allowing an owl's flight to be practically silent.
- Form owl pellets. Regurgitating the indigestible parts of their prey, allows the owl to get all the meat from the smaller animal and not loose pieces as they are trying to rip the meat from the bones.
- # eggs 3-6, incubation 33-37 days, fledging 42-46 days.

ARC/Hawk Hill
Barn Owl
Habitat: open country, farmlands or grasslands. Prefers to hunt along the edge of woods
- Long wingspan coupled with soft, fringed feathers that don't "swoosh" as they move for slow silent flight while hunting. Flight feathers are covered in a layer of tiny hairs that trap air within the feather surface and the foremost wing feather (the tenth primary) also has a row of tiny hooks that help to deaden the sound of air hitting the wings' leading edge.
- Large wings supporting a lightweight body allows barn owls to fly very slowly without stalling and hover in only the slightest lift which aids in hunting.
- Night vision eyes and 3D hearing with one ear positioned higher than the other as a way of determining distance and location of sound. The owl's low-light vision is highly movement sensitive.
- Satellite dish face for picking up faint sounds providing accurate determination of distance and sound location.
- Eyes are fixed in the socket. Head swivels 270 degrees so they are able to search for prey.
- Sharp beak and strong grasping talons for killing and tearing prey.
- Barn Owls are especially good at detecting the high frequency sounds emitted by small mammals moving in vegetation, vocalizing and chewing. Sensitive hearing is important even when a Barn Owl is hunting in daylight - their prey is often hidden in deep vegetation.
- Barn Owls have remarkably long legs, toes and talons enabling them to catch prey at the base of deep vegetation. The talons are extremely sharp and prey is thought to be killed by foot clenching rather than a peck.
- The backside coloring of barn owl provides good camouflage from views above, as the rough grassland over which they usually hunt is predominantly light brown for most of the year and the white underside provides the same for views from below.
- A light skeleton and wings allow a bird to fly in search of food.
- Form owl pellets. Regurgitating the indigestible parts of their prey, allows the owl to get all the meat from the smaller animal and not loose pieces as they are trying to rip the meat from the bones.
- # eggs 3-6, incubation 30-34 days, fledging 50-55 days.

Eurasian Eagle Owl
Habitat: Mountains and forests with cliffs and rocky outcrops. Prefer open habitats with some trees and rocky areas.
- The beak of the owl is short, curved and downward-facing. The beak is typically hooked at the tip for gripping and tearing its prey.
- Form owl pellets. Regurgitating the indigestible parts of their prey, allows the owl to get all the meat from the smaller animal and not loose pieces as they are trying to rip the meat from the bones.
- Facial disk for picking up faint sounds providing accurate determination of distance and sound location of prey
- Eyes are fixed in the socket. Head swivels 270 degrees so they are able to search for prey.
- Sharp beak and strong grasping talons for killing and tearing prey.
- A light skeleton and wings allow a bird to fly in search of food.
- Ear tufts are a camouflage adaptation. They break up the roundness of the owls face among the tree branches.
- Soft, fringed feathers that don't "swoosh" as they move for slow silent flight while hunting. Flight feathers are covered in a layer of tiny hairs that trap air within the feather surface and the foremost wing feather (the tenth primary) also has a row of tiny hooks that help to deaden the sound of air hitting the wings' leading edge.
- Feathers on their feet helps muffles sound while in flight.
- # eggs 2-4, incubation 31 - 36 days, fledging 7 weeks.

Great Horned Owl
Habitat: prefers open and secondary-growth woodlands and agricultural areas.
- The beak of the owl is short, curved and downward-facing. The beak is typically hooked at the tip for gripping and tearing its prey.
- Form owl pellets. Regurgitating the indigestible parts of their prey, allows the owl to get all the meat from the smaller animal and not loose pieces as they are trying to rip the meat from the bones.
- Large eyes for good nocturnal and binocular vision, allowing them to pinpoint prey and see in low light.
- Eyes are fixed in the socket. Head swivels 270 degrees so they are able to search for prey.
- Sharp beak and strong grasping talons for killing and tearing prey.
- A light skeleton and wings allow a bird to fly in search of food.
- # eggs 1-5, incubation 30 – 37 days, fledging 7 weeks.

Northern Saw-whet Owl
Habitat: Coniferous and deciduous forests

- The beak of the owl is short, curved and downward-facing. The beak is typically hooked at the tip for gripping and tearing its prey.
- Form owl pellets. Regurgitating the indigestible parts of their prey, allows the owl to get all the meat from the smaller animal and not loose pieces as they are trying to rip the meat from the bones.
- Facial disk for picking up faint sounds providing accurate determination of distance and sound location of prey
- Nocturnal hunter. Large eyes and binocular vision with exceptional vision in low light.
- Asymmetrical ear openings in their skulls, which allows them to more easily distinguish both vertical and horizontal sound position.
- Sharp beak and strong grasping talons for killing and tearing prey.
- Four toes with the outer toe of each foot being able to rotate in a number of positions. This allows the northern saw-whet owl to maximize the strength of its grip on its prey.
- When threatened a Saw-whet owl will elongate its body in order to appear like a tree branch or bump, often bringing one wing around to the front of its body.
- A light skeleton and wings allow a bird to fly in search of food.
- Northern Saw-whet Owls are unusual among North American owls in that the young can fly reasonably well as soon as they leave the nest. This allows them a greater chance of survival.
- # eggs 3-7, incubation 27 – 29 days, fledging 4 - 5 weeks.

Golden Eagle
Habitat: Open, deserted terrain to grasslands from sea-level

- A light skeleton and wings allow a bird to fly in search of food.
- Eagle has strong grasping talons with spiny scales (spicules) on soles of toes for gripping slipper fish.
- Large, exceptionally powerful eyes. Bald eagles can see objects three to four times further away than humans.
- Eagle eyes are fixed in the socket and do not move. Instead they can turn their heads 270 degrees, which allows excellent monocular and binocular color vision.
- Eagles store food in their crop prior to its entrance to the digestive system allowing them to gorge at each feeding.
- Excellent hearing for detecting danger and finding food.
- Large, heavily built with sharp, strongly hooked beak and strong grasping talons for killing and tearing prey.
- Long wingspan to aid in soaring on thermals in search of prey.
- A pair of eagles may often hunt together with one chasing the prey to exhaustion while the other swoops in for the kill.
- One bird can carry up to 8 lbs in flight. Allows the golden eagle to get larger prey.
- # eggs 2, incubation 43 - 45 days, fledging 65 - 70 days.

American Kestrel
Habitat: open areas with short ground vegetation and sparse trees.

- A light skeleton and wings allow a bird to fly in search of food.
- Sharp beak and strong grasping talons for killing and tearing prey.
- Moderately long, fairly narrow wings that taper to a point, which is an adaptation for their typical hunting behavior. They hover at a height of around 10–20 meters (33–66 ft) over open country and swoop down on prey.
- Dark “eyes,” or ocelli, on the back of their heads. These spots are thought to represent “false eyes,” presumably leading predators to think that the kestrels literally “have eyes in the back of their heads.”
- # eggs 4-5, incubation 26 – 32 days, fledging 30 to 31 days.

Turkey Vulture
Habitat: grasslands, forests and deserts

- A light skeleton and wings allow the bird to fly in search of food.
- Carnivorous bird with a bare featherless head, which is easier to keep clean while feeding from carrion. Feathers are also high on legs.
- Can eliminate excess heat by stretching out neck to expand the area of bare skin and increasing blood flow through the skin of that region.
- Large wingspan. As turkey vultures fly, they tip from side to side, soaring on thermal updrafts. They can fly for hours without flapping their wings.
- Short, hooked, ivory-colored beak for ripping meat from carrion.
- Keen vision and sense of smell for finding food. The Turkey vulture tends to fly low enough to detect the gasses (mercaptan) produced by the beginnings of the process of decay in dead animals. New World vultures rely more on smell to detect prey whereas Old World rely on eyesight.
- Colonial birds. The turkey vulture roosts in large communities.
- Turkey vultures lack a syrinx and are usually silent; its only vocalizations are grunts or low hisses.
- Young are fed by regurgitation. They develop rapidly and are soon able to leave the nest.
- Few natural predators but they will vomit up a foul smelling substance, which can sting the eyes and face of an animal looking for an easy meal from a turkey vulture nest.
- Anisodactyl toes are relatively weak and poorly adapted to grasping but built for movement on ground. The talons are also not designed for grasping, as they are relatively blunt. Turkey vulture are scavengers and don’t need to kill prey as do other raptors. The two front toes of the foot are long and have small webs at their bases which is an adaptation for being able to move on the ground better.
- Obtain much of their water needs from carrion moisture. Their kidneys allow them to excrete less water.
- Have a very sophisticated immune system, which protects them from diseases associated with decaying animals. By being a scavenger they play a vital part in food webs. Without scavengers dead animals would rot and potentially spread disease.
- Turkey Vulture often defecates on its own legs, using the evaporation of the water in the feces and/or urine to cool itself.
- The Turkey Vulture lowers its night-time body temperature by about 6 degrees Celsius to 34 °C (93 °F). This cuts back on energy requirements of the bird and hence needs less food to keep his body warm.
- This vulture is often seen standing in a spread-winged stance. The stance is believed to serve multiple functions: drying the wings, warming the body, and baking off bacteria.
- Regurgitates semi-digested meat as a means of defense; a foul-smelling vomit deters most creatures intent on raiding the vulture’s nest. The vomit will sting the predator’s face or eyes if they were close enough. If the vulture must flee, this is a way to lighten his load to take flight and flee.
- # eggs 1-3, incubation 1 mos, fledging 10 wks.

Scarlet Macaw
Habitat: humid evergreen forests in lowlands up to 500 m (1,640 ft) (at least formerly) up to 1,000 m (3,281 ft), prefer undisturbed rainforest

- Strongly down curved beaks that are light weight in proportionate to large size. The beak is used as a hand to aid in climbing trees and perching.
- Extremely powerful beak, which can generate a pressure of 2000 psi and can snap a broomstick in half and is perfectly adapted for crushing or opening even the hardest nuts or seeds. Macaws feed on seeds, fruits, nuts, berries, leaves, salts and minerals of riverbanks. Macaws often flock to mountains of clay known as "macaw licks". Such licks contain minerals and salts essential to the bird's diet. Macaws are able to eat some poisonous fruits, as the clay appears to neutralize the toxins.
- The upper mandible is articulated by having a movable joint on the cranium.
- Monogamous pairs. Macaws generally mates for life and stay in their pairs. They often appear very devoted to their mate and preen each other (allopreening).
- Head is large though neck and legs are short.
- Zygodactyl feet. Members of this family are the only birds to use their claws for feeding.
- The body is compact with strong wings. Macaws are able to reach speeds of up to 35 miles per hour.
- Excellent eyesight and a keen sense of hearing.
- Macaws are gregarious and loud, designed to carry many miles to call for their groups and make their presence known in dense rain forests.
- Mating pairs often nest in unlined hollows of trees or palms. Both the male and female share the responsibility of raising the altricial young and feed hatchlings by regurgitation.
- Seed Predators. They eat and destroy the seeds thus limiting the number of seeds that can germinate into new trees and plants.
- # eggs 1-2, incubation 24 – 26 days, fledging 90 days.

Blue-fronted Amazon Parrot
Habitat: forests (though generally avoids extensive humid forests), woodland, savanna and palm groves

- Very good climber but awkward flyer -- on the ground they waddle along clumsily.
- Uses their beaks to climb, crack open nuts and seeds, pick foliage, flowers, and fruits to eat.
- Gregarious and travel in large flocks where there is safety in numbers.
- Zygodactyl feet with sharp claws for climbing and for feeding
- Green coloring is good camouflage in the rainforests.
- # eggs 3 - 5 , incubation 27 days, fledging 60 days

African Savannah:
Reticulated Giraffe
Habitat: level savannah regions, grassland with scattered trees and lightly wooded areas.

- Tallest land animal. This allows them to eat from treetops as well as lower branches and shrubs, thus reducing competition with other hoofed animals. Bull giraffes forage higher in trees than cow giraffes, which reduces food competition between the sexes.
- Giraffes have seven elongated neck vertebrae. The articulation between vertebrae is like a ball and socket joint allowing more movement than a human. Human's vertebral articulation surfaces are flat with a disk in between whereas giraffe's have a round one side and concave on the other. A modified atlas-axis joint allows the animal to tilt its head vertically and reach more branches with its tongue.
- They have specialized flat premolars and molars for grinding leaves from browse. They have no canines or incisors leaving space to move tongue and food around in their mouth.
- The brown "reticulated" fur pattern helps the giraffe to stay camouflaged in the grassland surroundings and hide their outline. The unique patterns are used for individual identification and may be used in thermoregulation; underneath each patch lies a very sophisticated system of blood vessels. Around each patch there is a quite a large blood vessel that then branches off into smaller vessels underneath the patch.
- Giraffe tongues are 18 inches long and prehensile so they can grab leaves from among the thorns of acacia trees. Their long muzzle also allows for a longer grasping range. Tongues are bluish-black and slimy to protect from rough browse and provides natural sunblock. Their thick, sticky saliva coats any thorns they might swallow, preventing them from being hurt from the thorns. Lips and tongue are protected from the thorns by thick, horny bumps or papillae.
- Nostrils can be closed at will to protect against dust.
- Large eyes are on the sides of their head to spot predators and are shaded by long eyelashes, which protect them from dust and thorns of acacia trees.
- Giraffes have elastic blood vessels and a series of valves (rete mirabile) in the veins and arteries of their neck to regulate blood pressure in their brain when the head swings up and down. Lower leg skin is taut to help blood from pooling.
- Large strong heart (25 lbs) helps regulate blood flow to the brain.
- Giraffes can go weeks without water. Must spread long forelegs to the side or get down on its knees in order to head down to drink. This is a very vulnerable position for predation. Giraffes get some water from the browse (acacia leaves). Usually drink every 2-3 days when water is available.
- Giraffes are largest ruminators. Rumination facilitate proper digestion of coarse vegetation at times when predators are not active or around. They are unique in that they are able to ruminate while walking, an adaptation which suits their nomadic lifestyle.
- Long legs able to wander long distances in search of food. The large sized hooves allow giraffes to run at speed of 35 mph in avoiding predators, but only for a short time. Hooves also provide formidable kicking defenses against predators. Giraffes walk moving both legs on one side of the body then both on the other side; this is unique to giraffes. Because of their short bodies and long legs, this keeps them from tripping over their own feet. This gait allows a longer stride, which saves steps and energy. They run in a similar style to other mammals, however, swinging their rear legs and front legs in unison.
- Tassels on their tails to swish flies and other insects off their bodies. Each hair is about 10 times thicker than a human hair.
- A baby giraffe is able to stand, walk and take milk from its mother within an hour of birth. If a young giraffe were not able to stand it would be left behind as the other giraffes roamed for food leaving the young at risk of being eaten by predators. Calves tend to cluster in crèches, for the first four to five months, to rest and socialize while mothers forage in the distance.
- Only animal to be born with horns which are cartilaginous at birth and ossify ~ 1 year. Adult male's horns (ossicones) usually have the hair rubbed off the top. Males use their horns in ritualized combat and sometimes in serious fights. This "necking" behavior establishes their dominance rank. Female's horns are tufted like a paintbrush.
- Male's head gains weight with age. Males continue to deposit bone up over their horns, orbits, nape and nose increasing the size and number of their ossicones. This helps with declare their dominance. Bulls have a pecking order, if a strange bull enters an area, it will

be challenged by the dominant male. Dominance is established by neck wrestling using their horns to spar, and butting heads (they have particularly strong skulls) until one of them retreats.
- Usually sleep standing up and require very little sleep (20 min to 2 hrs per day). This is the shortest of any mammal. They are vulnerable to predation when lying down.
- # young 1 (usually every 20 - 30 mos.), gestation 14-16 mos, sexual maturity F 31/2 yrs, M 41/2 yrs.

Grant's Zebra
Habitat: open savannas and grasslands
- Excellent eyesight with large eyes on the side of their heads gives them excellent peripheral vision. If grazing with other zebras, they face in opposite directions to get full 360 degree view.
- Large rounded ears that can rotate in all directions enabling them to detect predators.
- Long snout. Nostrils are sensitive to smell so they can sense predators while grazing.
- They live in cohesive family group (harems) within larger herds with other kinds of hoofstock. This provides group defense for their young without much competition for food.
- Nonrumminating. Zebras prefer tall, coarse grasses, which exposes the shorter more succulent blades preferred by other antelopes. This allows them to graze in the same areas without competing with each other.
- Strong leg muscles. These powerful legs have hoofs, which are modified middle toes, which help them run faster. Zebras are able to reach up to 40 mph but can walk, canter, trot or gallop equally well. The hooves protect their feet and allow for greater mobility than unprotected feet. Hooves can also be used as a weapon in defense against a predator. Zebras are able to kick with hind feet or when in a defensive posture. When cornered, the zebra will rear up and kick or bite its attacker.
- Stripes are difficult to see in light and shadow of grasslands. In a large group, stripes break up shape of individuals in a herd thus making it more difficult for a predator to single any particular animal. When the sun starts to go down, their stripes blend in with the dark sky making them really hard to see. Since lions and other predators like to do their hunting at dusk, this crazy pattern of stripes helps the zebra survive. Each zebra has its own pattern of stripes and are used for individual identification (like individual fingerprints).
- Incisors developed to facilitate biting off vegetation. Massive jaws and powerful cheek teeth and muscles evolved for thorough mastication of coarse fibrous plant material.
- Precocial young. A baby zebra is able to stand soon after birth. If a young zebra were not able to stand it would be left behind as the other zebras roamed for food leaving the young at risk of being eaten by predators.
- Imprinting of foals on its mother is important. The mother is its regular protector. The head stallion and other mares may give some protection.
- Migratory; will migrate in search of grasses. Zebras lead the migration cropping the high grasses, followed by other species that prefer the shorter more succulent grass. Zebras are water dependent and so will travel many kilometers when water is lacking and when necessary will dig for water.
- # young 1, gestation 1 yr , sexual maturity F 2-3 yrs, M 1-3 yrs.

Greater Kudu
Habitat: Scrub and open forest, rarely in plains.
- Ruminating antelope. Ruminating allows them to ingest a lot of food and then retire to safety to chew and digest.
- Browser. Kudus are the only animal that thrives on scrub woodland and brush that grows in abandoned fields and pastures. Their dentition is specialized for pulling and grinding.
- Prehensile tongue makes it easier to grab leaves from the brush.
- Males have long spiral horns, which help them compete for females.
- Relatively independent of surface water if browse has sufficient moisture. Have additional moisture in their rumen for use in times of water shortage.
- Cryptic coloring and markings camouflages their presence. They prefer being under cover for protection.
- Keen sense of smell allows them to sense their predators.
- High jumpers. They can easily leap over objects that are 8 feet, often look back after running which is a fatal habit.
- Males have gruff bark, which is loudest of all antelopes. This vocalization is a way of communicating with its species in the scrub forests.
- Precocial young. A baby kudu is able to stand soon after birth so it won't be left behind as the other zebras roamed for food leaving the young at risk of being eaten by predators. Kudu young are hidden for the first 2 weeks of their lives for protection from predation.
- Kudus have hooves to protect their feet in a rocky environment and allow for greater mobility than unprotected feet.
- Greater kudu have a narrow body and long legs built for long distance travel in search of food. They are not territorial.

- Kudus have large, round ears with a good sense of hearing in order to detect predators.
- Social licking between mother and calf provides bond a social bond between them.
- Females separate themselves from the herd just before giving birth, leaving the calf lying in concealment. Calves remain hidden for two weeks before mothers re-join the herd. This isolation allows time for the calf to imprint on its mother.
- # young 1, gestation 9 mos, sexual maturity F 2-3 yrs, M 5 yrs.

Ostrich
Habitat: savanna and open areas where there is little cover or standing water
- Largest flightless bird with long muscular legs built for running. Can cover great distances with minimum effort and lead nomadic lifestyle. Can run about 30-35 mph for about ½ hour and can outpace most pursuers, such as lions, leopards, and hyenas.
- Ratite bird with no keel on their sternum. Without this keel to anchor their wing muscles, ostriches could not fly even if they were to develop suitable wings.
- Reduced wings with spurs on end that can be used to fight enemies. Ostrich will also use posture to intimidate a rival or a predator. Its wings are spread out and the feathers fluffed up and the bird hisses loudly.
- Excellent eyesight with large eyes combined with long neck and long legs giving the ostrich advantages for spotting potential predators from a long way off. Eyes are largest of any land animal.
- Only bird with two toes. The large inner toe has a long, flattened claw, which is powered by a formidable kick from strong legs and is used for protection. An ostrich can kill a lion with its kick. The reduced number of toes is an adaptation in fast running animals. Natural selection has reduced the surface area contacting the ground.
- Soft elastic pads on bottom of toes to prevent feet from sinking in sand.
- Broad, flat bills for feeding on seeds, berries, wild figs, and small animals such as tortoises and other reptiles. They will eat stones and sand to help digest food in their gizzard.

- Long eyelashes for protection from the sun and dust from their habitat.
- Live together in groups. There is safety in numbers. Ostriches travel with antelopes and zebras that stir up insects, small reptiles and rodents, which the ostrich likes to eat. It is a mutually beneficial relationship as the ostriches keep an eye out for trouble.
- Sexually dichromatic. Male's plumage is black with white tail and wings; female is overall brown. Males and Females share incubating duties. Since they nest in open areas the coloration is needed for camouflage. The females sit on the eggs during the day and the males at night.
- Dominant female ostrich lays 5-11 eggs in the center of a nest that the dominant male has prepared in a shallow depression. Up to 5 minor hens lay 2-6 eggs around hers. This will protect the dominant female's eggs from predation and increase their chance of surviving. Male cares for the young in the first month. A female ostrich shows a remarkable ability to recognize her own eggs even when mixed in with those of other females in their communal nest.
- Drinks water every 2-3 days when available. An ostrich can go weeks to months without water.
- Feathers lack the tiny hooks that lock together the smooth external feathers of flying birds, and so are soft and fluffy and serve as insulation. Ostriches are the only bird to have feathers with vanes equal on either side of the shaft. They have no bare or less-feathered skin (apteria) between feather tracts.
- # eggs major hen 5-11, 5 minor hens 2-6, incubation 42-46 days.

East Africa Crowned Crane and West Africa Crowned Crane

Habitat: marshes and grassy flatlands near rivers and lakes

- Most primitive of living cranes.
- Long legged for wading through grasses in the plains. Crowned cranes will stamp their feet as they walk to flush out insects, which are quickly caught and eaten. They will also associate with grazing herbivores, who also with flush out insects as they walk.
- Eyes on side of head provide excellent peripheral vision this combined with long legs allow them to spot predators in the tall savannah grass. These cranes also associate with grazing herbivores, benefiting from the ability to grab prey items disturbed by antelopes and gazelles. This is a mutually beneficial arrangement.
- Anisodactyl feet are large and slender and adapted for balance rather than defense or grasping. Only crane to perch in trees. They use their long hind toe to grasp branches. Crowned cranes prefer solitary trees that afford a wide view. Important in their defense against predation.
- Lighter bones and large wings give the crowned crane excellent flying ability for searching for food and to escape predation.
- Relatively short powerful and straight bill to eat invertebrates, insects and vegetable matter.
- No crop. Food goes directly to their stomach. Crowned cranes eat small rocks to aid in digestion.
- Perform spectacular dances involving head-bobbing, wing fluttering, leaps and bows to attract mates. Both males and females dance. Dancing is an integral part of courtship, but also may be done at any time of the year.
- Red gular sac, which becomes inflated to create a booming call. Crowned cranes also make a honking sound quite different from the trumpeting of other crane species. May serve to keep the flock together during migration.
- Crowned crane parents often pretend to be injured to lure predators away from their nestlings.
- Chicks are precocial and can run as soon as they hatch, and fly in 10 weeks. This is a strategy for survival.
- # eggs 1-4, incubation 28-31 days, fledging 56-100 days.

African Aviary:

Hadada Ibis

Habitat: swamps, marshes, flooded areas, rivers with a margin of trees, edges of lakes and pastureland.

- Feed by touch rather than sight, using their long legs and down curved (decurved) bills to probe mud and water for prey.
- Both sexes feed the young. Fledglings feed on regurgitated food, which they get by inserting their bills down the parents' gullet.
- Long legs for wading in search of food.
- Anisodactyl feet. Long toes distribute weight when walking on mud. The hadada ibis is the least aquatic of all the African ibises.
- A shaggy ruff of black feathers around the neck is raised in courtship displays
- A light skeleton and broad, rounded wings allow the bird to fly in search of food and to escape predation.
- Communicate by a distinctive call: a loud, far-reaching "Haa-Daa-Daa". They are particularly noisy at dawn and dusk on the way to or from their overnight roosts.
- Benefit from humans being in the area. Humans often bring livestock, and livestock dung leads to larger populations of dung beetles, one of the hadada ibis' favorite foods!
- The young develop rapidly and are soon able to leave the nest. The nesting cycle lasts 2-3 months.
- They nest in isolation, many times at the top of telephone poles. When not breeding, they feed and fly in large groups.
- Ibises use their long beak to preening and smooth their feathers.
- # eggs 2-7, incubation 20-29 days, fledging 5 weeks.

Waldrap Ibis

Habitat: Found in open, dry areas, coastlines, and cliff ledges

- Have evolved long curved, downward-pointing (decurved) beaks for probing for food in the mud and sand. Peck on the ground and probes fissures and under stones for invertebrates. Ibises also sweep their bill from side to side.
- Long legs for wading in search of food.
- Have sensitive feelers on the inside of their beaks help them identify food before they even see it. They feed by touch rather than sight.
- Waldrap Ibises have bald heads to help them keep their heads clean while probing in the dirt.
- Both sexes feed the young. Fledglings feed on regurgitated food, which they get by inserting their bills down the parents' gullet.
- The young develop rapidly and are soon able to leave the nest.
- A light skeleton and wings allow the bird to fly in search of food and to escape predation.
- These gregarious birds gather in huge breeding colonies. Highly social by nature, they mingle in flocks.
- Shaggy ruff of black feathers around the neck is raised in courtship displays.
- Ibises use their long beak to preening and smooth its feathers.
- Anisodactyl feet. Waldrap Ibis feet are used to grip tree branches and the back toe helps them stay balanced.
- # eggs 2-4, incubation 24-28 days, fledging 10 weeks.

Hamerkop

Habitat: Marshy shorelines (lakes, rivers, estuaries), hunting along the water edge.

- Vertically flattened, stout bill for eating insects, fish, crabs, frogs, rodents and similar small animals.
- Probe mud for invertebrates.

- Stalk their prey by wading through shallow water with short legs and striking forward with bill. Usually take catch to land to eat.
- Smallest of the storks. They have no syrinx but clatter their bills for communication.
- A light skeleton and wings allow the bird to fly in search of food and to escape predation.
- Hamerkops make massive roofed nests, which may measure up to 61/2 feet wide, and 61/2 feet deep; these nests are structurally sound, and will support the weight of a man! These structures provide protection for their young. The entrance is downward facing and when abandoned provides homes for snakes, bees, owls, etc.
- Partially webbed feet. Its middle toe is comb-like (pectinated) like a heron's.
- # eggs 2-6, incubation 28-30 days, fledging 44-50 days.

African Open-billed Stork

Habitat: typically found in marshes, swamps and lakes, freshwater wetlands

- Long legs for taking long strides and wading in deep water for food.
- Long, open bill is specialized for grabbing and eating mollusks and snails. Bill is not used as a nutcracker. The snails and mollusks are held underwater with tip of upper bill while lower part is inserted into shell to cut mollusk free. The snail is then pulled out and swallowed, leaving the shell intact.
- Storks lack a syrinx and the open-billed stork cannot bill clatter like other storks. Instead the open-billed stork has developed a loud, sonorous, raucous honk.
- A light skeleton and long broad wings allow the bird to fly in search of food and to escape predation.
- A long neck allows them to stretch out to capture their prey.
- Anisodactyl feet.
- Open-billed storks fly with their neck outstretched and dangle their legs behind them as they fly, making them streamline. They fly mostly by soaring on warm air currents, with long, broad wings that only flap occasionally.
- # eggs 3-4, incubation 25-30 days, fledging 50-55 days.

Primates

- 5 digits on each hand and foot
- Flat nails on toes/fingers, some species posses a modified claw on paired digits
- At least one opposable pair of digits (except Colobine - no thumb) allows the digits to grasp and handle objects
- Large Clavicle which provides rigid support from which the scapula and free limb (arm) are suspended; an arrangement that keeps the upper limb away from the thorax so that the arm has maximum range of movement.
- Eyes surrounded completely by bone and generally face more forward to facilitate stereoscopic vision
- Color vision to some degree
- Paired mammary glands, usually in the chest (in Aye-Aye located on the lower abdomen)
- Testes in a naked or thinly haired scrotum, a suspended penis often with a baculum (bone)
- Well developed cecum, reduced to the appendix in humans for herbivorous diet
- General increase in size and complexity of the brain's cerebral hemispheres
- Most give birth to a single live offspring
- Trend toward longer period of parental care
- Trend towards longer gestation periods and longer lifespans

Lemurs

- Lemur adaptations have more to do with behavioral adaptations than actual physical adaptations.
- Each species is found in a particular habitat.
- 75% of lemurs are nocturnal.
- About 75% of Madagascar's species are endemic.
- Female lemurs are dominant (exception: red-fronted brown lemur)

Ring-tailed Lemur

Habitat: semi-arid brush and scrub forests, closed canopy deciduous forests, dry, rocky mountainous areas with patches of deciduous forests of south, southwest Madagascar

- See primate traits above
- See lemur traits above
- They are the only surviving semi-terrestrial diurnal lemur in Madagascar. They spend 15% of their time on the ground. They forage and travel at all levels in the forest.
- Strepsirhini (wet naked nose). Lemurs rely on sense of smell to gather food and information with their long nose and large olfactory lobe.
- Incisors and canines form a dental comb which they use for self-grooming
- Second toe has distinctive grooming claw
- Semi-opposable thumb and toes. Big toe of hind foot is widely separated from other toes allowing for a secure grip.
- Relatively large, forward facing eyes giving them some binocular vision. Their eyes do not point as directly forward as monkeys. Lemurs have a tapetum, a highly reflective layer on the back of their retina. This intensifies the light coming into the eye, allowing them to see during the night.
- Hindlimbs are longer than forelimbs which is good for jumping
- Long tail helps maintain their balance in the trees it also plays a significant role in signaling.
- Vocalizations are a way of communication and locating each other. They make different calls for different threats.
- Scent marking is a major way of communicating. Females scent with vulva scent glands and males with their wrist and scrotal glands that they use to mark their territories and broadcast their breeding status.
- A lemur's soft, broad fingers and toes have flat nails that allow it to grip objects and groom other lemurs.
- Ring-tailed lemurs have "stink wars" and "jump fights" to compete for females during the breeding season.
- Lemurs eat predominantly fruit and are an important seed disperser through their droppings.
- Maintain a "sun worshipping" sitting position. They sit with their arms outstretched and heads back to maximize exposure to the sun.
- Ring-tailed lemurs are social animals, living in groups of 3 to 24 individuals of both sexes, with a well-defined dominance hierarchy. Females are dominant over males. Females get first access to food and priority grooming.
- # young 1 (sometimes twins), gestation 134-138 days, single pair pectoral mammae, sexual maturity 2 yrs.

Blue-eyed Black Lemur

Habitat: primary and secondary rainforests of northwest Madagascar

- See Primate traits above
- See Lemur traits above
- Strepsirhini (wet naked nose). Lemurs rely on sense of smell to gather food and information with their long nose and large olfactory lobe.
- Incisors and canines form a dental comb which they use for self-grooming
- Second toe has distinctive grooming claw
- Semi-opposable thumb and toes. Big toe of hind foot is widely separated from other toes allowing for a secure grip.
- Relatively large, forward facing blue eyes giving them some binocular vision. Their eyes do not point as directly forward as monkeys. Lemurs have a tapetum, a highly reflective layer on the back of their retina. This intensifies the light coming into the eye, allowing them to see at night better.
- Hindlimbs are longer than forelimbs which is good for jumping
- Long tail helps maintain their balance in the trees it also plays a significant role in signaling.
- Vocalizations are a way of communication and locating each other. They make different calls for different threats. Black lemurs travel in noisy bands of about 7 – 15 individuals.
- Scent marking is a major way of communicating. Females scent with vulva scent glands and males with their wrist and scrotal glands
- Lemurs eat predominantly fruit and are an important seed disperser through their droppings.
- Sexually dichromatic. Males are black and Females are reddish-brown in color. Lack the ear tufts of Black lemurs.
- # young 1-3, gestation 90-102 days, single pair pectoral mammae, sexual maturity F 18mos, M 21/2 yrs.

Red-fronted Brown Lemur
Habitat: dry lowland forests, southeast moist forest

- See primate traits above
- See lemur traits above
- Strepsirhini (wet naked nose). Lemurs rely on sense of smell to gather food and information with their long nose and large olfactory lobe.
- Incisors and canines form a dental comb which they use for self-grooming
- Fingertips are broad and padded to provide sure grip on branches.
- Second toe has distinctive grooming claw
- Semi-opposable thumb and toes. Big toe of hind foot is widely separated from other toes allowing for a secure grip.
- Relatively large, forward facing eyes giving them some binocular vision. Their eyes do not point as directly forward as monkeys. Lemurs have a tapetum, a highly reflective layer on the back of their retina. This intensifies the light coming into the eye, allowing them to see at night better.
- Hindlimbs are longer than forelimbs which is good for jumping
- Long tail helps maintain their balance in the trees it also plays a significant role in signaling.
- Vocalizations are a way of communication and locating each other. They make different calls for different threats. Black lemurs travel in noisy bands of about 7 – 15 individuals.
- Scent marking is a major way of communicating. Females scent with vulva scent glands and males with their wrist and scrotal glands
- Lemurs eat predominantly fruit and are an important seed disperser through their droppings.
- sexually dichromatic with variations between individuals and between east and west populations
- horizontal posture suited for quadrupedal mode of transportation in the upper layers of the canopy
- sociable, permanent groups usually of 4 to 18 individuals. Red-fronted lemurs are one of the few lemur species that is not female dominated and without a noticeable hierarchy.
- # young 1, gestation 120 days, wean 4-5 mos, single pair pectoral mammae, sexual maturity 2 yrs.

Red-bellied Lemur
Habitat: dense evergreen vegetation of rainforest

- See primate traits above
- See lemur traits above
- Strepsirhini (wet naked nose). Lemurs rely on sense of smell to gather food and information with their long nose and large olfactory lobe.
- Incisors and canines form a dental comb which they use for self-grooming
- Fingertips are broad and padded to provide sure grip on branches.
- Second toe has distinctive grooming claw
- Semi-opposable thumb and toes. Big toe of hind foot is widely separated from other toes allowing for a secure grip.
- Relatively large, forward facing eyes giving them some binocular vision. Their eyes do not point as directly forward as monkeys. Lemurs have a tapetum, a highly reflective layer on the back of their retina. This intensifies the light coming into the eye, allowing them to see at night better.
- Hindlimbs are longer than forelimbs which is good for jumping
- Long tail helps maintain their balance in the trees it also plays a significant role in signaling.
- Vocalizations are a way of communication and locating each other. They make different calls for different threats.
- Scent marking is a major way of communicating. Males have prominent scent glands atop their heads.
- Lemurs eat predominantly fruit and are an important seed disperser through their droppings.
- Sexually dichromatic
- horizontal posture suited for quadrupedal mode of transportation in the upper layers of the canopy
- sociable, family groups usually of 2 to 6 individuals.
- Males and Females share in caring for young
- Female dominance.
- # young 1, gestation 127 days, wean 135 days, single pair pectoral mammae, sexual maturity 2 yrs.

Black & White Ruffed Lemur
Habitat: coastal rainforests at canopy level in eastern Madagascar.

- See Primate traits above
- See Lemur traits above
- Largest of the lemurs.
- Strepsirhini (wet naked nose). Lemurs rely on sense of smell to gather food and information with their long nose and large olfactory lobe.
- Incisors and canines form a dental comb which they use for self-grooming
- Second toe has distinctive grooming claw
- Semi-opposable thumb and toes. Big toe of hind foot is widely separated from other toes allowing for a secure grip.

- Relatively large, forward facing eyes giving them some binocular vision. Their eyes do not point as directly forward as monkeys. Lemurs have a tapetum, a highly reflective layer on the back of their retina (internal). This intensifies the light coming into the eye, allowing them to see at night better.
- Distinctive golden eyes have some stereoscopic vision but no cones, the basis for color vision, in the retina.
- Hindlimbs are longer than forelimbs which is good for jumping
- Long tail helps maintain their balance in the trees it also plays a significant role in signaling.
- Vocalizations are a way of communication and locating each other. They make different calls for different threats. Black and white ruffed lemurs are highly vocal with a raucous barking to communicate with one another and maintain spacing in the forest.
- Scent marking is a major way of communicating. Females will mark with vulva scent glands and males with their wrist and scrotal glands. The ruffed lemur has a marking gland on its' neck.
- Lemurs eat predominantly fruit and are an important seed disperser through their droppings. Black and white ruffed lemurs are essential pollinators by using their tongue and long snout to get nectar from flowers.
- Form small family groups, generally a mated pair with two to five young
- Thick pelage of ruffed lemurs is good adaptation to rain.
- Three pair of mammae. Black and white ruffed lemurs tend to have liters with over half the births being twins.
- Ruffed lemurs are territorial. Females are dominant and defend territory
- Ruffed lemurs often hang upside down by their feet to feed.
- # young 1-3, gestation 90-102 days, three pair pectoral mammae, sexual maturity 20 mos.

Red Ruffed Lemur

Habitat: undisturbed primary forests in a remote area of northeast Madagascar.

- See Primate traits above
- See Lemur traits above
- Strepsirhini (wet naked nose). Lemurs rely on sense of smell to gather food and information with their long nose and large olfactory lobe.
- Incisors and canines form a dental comb which they use for self-grooming
- Second toe has distinctive grooming claw
- Semi-opposable thumb and toes. Big toe of hind foot is widely separated from other toes allowing for a secure grip.
- Relatively large, forward facing eyes giving them some binocular vision. Their eyes do not point as directly forward as monkeys. Lemurs have a tapetum, a highly reflective layer on the back of their retina. This intensifies the light coming into the eye, allowing them to see at night better.
- Hindlimbs are longer than forelimbs, which is good for jumping.
- Long tail helps maintain their balance in the trees it also plays a significant role in signaling.
- Vocalizations are a way of communication and locating each other. They make different calls for different threats. Red ruffed lemurs live in groups of two to ten individuals.
- Scent marking is a major way of communicating. Females scent with vulva scent glands and males with their wrist and scrotal glands. The ruffed lemur has a marking gland on its' neck.
- Lemurs eat predominantly fruit and are an important seed disperser through their droppings.
- Red ruffed lemurs' social behavior is different than other lemurs because of their remoteness of their habitat.
- Thick pelage of ruffed lemurs is good adaptation to rain.
- Three pair of mammae. Red ruffed lemurs tend to have liters with over half the births being twins.
- Ruffed lemurs are territorial. Females are dominant and defend territory.
- Ruffed lemurs often hang upside down by their feet to feed.
- # young twins 50%, gestation 90-102 days, three pair pectoral mammae, sexual maturity 20 mos.

Monkeys

Mandrill

Habitat: high moist forest of low-level trees and forest floor

- See Primate traits above
- Forward-facing eyes for binocular vision (allowing depth perception)
- Adult male mandrills are very colorful. These bright colors are thought to be attractive to females. But those bright colors also show up on the mandrills' rear ends that may enhance visibility in thick vegetation as troops move through the forest.
- The coloration of dominant males is brighter than juvenile or non-dominant males. This ensures that his genes will be passed on.
- Mandrills have large cheek. These pouches can contain nearly a full stomach load of food when fully distended. When competing for food or foraging in a dangerous place, mandrills can quickly cram food into the cheek pouches then retreat to a safe place to eat. They use the back of their hand to push food out of the pouches and into their mouth.
- Vestigial tail. Mandrills live in dense rain forests and they are terrestrial, so a long tail is not needed for balance.
- Sexual dimorphism. Males are twice as big as female and has large canine, which conveys his toughness. The coloring of the mandril emits better in dull light of the dense forests especially with the male.
- Long canines are not for hunting prey but for threatening other males. By bearing a large set of sharp teeth, a male can show his power or instill fear in another male or predator.
- The mandrill are the largest of all monkeys and have a stocky, powerful body and muscular arms for running from predators and which they use to frighten off other males.
- Males are constantly alert for predators and will place themselves between family and intruder, growling and displaying their teeth. If this behavior does not suffice to scare off the intruder, the male will work himself into a frenzy by jumping up and down. Bright red spots will appear on his wrist and ankles while his chest will turn a vivid blue. It is believed that this color change is produced by a specialized circulatory function.
- Males use facial colors as threat signals along with a penetrating stare to intimidate a male rival and to establish domination.
- Use vocalizations for communication.
- Mandrills walk on their fingers and toes, so that the palms of their hands and soles of their feet do not touch the ground.
- Mandrills have an opposable first digit on their hands and feet. These opposable digits aid in foraging for food throughout the day as they pick up fruits and seeds and turn over rocks and debris to find food.
- Mandrills walk plantigrade on their back feet, but on their fingers with their front feet. This is an adaptation for a terrestrial gait.
- Mandrills have unique fingerprints that can identify individual animals.
- Although they are adapted to live on land, mandrills seek shelter in trees at night.
- Will live in groups of 1,000 individuals. They live in harems with the males on the periphery.

- # young 1, gestation 167-176 days, sexual maturity 5 yrs.

Black and White Colobus – off exhibit
Habitat: lowland tropical rainforest to the upper reaches of the montane forests up to 10,824 ft.
- See Primate traits above
- Forward-facing eyes for binocular vision.
- Long fluffy tail with large white tuft at the end is used to steer or brake in midair. The tail arrests fall when jumping from a tree. A colubus is highly arboreal and the tail is an adaption to their life in the trees.
- Slender body for moving quickly through the trees.
- Complex, sacculated stomach and large salivary glands aid the colobus to digest leaves more efficiently.
- Small phalangeal tubercle or lack of the thumb may be an adaptation for quick movements through the trees.
- Molars have high, pointed cusps for grinding their leafy vegetation diet.
- Upper canines are elongated and tusk-like and make the colubus appear threatening and help ward off predators or other troops. Well-defined territories are vigorously defended by males with leaps and cries, hand-to-hand communication, roars, and occasional chasing and fighting. Additionally, displays of the white fringe fur flapping up and down serve as warning to others.
- Maintain strong group bonds by mutual grooming and "infant transfer." This latter phenomenon consists of an infant being handled by several females.
- These monkeys spend most of their time sitting in the tops of trees resting. Do not get a lot of energy from the leaves they eat.
- Stomachs are larger than their chests. Their stomach size is attributed to their enlarged intestines, which digest the bulky fibrous vegetation they consume.
- Live in groups (8-15 individuals) with a single adult male.
- Territorial. The male defends the territory.
- # young 1, gestation 6 mos, sexual maturity F 3-4 yrs, M 6 yrs.

Black Howler Monkey – off exhibit
Habitat: Various tropical habitats including seasonal (dry) to typical rainforest and wooded savannas
- See Primate traits above
- Forward-facing eyes for binocular vision (allowing depth perception)
- Sexual dimorphism. Males are larger and black while the females are golden brown.
- Long tail provides balance as they move about in the trees.
- Their prehensile tail is sensitive to touch and enables the monkey to feel what it is gripping thus assisting when leaping from tree to tree.
- Strong prehensile tail that can catch a limb if the monkey falls.
- Howlers have enlarged throats, due to an extra-large voice box which acts as a resonance box, amplifying the howls. This allows the howler to communicate over great distances, the troops location and territory. Males use their booming voice to defend their territory. Hyoid bone amplifies call and can be heard up to 3 miles.
- Howlers lack the opposable thumb but their hands have a cleft between index finger and middle finger that affords a secure grip for their arboreal life.
- The young are born the golden color of the females. Infant is cared for by several females of their group. The coloring may stimulate maternal instinct.
- Howlers lack the specialized stomach of true leaf eater monkeys but they do have a slightly more complex stomach to handle their leafy diet. The cellulose-digesting bacteria needed for fermentation are found in small sacks below the small intestine. Not true leaf eater. They eat the tender young leaves and are an important seed disperser.
- Scentmark their territory. Howlers will sometimes move together to the same branch to defecate. This ensures to broadcast their scent better.
- # young 1, gestation 180-194 days, sexual maturity F 4-5 yrs, M 6-8 yrs.

François Langur or François Leaf Monkey
Habitat: Moist forests and well-sheltered rocky areas in the limestone hills and caves of undisturbed China and Vietnam. They eat mostly leaves, young and mature. Fruit, buds, flowers, seeds, stems, bark and insects are also eaten.
- See Primate traits above
- Forward-facing eyes for binocular vision (allowing depth perception)
- Slim body, with a small head, slender extremity and long tail allows them to be extremely agile and adept at jumping from tree to tree.
- Forelegs are much shorter than hind legs which allows them to leap among the trees.
- Long tail provides balance as they move about in the trees.
- Hairless hands and feet allow easy grasping of branches.
- Thumbs are well-developed and opposable allowing them to grasp leaves for eating and the branches for locomotion in the trees.
- Molars have high pointed cusps which is important for herbivores in grinding their food.
- The stomach is large and multi-chambered, and the fore-stomach supports bacteria with cellulose-digesting abilities. This allows them to digest the fibrous leaves of their diet. The salivary gland is enlarged to help in the digestion also.
- They lack cheek pouches but have enlarged salivary glands, which help them digest fibrous leaves.
- François leaf-monkeys spend most of their time in the trees. There is increase risk of predation on the ground. They drink very little water but get their moisture by drinking dew from leaves.
- The young are born a rust color. Infant is cared for by all members of their group. The coloring may stimulate maternal instinct.
- Mutual relaxed grooming is important in the social life of these primates and occupies up to five hours a day.
- Live in harem groups (4-27 individuals) of one dominant male and several females and their offspring.
- Infant is brownish-yellow to rusty red color. Infant is handled and raised by group. The coloring is thought to stimulate maternal instinct.
- # young 1, gestation 196 days, sexual maturity 4 yrs,

Apes
Chimpanzee
Habitat: deciduous woodland to mixed savanna
- See Primate traits above
- Quadrapedal gait while knuckle-walking. Long arms with a knuckle-walking posture allows these tree climbers to use their hands for terrestrial locomotion while retaining long fingers for climbing. It may also allow small objects to be carried in the fingers while walking on all fours and maintains their sense of touch by protecting the finger pads..
- Opposable thumb is adapted for climbing, picking fruits and catching insects. The thumb allows for a power and precision grip.

- Progressive expansion and elaboration of the brain, especially of the cerebral cortex in primates and especially great apes. Chimpanzees use and make tools. They use stems or twigs to extract termites or ants from hiding places
- Mainly herbivore but have been known to eat meat. Generalist teeth for an opportunistic, omnivorous diet. Teeth less specialized.
- Chimps use body language, facial expressions; hand clapping, grooming, and kissing to communicate within their peers.
- Whenever possible they eat large meals from a single food source so they can rest an hour or two before going to the next tree to eat.
- Chimps build tree nest of vegetation each night. Adults sleep alone while infants sleep with their mother until the next baby is born.
- Grinds jaw back and forth to break down plant material.
- Spend large amount of time in trees where their food supply is.
- Grooming one another is a major occupation among chimps. Not only does this help maintain social bonds but also they get insects to eat and rid others of the insects.
- Male and Female dominance is important in social groupings.
- Use tools for hunting and probing for food.
- Females have pink swelling when in estrous.
- # young 1, gestation 230 days, sexual maturity 7 yrs.

Western lowland gorilla

Habitat: tropical secondary forest, moist cool upland slopes, some forests and lowland swamps

- See Primate traits above
- Quadrapedal gait while knuckle-walking. Largest of all living primates with very long arms (the arms are longer than the legs) , which indicate a tree-dwelling ancestry even though gorillas are now predominantly terrestrial. This form of hand-walking posture allows for hand use for terrestrial locomotion while retaining long fingers for climbing. It may also allow small objects to be carried in the fingers while walking on all fours. Knuckle-walking maintains the gorilla's sense of touch by protecting their finger pads. Most of their weight is born by the arms.
- Dark coloring provides camouflage in the forests. The silverback area breaks up their overall dark coloration, creating an optical illusion of increased length and larger size.
- Forward-facing eyes for binocular vision (depth perception). Gorillas have good eyesight, which is used for finding and identifying food and to detect movement.
- Good sense of hearing since visibility is often restricted by dense vegetation. Hearing is used to locate one another and to detect danger. Gorillas seem to respond to unusual noises that are not a part of their normal activity.
- Gorillas have a good sense of smell and are able to detect strong odors in the environment. They tend to rely more on vision than smell.
- Sexual dimorphism. Males are almost twice the size of females. They develop their silverbacks and a distinctive sagittal crest at around 12-14 years. The sagittal crest supports the large temporal muscles needed to grind coarse vegetation. Although they become sexual mature at 7 years they are not able to compete for females until they are typically have acquired their silverback. This enables the larger, more mature, knowledgeable males to reproduce, giving the group a better chance of survival.
- Displays of chest beating are signs of self-assertion, a threat display or for just letting steam off. The dominant silverback will ferociously beat its chest, produce loud scowling vocalizations and a pungent odor, throw vegetation and charge at its opponent or intruder as he is responsible for the protection and safety of the troop. Charges are mainly bluffs; providing the rest of the troop time for retreating to a safe distance. However if pressed, the silverback will follow through with his threat.
- Hands and feet have five digits with an opposable digit. Gorillas are able to grasp object with both their hands and their feet. The opposable digits allow for a power and precision grip.
- Herbivore dentition with large strong molars adapted for the coarse vegetation gorillas consume.
- The large bulging forehead protects the eyes of an adult male from environmental and defensive conditions.
- Large, sharp canines develop in adult males and are used to show power or instill fear in another.
- Get their water needs from plants.
- Adult male gorillas have large apocrine (scent) glands in their armpits that produce a pungent odor when excited or stressed. Gorillas have scent and sweat glands that lubricate the palms of their hands and soles of their feet.
- Gorillas communicate with each other using many complicated sounds, gestures and facial expressions. Communication is used to teach the young the many skills that they need to survive, and for other gorillas to communicate about food, social relationships, distress, mating, etc. Gorillas interpret staring as a threat display.
- Dominance order of females depends on acquisition order by the silverback.
- They live in small relatively stable groups of 6-7 individuals, including one silverback, a few unrelated females, and their young. The group living provides protection of young. They are nonterritorial.
- Grooming is a major occupation among gorillas in a band but Gorillas are not as tactile as other primates. Female groom their offspring, one another, and the silverback; the silverback seldom reciprocates. Grooming helps keep the hair free from dirt and parasites and also reinforces social bonds.
- A female and her nursing young construct a "nest" for the night in which they will curl up and sleep. Silverbacks makes nest at the base of the tree(s) as they are typically too large for the branches. They seek protection in the trees from predators.
- Young gorillas learn by imitating what the others in the troop are doing, and by play fighting with other young. Young gorillas practice new skills they will need for survival.
- Nose is unique to each gorilla and is a way to differentiate individuals.
- Individualized fingerprints, toeprints, and unique noses and is used for identification purposes.
- Gorillas have a distinctive shape, with their stomachs are larger than their chests. Their stomach size is attributed to their enlarged intestines, which digest the bulky fibrous vegetation they consume.
- Gorillas have fingernails and toenails rather than claws. They are used for opening, scraping, cleaning, and scratching.
- # young 1, gestation 251-195 days, sexual maturity F 6-8 yrs, M 7-10 yrs.

Australian Walkabout

- Many Australian animals have evolved differently due to a long period of isolation without much competition or predation from placental mammals.

Koala

Habitat: coastal eucalyptus forests

- Koalas are marsupials and have a pouch. Marsupials lack a true placenta and the altricial young are born in a minimally developed state after a brief gestation period. Gestation is only 25-35 days and the majority of the young's development occurs the 7 months in the pouch. The pouch allows the mother to carry young longer until they are developed and better able to cope on their own.

- Special digestive system and powerful jaws. Koalas have adapted to be able to eat tough, poisonous eucalyptus leaves while other animals cannot. Adults have an extremely long caecum (8 feet) where microbes break down cellulose and detoxify eucalyptus oils that are toxic to many other animals. With the long caecum they can maximize digestion of cellulose from the leaves and also extract water.
- Soil or gravel when they are on the ground to help aid in digestion.
- Herbivorous who eat only certain eucalyptus leaves. Strong-smelling oil in eucalyptus gives koalas a characteristic odor.
- Herbivorous dentition. Koalas have sharp incisors to clip leaves at the front of the mouth, separated from the molars by a wide gap (diastema). The molars are broad and high cusped, enabling the koala to finely grind the leaves for easier digestion.
- Large nose with sensitive hairs enables the koala to detect differences in smell between different eucalyptus leaves.
- Cheek pouches allow animal to store food not yet chewed while moving to a safer or more protected location.
- Koalas are gray to tawny above and whitish below. This countershading provides camouflage from predators that may be looking up against the sky or from above looking down.
- Koalas are nocturnal which allows them to be active in cooler temperatures. They lose less moisture and use less energy at night.
- Koalas cool themselves by licking their arms and stretching out as it rests in the trees. Koalas have no sweat glands.
- Extra thick fur, especially on the neck and shoulders, helps protect the koala from high and low temperatures and even the worst weather, as koalas do not build nests.
- Large black nose for highly developed sense of smell. Koalas will only eat certain types of eucalyptus leaves and they can determine the good leaves by smell. They have a vomeronasal organ (VMO) for the detection of pheromones. The pheromones give information about other koalas in the area and play a role in reproduction and social behavior.
- Large, hairy ears for sensing predators.
- Compact, pear-shaped body provides stability and a thickly, padded tail provides comfort allowing koalas to sit in tree all day. Their arboreal existence keeps them near their food and water source of Eucalyptus leaves.
- Specialized paws including opposable thumbs and toes allow for a tight grip when climbing trees. Hind paws: second and third digit fused and used for grooming and wide, clawless opposable toe for good grasping and climbing. Front paw: two clawed opposable digits on each paw for good grasping. They are good tree dwellers with vice like grips and powerful forelimbs.
- Rough pads on undersurface of hands and feet increase traction while the koala is climbing. Have fingerprints like humans for secure grip while climbing or grasping.
- The Koala rarely leaves the safety of trees to find water instead it receives most of its moisture from its food. “Koala” means “never drink”.
- Koala pouch opens to the rear of the mother, which aids in caecal feeding. Toward the end of pouch life, in addition to nursing the young feed on partially digested eucalyptus, which has passed through the mother’s digestive tract. This prepares the young’s own digestive tract for their adult diet.
- One pair of mammae in pouch. Litters generally consist of a single offspring though twins have been recorded.
- Males emit a series of harsh inhalations each followed by a resonant, growling expiration. These calls advertise an individual’s presence while warning other males to stay away. The only vocalization commonly heard from females and sub-adult males is a harsh wailing distress call, given usually when being harassed by adult males. By claiming their territory the koala is able to claim their territory and keep their numbers to a size their environment can handle.
- Koalas have a slow metabolic rate. Koalas spend 18-20 hours a day sleeping high in a fork of a tree nor do they move fast or far from trees. The fibrous eucalyptus leaves are hard to digest and koalas do not get a lot of energy from them. By having a slow metabolism, koalas are able to keep food in their system. Due to this inactivity there is little obvious social behavior or groupings outside the breeding season.
- Usually solitary with restricted home ranges centered on a few large trees. There is an overlapping of the sexes within this range.
- Sternal chest gland. Males stake out territories by producing a powerful scent from this gland. During a breeding period, males are very active at night constantly moving through their range ejecting male rivals and mating with receptive females. They also use urination as a way of marking their territory.
- Brain tiny for an animal its size. An adaptation for its low-energy diet of eucalyptus leaves.
- Cools itself by licking its front legs and stretching out to rest in a tree since it has no sweat glands.
- # young 1, gestation 25-35 days, pouch 7 mos, sexual maturity 4yrs.

Red Kangaroos

Habitat: dry grassy plains and stay away from the wetter grasslands.

- Red Kangaroos are the largest living marsupial. Females have a forward facing pouch.
- Marsupials with two special bones attached to their hipbones (“marsupial bones”). These bones help support the female’s pouch. Males also have the marsupial bones, although they have no pouches.
- Red Kangaroos are usually reddish brown in males and bluish gray in females, which provides a camouflage for them in the grassy plains that they require.
- Four toes on their hind feet with the inside toes joined. This is used for grooming. The extra-long middle toe has a sharp nail, which is used as a weapon during fights.
- Their foreshortened upper limbs terminate in clawed paws used with great dexterity in eating, grooming, and self-defense.
- They are robustly built, with large, well-muscled tails and powerful hindquarters. The tail is strong enough to support the kangaroo's body weight, acts as a balance when jumping, and is used, with the two legs, to form a tripod for resting. Kangaroos are able to jump 30 feet in one bound and as fast as 35 mph. The tail can be used as a prop when standing. Hind legs are much larger than their front limbs which an adaptation of jumping.
- Kangaroos can hop for a very long time without getting tired. They can store energy in their Achilles tendons in their hind legs. Like the spring in a pogo stick, these tendons release more and more energy as the kangaroo hops along. The faster it hops, the less energy it takes for the kangaroo to keep going. Kangaroos can maintain a speed of 12 mph for hours.
- Primarily nocturnal. Kangaroos are inactive during the warmest part of the day. They take shelter in the shade or in holes they have dug.
- In high temperatures they often lick their arms, chest and legs using the evaporating saliva to cool the body.
- Foregut fermentation or rumination. Larger particles are selectively filtered out and retained in the rumen to be broken down further, allowing kangaroos to extract maximal nutrition from their diet. By chewing their food twice, kangaroos avoid having to chew their food thoroughly while foraging; proper mastication can be performed while resting during the heat of the day. The multi-chambered stomach allows harsh grasses to be digested.
- Receive water from the plants that they eat, an adaptation to warmer climates.
- Herbivorous grazing animal. Have four pairs of cheek teeth on either side of the jaw with only the front one engaged. As they are worn down to the roots, they fall out and the rear teeth migrate forward to take their place. Once all four are worn down, the animal will eventually die of starvation.

- Red kangaroos travel in “mobs” (up to 10 individuals) for protection. Occasionally, large numbers of red kangaroos congregate in areas of excellent forage, sometimes numbering as much as 1,500 individuals.
- They also have excellent vision and hearing, suggesting these are important sensory modes.
- Male red kangaroos compete for mating opportunities with several females. Males will try to monopolize access to several females and will actively drive away other males or compete in "boxing" matches, where males hit at each other with their forepaws and kick with their feet.
- Marsupials lack a true placenta and the young are born in a minimally developed state after a brief gestation period. (30-42 days) At birth only the large clawed forelimbs, tactile sense, olfactory sense, and static sense (anti-gravity reflex that allows them to know which way is up) are well developed. The newborns climb into their mother’s pouch and attach themselves to a teat, which swells to lock in place and milk is pumped in. the joey will continue to nurse from the same nipple once out side the pouch and another embryo has entered the pouch.
- The corcoid bone in the shoulder of newborn marsupials is a primitive reptilian feature not found in placentals. This bone provides additional strength to the newborn for the climb to their mother’s teat. After birth the metacoracoid breaks apart and becomes the corcoid process of the shoulder blade, so the shoulder of an adult marsupial looks like that of a placental.
- Females have forward opening pouch and 4 Mammae. Milk in mammary glands can be a different composition than the others. This allows the mother to feed joeys in different stages of development.
- Embryonic diapause. The female is able to suspend the development of an embryo until climatic conditions improve or until an earlier joey has left the pouch. Under good breeding conditions, nearly all females have one running offspring and one attached to a teat in the pouch.
- # young 1, gestation ~33 days, pouch 235 days, sexual maturity F 15-20 mos, M 20-24 mos.

Common Wallaroo

Habitat: coastal mountains and rocky inland ranges, preferring grass covered stony ridges

- Marsupials with two special bones attached to their hipbones (“marsupial bones”). These bones help support the female’s pouch. Males also have the marsupial bones, although they have no pouches.
- Wallaroos are stocky and robust with have powerfully muscled hindquarters and long tapered tail that acts as a balance and rudder when leaping and third leg when sitting. They may reach speeds of 30 mph when pressed in open country.
- Herbivorous grazing animal. Have four pairs of cheek teeth on either side of the jaw with only the front one engaged. As they are worn down to the roots, they fall out and the rear teeth migrate forward to take their place. Once all four are worn down, the animal will eventually die of starvation.
- Foregut fermentation or rumination. Larger particles are selectively filtered out and retained in the rumen to be broken down further, allowing kangaroos to extract maximal nutrition from their diet. By chewing their food twice, kangaroos avoid having to chew their food thoroughly while foraging; proper mastication can be performed while resting during the heat of the day. The multi-chambered stomach allows harsh grasses to be digested.
- Drink little water and get most water from their food. Can dig 3 feet for water when it is needed.
- In high temperatures they often lick their arms, chest and legs using the evaporating saliva to cool the body.
- Herbivorous grazing animal. Have four pairs of cheek teeth on either side of the jaw with only the front one engaged. As they are worn down to the roots, they fall out and the rear teeth migrate forward to take their place. Once all four are worn down, the animal will eventually die of starvation.
- They are crepuscular, seeking shade in the hottest part of the day usually in rocky outcrops with caves or overhangs.
- Four toes on their hind feet with the inside toes joined. This is used for grooming. The extra-long middle toe has a sharp nail, which is used as a weapon during fights.
- One of the most unusual characteristics of Wallaroos is that their behavior is very well adapted for survival in arid environments. Temperatures in the desert may reach as high as 120 F, yet they are able to survive. They have several ways in which they regulate their body temperature. When heat is excessive, they pant to induce evaporative cooling. They also excavate holes near or under rocks and stunted trees. In the hole, they lie in an upright position. They rarely forage more than 200 m from a rock shelter. To minimize water loss, they venture from their shelters and forage in the evening.
- They lead sedentary and solitary lives though little is known of territorial or social behavior. The Wallaroo prefers to remain in a restricted home range even when food and water become scarce.
- Males are much larger than the females. The largest most dominant male is able to monopolize females in heat. Breeding may occur throughout the year but reproduction is reduced in times of drought and may cease if drought is prolonged.
- Marsupials lack a true placenta and the young are born in a minimally developed state after a brief gestation period. (30-42 days) At birth only the large clawed forelimbs, tactile sense, olfactory sense, and static sense (anti-gravity reflex that allows them to know which way is up) are well developed. The newborns climb into their mother’s pouch and attach themselves to a teat, which swells to lock in place and milk is pumped in. the joey will continue to nurse from the same nipple once out side the pouch and another embryo has entered the pouch.
- The corcoid bone in the shoulder of newborn marsupials is a primitive reptilian feature not found in placental mammals. This bone provides additional strength to the newborn for the climb to their mother’s teat. After birth the metacoracoid breaks apart and becomes the corcoid process of the shoulder blade, so the shoulder of an adult marsupial looks like that of a placental.
- Females have forward opening pouch and 4 Mammae. Milk in mammary glands can be a different composition than the others. This allows the mother to feed joeys in different stages of development.
- Embryonic diapause. The female is able to suspend the development of an embryo until climatic conditions improve or until an earlier joey has left the pouch. Under good breeding conditions, nearly all females have one running offspring and one attached to a teat in the pouch.
- # young 1, gestation 32 days, pouch 235 days, sexual maturity

Emu

Habitat: Semi-arid, grass covered plains and woodlands

- World’s second largest flightless bird with long strong legs for running. Can cover great distances with minimum effort. Can run at speeds between 30 - 40 mph and run with a bouncy swaying motion. Only birds with gastrocnemius muscles in the back of the lower legs.
- Ratite bird with no keel on their sternum. Without the keel to anchor their wing muscles, emus could not fly even if they were to develop suitable wings. The rudimentary wings are long wire-like quills which have spurs on end that can be used to fight enemies. Also the emu can strike heavy blows against an enemy with its strong legs, easily breaking bones or tearing muscle.
- Plumage is coarse, loose and drooping. Feathers lack the tiny hooks (barbs) that lock together the smooth external feathers of flying birds, and so are soft and fluffy and serve as insulation. Each feather has a double rachis emerging from a single shaft. The

afterfeathers are as large as the main feathers. These contour feathers help to form a thick protective coat that used for protection in the dense brush of the Australian scrublands.

- Feathers specialized to aid in cooling. The shafts and the tips of the feathers are black. The dark tips absorb the sun's radiation, and the loose-packed inner plumage insulates the skin. The resultant heat is prevented from flowing to the skin by the insulation provided by the coat, allowing the bird to be active during the heat of the day.
- Pant to maintain their body temperature. Emu lungs work as evaporative coolers and, are not effected by low levels of carbon dioxide in the blood. For normal breathing in cooler weather, they have large, multifolded nasal passages. Cool air warms as it passes through into the lungs, extracting heat from the nasal region. On exhalation, the emu's cold nasal turbinates condense moisture back out of the air and absorb it for reuse.
- Coloring blends in with their environment, helping camouflage the emu while they hunt for food. The skin of the head and neck is blue and shows through its sparse feathers. The coloring becomes darker or lighter depending on its mood.
- Emu has airfilled leg bones and their feet have three toes that bear strong claws.
- Excellent eyesight with large eyes combined with long neck and long legs giving the emus an advantage for spotting potential predators from a long way off.
- Soft, broad, flat bill for diverse grazing on seeds, fruits, grass and insects. Emus require pebbles and stones to assist the gizzard in digesting of the plant material. Emus serve as an important agent for the dispersal of large viable seeds, which contributes to floral biodiversity.
- Emus will sit in water and are also able to swim when necessary.
- Emus have a deep, booming call that seems to be amplified in a tracheal chamber connected to the windpipe. Males have a guttural call while the female's is more booming. The booming sound is created in an inflatable neck sac.
- Emus are nomadic and travel predominately in pairs. They can form enormous flocks, but this is an atypical social behavior that arises from the common need to move towards food sources. Emus have a rich diet enabling it to grow fast and reproduce rapidly, but such rich foods is not always available thus emus must move to remain in contact with their food. When food is abundant the emu lays down large stores of fat; it is able to use these stores while looking for more food. Emus are only forced to stay in one place when the male is sitting on eggs.
- Both male and female defend their territory during breeding.
- The male has a retractable sex organ.
- Male incubates eggs. He uses his wings to shade nest. Female may either remain and defend her mate or go off and produce more eggs with other males. During incubation the male does not eat, drink or defecate so he is independent of the state of the local food supply. He can loose up to 1/3 his body weight. The eggs, five inches in length, dark green and granulated are laid in a scrape in the ground, usually near a shrub. It is covered with grass, leaves and sticks.
- Male raises chicks. Males become aggressive when the chicks hatch and remains with them for approximately five to seven months.
- Precocial young. Chicks are active and can leave the nest within a few days.
- # eggs up to 20, incubation 52-60 days.

Southern Cassowary

Habitat: Rain forests and savanna woodland from lowlands to 9,842'

- The helmet like casque may be used as a shovel to search for food in the leaf litter of the forest floor and may be an indication of dominance and age. The casque may protect its head in the dense vegetation as it is running. It continues to grow slowly throughout the bird's life and may be an indicator of social status and dominance. Male casques are generally larger than females.
- Course plumage and scaly legs help protect the body from sharp vegetation, thorns and leaves as it moves around the dense forest floor.
- Primarily frugivorous diet, which they eat whole and are thus are important seed dispersers.
- Flightless bird with long, strong leg muscles for running and jumping. Can run 30mph through thick underbrush and jump ~ 5 ft.
- Cassowary has three toes with a stout claw while the middle toe has a long dagger-like claw for defense. A cassowary will run and leap with its feet first to attack with inner claw.
- Cassowary has brightly colored wattles, which may change with the bird's mood. The coloration occurs at about three years of age.
- Generally solitary and shy except during breeding season when it becomes territorial. It can become quite aggressive during breeding, especially when accompanied by chicks, and also when cornered. Will give a low frequency noise, which is good in dense bush.
- Most active occurs during early morning and late afternoon as well as moonlit nights. This allows it to be inactive during the hottest part of the day.
- Breed during the dry season (June - October) when fruit is most plentiful. Ensures the young will have enough food to survive.
- Males make the nest, a shallow depression in the ground lined with grass and leaves well camouflaged in the rain forest. Like emus and rheas the male remains in charge of the eggs and chicks. Female lays eggs and leaves.
- The chicks are precocial, able to walk and feed themselves within a few hours after hatching.
- After leaving the parent chicks probably remain together for some time.
- The remiges or flight feathers are reduced to long corneous (horn-like) spines, which they can you for defense and protect them against underbrush as they move through the forest.
- Excellent swimmer and divers.
- Cassowaries produce a variety of different sounds, ranging from booming low frequency territorial calls to the coughing contact call used by an adult male to maintain contact with chicks.
- # eggs 3-5, incubation 49-56 days.

Tropical Rainforest

- More than 60% variety of life on earth found 1.4% land. Extreme biodiversity of rain forests.
- Top soil only few inches thick. Very poor nutrients. Nutrients in plants not soil.
- <2% of sunlight reaches forest floor
- ~17% estimated of plants and animals identified in the rainforest.
- Emergent layer: eagles, monkeys, butterflies, insect eating bats and snakes.
- Canopy: bromeliad plants, vines, fruits, colorful flowering plants; toco tucan, red eyed tree frog, sloth, monkeys, snakes, birds, tree frogs, bats, butterflies, insects.
- Understory: jaguar, leopard, most insects, horned guan.
- Forest floor: capybera, invertebrates, leaf cutter ant, frogs, snakes.

Anaconda

Habitat: swamps, marshes, and slow-moving streams, mainly in the tropical rain forests of the Amazon and Orinoco basins.

- The green anaconda can grow up to 36 feet long and can weigh up to 550 pounds and measure more than 12" in diameter. Can eat larger prey such as a capybara. Generally shorter but wider than reticulated python but outweighs it by 2xs.
- Eyes and nostrils are located on the top of the snout so the snake can stay submerged while hunting.
- The black patches on its back combine with dull background color to blend in with the thick, wet vegetation of its habitat.
- Constrictor. Is not venomous. It lies in a murky pool to ambush prey coming to the water to drink. It can stay submerged for 10 minutes at a time and often lies beneath the surface waiting for prey. It seizes its prey quickly with its sharp teeth and drags it into the water. It is extremely muscular and squeezes tighter each time the animal breathes out so it cannot breath again. The prey dies quickly from suffocation and is swallowed whole. On land it will usually hang from a tree and grab the prey from above.
- Excellent swimmer. This heavy snake is more at home in the water than on land, and it swims with grace and agility. The anaconda is capable of surprising speeds both under water and on its surface.
- Quadrate bone. The snake can stretch its mouth around prey twice the width of its head because its jawbones are loosely attached to its skull and to each other. Do not unhinge jaw. Anacondas will eat capybara, deer, fish, turtles, caiman, and dogs.
- Slow acting digestion. After a large meal, the anaconda sleeps for several days as it digests and may not feed again for weeks or up to 2 years. May eat up to 90% of its weight.
- Anacondas have scales to protect their bodies from the variety of terrain they encounter. Its habitat is largely made up of water.
- Large, narrow head is not distinct from the neck.
- Nocturnal.
- Females are thought to emit pheromones to attract males. Often up to 12 males will cluster into a "breeding ball" by twining around the much larger female.
- Viviparous. Unlike most snakes, anacondas give birth to live young that are precocial and are able to hunt, feed and swim at birth. The young snakes are about two feet long.
- Anacondas grow throughout life. 500 fold increase in mass from hatchling to adult. Shed their skin in response to growth and to ensure a continual protection from the environment
- The only area on the anaconda's body without scales is the cloaca. Glands in this area emit a foul smelling musk, which is poisonous for small organisms and may prevent ticks and leeches from attaching themselves to the cloaca.
- A thin transparent scale (brille) protects the anaconda's eyes. The brille helps the anaconda see while submerged and from brush on land. The brille is shed with the skin.
- Sharp teeth. The anaconda uses these teeth to hold an animal in an inescapable grip.
- Keen sense of smell. The anaconda's eyesight and hearing are very poor but the snake is sensitive to vibrations, and sense animals moving towards them. It uses its tongue by flicking it to test the environment and search for prey.
- The scale patterns on the underside of the lower tail are unique to each snake and may be used for identification.
- # young 20-40, gestation 6 mos, sexual maturity 3-4 years.

Red-and-green Macaw or **Green-winged Macaw**
Habitat: tropical forests, mangrove swamps, savannas

- Second largest of the Macaws (hyacinth macaw is largest).
- Strongly down curved beaks that are light weight in proportionate to large size. The beak is used as a hand to aid in climbing trees and perching.
- Extremely powerful beak, which can generate a pressure of 2000 psi and can snap a broomstick in half and is perfectly adapted for crushing or opening even the hardest nuts or seeds.
- Macaws feed on seeds, fruits, nuts, berries, leaves, salts and minerals of riverbanks. In order to avoid competition with other forest herbivores, macaws eat under-ripe fruits and plants that are chemically defended and generally unpalatable or even toxic to other animals. Macaws often flock to mountains of clay known as "macaw licks". Macaws are able to eat some poisonous fruits, as the clay appears to neutralize the toxins. Such licks contain minerals and salts essential to the bird's diet.
- The upper mandible is articulated by having a movable joint on the cranium.
- Monogamous pairs. The Red-and-green Macaw generally mates for life and stay in their pairs. They often appear very devoted to their mate and preen each other (allopreening). This strong bond appears to be essential in rearing young successfully.
- Zygodactyl feet. Members of this family are the only birds to use their claws for feeding.
- The body is compact with strong wings. Macaws are able to reach speeds of up to 35 miles per hour.
- They also have excellent eyesight and a keen sense of hearing.
- Preening helps keep feathers clean and free of parasites but also reinforces familial bonds.
- Macaws are gregarious and loud, designed to carry many miles to call for their groups and make their presence known in dense rain forests.
- Mating pairs often nest in unlined hollows of trees or palms. Both the male and female share the responsibility of raising the altricial young and feed hatchlings by regurgitation. Offspring stay with parents until they are three despite being fully grown at six months.
- Seed Dispersers. Macaws are very messy eaters. In the course of daily feeding, macaws allow plenty of seeds (while eating, as well as in their droppings) to fall to the forest floor, thus regenerating much of the forest growth.
- # eggs 2-3, incubation 5 wks, fledging 100 days.

Scarlet Ibis
Habitat: coastal swamps, mangroves, lagoons, tidewater rivers

- Non-visual, tactile forager decurved bill for foraging in muddy habitat. The Ibis sweeps its long bill back and forth across the bottom to pick out suitable food items.
- Sensitive feelers on the inside of their bill help the bird identify food before it even sees it.
- Nostrils are at the base of the bill, so the ibis can breath while sticking its bill in the water or mud.
- Long neck with long legs for wading in the water for food.
- Colonial; a gregarious bird who lives & breeds in large flocks. Large flocks provide protection, as there is safety in numbers.
- Ibis fly with neck and legs outstretched, often in long, loose lines or 'V' formations, which improve the birds' aerodynamic efficiency. These lines fly in an undulating pattern as they alternately flap and glide.
- Perching feet that are only slightly webbed. The long legs and toes help make the ibis just as comfortable walking as flying or perching in trees.
- # eggs 1-3, incubation 21 – 23 days, fledging 35 - 42 days.

White Ibis
Habitat: shallow coastal marshes, wetlands and mangrove swamps

- Non-visual, tactile forager decurved bill for foraging in muddy habitat. The Ibis sweeps its long bill back and forth across the bottom to

pick out suitable food items. Then, it cleans its prey in the water before to swallow it.
- Sensitive feelers on the inside of their bill help the bird identify food before it even sees it.
- Nostrils are at the base of the bill, so the ibis can breath while sticking its bill in the water or mud.
- Long neck with long legs for wading in the water for food.
- Colonial; a gregarious bird who lives & breeds in large flocks. Large flocks provide protection, as there is safety in numbers.
- Ibis fly with neck and legs outstretched, often in long, loose lines or 'V' formations, which improve the birds' aerodynamic efficiency. These lines fly in an undulating pattern as they alternately flap and glide.
- Perching feet that are only slightly webbed. The long legs and toes help make the ibis just as comfortable walking as flying or perching in trees.
- # eggs 1-3, incubation 22 – 24 days, fledging 35 - 42 days.

Roseate Spoonbill
Habitat: marshes, swamps, ponds, and rivers, feeding in both fresh and saltwater wetlands
- Long neck with long legs for wading in the water for food.
- Roseate spoonbills hunt by touch instead of sight, an adaptation for a bird that feeds in muddy or vegetation-clogged waters.
- Large spoon-shaped bill for efficient feeding. Sensitive touch receptors along the bill's length detect vibrations and signal the partially opened bill to close quickly when the prey is swept inside the spoon.
- The bill is swept in rapid arcs from side to side to create swirling currents like mini-whirlpools that pull up small prey from the muddy bottom.
- Papillae help move food back to the throat.
- Nostrils are located at top of the bill, making it possible for the bird to breathe while the bill is under water.
- Colonial nester. Safety in numbers.
- # eggs 2-5, incubation 22 – 24 days, fledging 6 weeks.

Poison Dart Frog or **Poison Arrow Frog**
(@ zoo: blue poison dart frog, yellow-banded poison dart frog, dyeing poison dart frog and golfodulcean poison dart frog)
Habitat: forest floor of tropical rainforest. Occasionally climbing a few feet into vines or trees.
- 40 species of *Dendrobates* poison dart frogs. All have bright coloration, an adaptation for diurnal foraging, in which predators can easily recognize and avoid their toxic skin secretions. Camouflage is their main defense mechanism. An amphibian's poison defense is usually a last resort and will only work if a predator tries to eat it.
- Four methods of breathing in a frog: gills in tadpole stage, lungs, skin, buccopharyngeal (Gas exchange also occurs across the moist surfaces of the mouth and pharynx – throat pulsation increases with temperature).
- Smooth skin that serves as a respiratory membrane, protects against abrasions and parasites, absorbs and releases water, has poisons that protect against predators and acts as camouflage to warn away predators.
- Metamorphosis. The life cycle of many amphibians requires them to see underwater and on land. Amphibians focus their eyes by a change of position of the lens, rather than by a change in the shape of the lens in reptiles, birds, and mammals.
- Good sense of hearing with well developed ears. Frogs are vocal and use their voices to attract mates and to defend their territory.
- All amphibians will gorge themselves if food is plentiful, to enable them to survive when food is scarce. Will often sit and wait for prey; a "see-it-and seize-it" strategy. Sticky tongues enable them to quickly pick up prey.
- Cold blooded. Frog doesn't have to each as much and the landmass can accommodate more frogs.
- Naked, not watertight skin. Amphibians are a key to health of an environment. Water quality issues are indicated by a decrease in amphibians.
- Play an important role in food webs as both predator and prey, maintaining the delicate balance of nature.
- Frogs have teeth on upper jaw only.
- Jacobson organ for chemoreception of pheromones. Used for finding mates and defining territories.
- Embryonic (fertilized) egg lacks protective membranes of higher vertebrates and must be placed in a moist environment.
- Males are territorial, calling to advertise to females and to defend their area. Calls are species dependent and can be anything from a buzz to trilling whistles. Females are slightly less territorial, and do not call, but will wrestle with other females over their space.
- Terrestrial. Have sticky suction cup pads on toes for climbing and clinging to leaves and branches. Front feet lack webbing.
- Breed in the trees. Eggs are laid in holes in tree limbs or in plants such as bryophytes or bromeliads that collect enough moisture to pool in the bottom to hold the tadpoles when they hatch.
- The female facilitates courtship. She will locate a male and tap on its back with her hindfeet to signal readiness for mating.
- Tadpoles turn into tiny froglets up in the canopy. The frogs exhibit some maternal care by returning to the tadpoles and laying unfertilized eggs for them to feed on. In some other species, the male guards the eggs, and will transport the tadpoles on his back to small pools.
- Yellow-banded poison dart frogs have been observed giving parental care. They will keep the eggs, which are attached to leaves, moist until they are ready to hatch. Upon hatching the male will transport the tadpoles to live out their larval stage in cups of water found in bromeliad plants.
- Cannibalistic. Females are predatory on each other's eggs.
- Sticky tongues to quickly pick up insectivorous prey. Poison dart frogs eat small invertebrates, particularly ants, which give them their poisonous properties in most cases.
- Elongated hind legs. On land poison dart frogs move rapidly and leap with their powerful hind limbs and land on their forelimbs.
- Large rounded eyes positioned high on head and short snout. Have good sense of sight and smell.
- The skin of a poison arrow frog stays sticky from mucus. This feature helps to hold in moisture and it helps tadpoles hold on tight when they are being carried from hatching site to nursery site.
- External fertilization. Poison dart frogs fertilize their eggs externally; the female lays a clutch of eggs and a male fertilizes them afterward.

Golfodulcean Poison Frog
Habitat: wet lowland forests, found primarily in leaf litter and vegetation near the ground.
- Four methods of breathing in a frog: gills in tadpole stage, lungs, skin, buccopharyngeal (Gas exchange also occurs across the moist surfaces of the mouth and pharynx – throat pulsation increases with temperature).
- Smooth skin that serves as a respiratory membrane, protects against abrasions and parasites, absorbs and releases water, has poisons that protect against predators and acts as camouflage to warn away predators.
- Metamorphosis. The life cycle of many amphibians requires them to see underwater and on land. Amphibians focus their eyes by a change of position of the lens, rather than by a change in the shape of the lens in reptiles, birds, and mammals.

- Good sense of hearing with well developed ears. Frogs are vocal and use their voices to attract mates and to defend their territory.
- All amphibians will gorge themselves if food is plentiful, to enable them to survive when food is scarce. Will often sit and wait for prey; a "see-it-and seize-it" strategy. Sticky tongues enable them to quickly pick up prey.
- Cold blooded. Frog doesn't have to each as much and the landmass can accommodate more frogs.
- Naked, not watertight skin. Amphibians are a key to health of an environment. Water quality issues are indicated by a decrease in amphibians.
- Play an important role in food webs as both predator and prey, maintaining the delicate balance of nature.
- Frogs have teeth on upper jaw only.
- Jacobson organ for chemoreception of pheromones. Used for finding mates and defining territories.
- Embryonic (fertilized) egg lacks protective membranes of higher vertebrates and must be placed in a moist environment.
- Endemic to Costa Rica.
- Diurnal. Prefer to stay close to the ground
- Poisonous. Toxins can incapacitate predators who try to eat them.

Waxy Monkey Frog
Habitat: drier neoptropical forests, shrublands, and savannas

- Four methods of breathing in a frog: gills in tadpole stage, lungs, skin, buccopharyngeal (Gas exchange also occurs across the moist surfaces of the mouth and pharynx – throat pulsation increases with temperature).
- Smooth skin that serves as a respiratory membrane, protects against abrasions and parasites, absorbs and releases water, has poisons that protect against predators and acts as camouflage to warn away predators.
- Metamorphosis. The life cycle of many amphibians requires them to see underwater and on land. Amphibians focus their eyes by a change of position of the lens, rather than by a change in the shape of the lens in reptiles, birds, and mammals.
- Good sense of hearing with well developed ears. Frogs are vocal and use their voices to attract mates and to defend their territory.
- Large rounded eyes positioned high on head and short snout. Have good sense of sight and smell.
- All amphibians will gorge themselves if food is plentiful, to enable them to survive when food is scarce. Will often sit and wait for prey; a "see-it-and seize-it" strategy. Sticky tongues enable them to quickly pick up prey of invertebrates.
- Cold blooded. Frog doesn't have to each as much and the landmass can accommodate more frogs.
- Naked, not watertight skin. Amphibians are a key to health of an environment. Water quality issues are indicated by a decrease in amphibians.
- Play an important role in food webs as both predator and prey, maintaining the delicate balance of nature.
- Frogs have teeth on upper jaw only.
- Jacobson organ for chemoreception of pheromones. Used for finding mates and defining territories.
- Embryonic (fertilized) egg lacks protective membranes of higher vertebrates and must be placed in a moist environment.
- Nocturnal. Climb to an exposed perch and draw in their arms and legs and sleep in the sun. Hunt when air temperature and the rate of water loss are lower.
- Insectivorous diet.
- Secrete a waxy coating to prevent their skin from drying out in dry climates. Waxy monkey frogs seal in their moisture by giving their bodies a rubdown with a waxy substance secreted through skin glands.
- Long limbed, hence the name "monkey". Waxy monkey frogs climb from branch to branch instead of leaping or hopping.
- Opposable thumbs for climbing and grasping branches.
- Breeds in the trees. Females lay eggs on leaf surfaces above pools of water. The eggs are laid down the middle of a leaf and then the leaf is folded, sandwiching the eggs inside. When ready to hatch, the gelatinous egg masses liquefy and the tadpoles fall into the water below.

Mountain yellow-legged Frog
Habitat: mountain creeks and lakes, particularly sunny riverbanks, meadow streams, isolated pools, and lake borders. They are generally found near steep gradient streams of a chaparral belt or other water sources around ≈1200–7550 feet in Sierra Nevada Mts.

- Four methods of breathing in a frog: gills in tadpole stage, lungs, skin, buccopharyngeal (Gas exchange also occurs across the moist surfaces of the mouth and pharynx – throat pulsation increases with temperature).
- Smooth skin that serves as a respiratory membrane, protects against abrasions and parasites, absorbs and releases water, has poisons that protect against predators and acts as camouflage to warn away predators.
- Metamorphosis. The life cycle of many amphibians requires them to see underwater and on land. Amphibians focus their eyes by a change of position of the lens, rather than by a change in the shape of the lens in reptiles, birds, and mammals.
- Good sense of hearing with well developed ears. Frogs are vocal and use their voices to attract mates and to defend their territory.
- All amphibians will gorge themselves if food is plentiful, to enable them to survive when food is scarce. Will often sit and wait for prey; a "see-it-and seize-it" strategy. Sticky tongues enable them to quickly pick up prey.
- Cold blooded. Frog doesn't have to each as much and the landmass can accommodate more frogs.
- Naked, not watertight skin. Amphibians are a key to health of an environment. Water quality issues are indicated by a decrease in amphibians.
- Play an important role in food webs as both predator and prey, maintaining the delicate balance of nature.
- Frogs have teeth on upper jaw only.
- Jacobson organ for chemoreception of pheromones. Used for finding mates and defining territories.
- Embryonic (fertilized) egg lacks protective membranes of higher vertebrates and must be placed in a moist environment.
- Chiefly diurnal.
- Tadpoles are among the largest of any frog. Larger body size important helps them survive the colder temperatures.
- Unlike most frogs/toads, mountain yellow-legged frog tadpoles usually overwinter 2-3 times before metamorphosing into young frogs. Because of the high elevations and cold water temperatures, the tadpoles grown slowly and are not ready to metamorphose into young frogs by the end of the first summer. Spend the winter under ice. They may take 4 years to develop to adulthood.
- Lay eggs in shallow water.
- External fertilization.
- # eggs 40-300 laid in a compact cluster with the embryo being encased in a thick protective jelly coat and are often attached to submerged vegetation, undercut banks, or near-shore rocks.
- Smells like garlic when handled.
- Cold blooded. Throughout the summer, tadpoles of all ages congregate in the warm shallows near shore where they feed on algae. They bask at the water's edge, often aggregating in dense clumps that allow frogs to maximize heat intake while minimizing water loss.

- Sexual dimorphism. Male frogs of this species develop nuptial pads on their thumb base during the breeding season. The nuptial pads aid with grip, used primarily by males to grasp (or clasp) females during amplexus.
- Webbed toes for their aquatic environment.
- Color pattern provides excellent camouflage against a wide variety of backgrounds
- Lack the vocal sacs that many frogs and toads use to produce calls, but are able to produce a relatively loud distinctive call. During the spring breeding season, male mountain yellow-legged frogs attract females with these calls, which are rarely heard because it is made underwater.
- External fertilization. Amplexus.
- Occupy different levels of the food web during the stages of metamorphosis. Mountain yellow-legged frogs start life as tadpoles that feed on algae. When a tadpole metamorphoses into a frog, it switches from being an herbivore to being a predator. Juvenile and adult mountain yellow-legged frogs feed primarily on the terrestrial stages of herbivorous aquatic insects. However, mountain yellow-legged frogs themselves are also important prey for terrestrial predators, including garter snakes, birds, coyotes, and bears. The loss of these frogs will have multiple impacts on the aquatic ecosystem.

Puente al Sur

Giant Anteater

Habitat: swamps, grasslands and humid forests

- Giant anteaters have no teeth. They do not chew their food but instead they grind and crush insects against the horny growths on the roof of the mouth and sides of the cheek.
- Good sense of hearing and of smell used to forage for food and detect predators. Poor eyesight and small eyes so rely on sense of smell.
- Giant anteater gets its water by licking wet plants.
- These anteaters have thick coarse fur that is longer towards the tail. Tail is bushy and nearly as long as the body. Used to warm and protect themselves against the elements. Anteaters tend to always sleep with their tail in the same direction, wrapped around them to keep them warm. The hair on the tail is parted to one side.
- Hind feet have 5 short claws, and the forefeet have 5 claws with the inner 3 being very long and sharp. These powerfull fromt limbs are use to rip open a termite mound and insect nests with a single blow of its paw. Strength is necessary because termite nests are extremely hard having been made of soil and termite saliva and then baked in the son. The anteater's front limbs also provide some defense against its natural predators, the puma and the jaguar. The giant anteater will stand on its hind legs when threatened using its tail as balance.
- Knuckle walks. When walking, the giant anteater protects these front claws by walking on its knuckles, giving it a shuffling gait.
- Very long tongue with spine-like protrusions and a sticky saliva, from enlarged salivary glands, allows the anteater to pick up the small insects it eats. The tongue can be extended 150 times a minute to obtain prey. The tongue is attached to its sternum allowing for the quickness. Long tongue enables them to probe deep inside ant or termite colonies. Sticky saliva helps to trap insects.
- Insectivore. Anteaters stay eating at an ant colony for about a minute, opening it with their powerful claws without demolishing it and then it will move on to another prey colonies within its home range. In this way the anteater avoids overexploitation of its food supply.
- Giant anteaters are usually solitary, except for mother-young pairs, or only coming together for brief periods for courtship.
- Sleeping occurs in abandoned burrows, dense vegetation, or depressions in the ground. Although they have the ability to dig well, they do not construct burrows.
- When fights do occur, individuals will rear up into a bipedal stance using the tail as balance and forelimbs to fight. Anteaters can move around on the hind legs with great agility then strike with the forefeet in any direction.
- A mother will carry the baby on her back until it is almost half her size, at about 6 to 9 months. (usually ~ 1 year) for protection. The baby is camouflaged by aligning with the mother's stripes. Mammary glands are near the armpit, which allows for easy access by the young from its mother's back. Female gives birth standing up and immediately the young anteater climbs onto her back. Young are born with a full coat of hair and adult-like markings.
- Anteaters are excellent swimmers, but usually stay on dry ground and can are amazingly quick.
- The stomach has strong, muscular walls and a horny stomach lining further crushes insect food. Sand and small stones have been found in the stomach, and apparently help digestion.
- # young 1, gestation 190 days, sexual maturity 2-3 yrs.

Guanaco

Habitat: Arid and semi-arid mountainous regions of the Andes including elevations up to 14,500'

- Thick, wooly coat that can be light brown, brownish yellow, or a rusty red. Coloring and thick wool is good thermal protection in cold and warm conditions.
- Thicker skin on its neck for protection.
- Large eyes with thick lashes for good vision and protection against dusty conditions.
- Two pads on each foot to help with footing on rocky trails or gravel slopes.
- Ruminants with 3-chambered stomach. They are able to get more nutrition from food.
- Don't need to drink water. They get the water from the food they eat. Guanacos are able to conserve water.
- Hemoglobin has a greater affinity for oxygen and there is a greater number of red blood cells allowing them to live in high altitudes with lower oxygen available.
- Long legs and fast runners are able to reach 40 mph and out run predators.
- Strong swimmers
- Live in herds of females with a dominant male. Male mates with several females. Rest of males form bachelor groups of up to 50 males.
- Their upper lip is split in two and can be used like fingers to help draw in food.
- Precocial young or chulengos; chulengos able to run soon after birth.
- Male chulengos are chased off from a herd at about one year. This prevents inbreeding.
- # young 1, gestation 11 mos, sexual maturity F 2 yrs, M 2-4 yrs., one breeding season/year

Rhea

Habitat: grassy plains (pampas) and sparse woodlands

- Have a non-keeled sternum; rheas are ratites and the largest bird in the Americas.
- They have long powerful legs and can use their feet to kick at a potential predator but prefer to outrun them.
- Large wings are useless for flight, they are used for balance and for changing direction as the bird runs. Rheas reach speeds of 37 mph and spread their wings out to act as sails and their long neck is almost horizontal to the ground. Three-toed feet.

- Strong claw on each wing, which can be used as an effective weapon.
- Good swimmers.
- Excellent eyesight and good hearing allowing them to detect predators from far away.
- Males are solitary in the spring breeding season, but in winter, are social and flock together in groups of 10 to 100 birds. Rheas frequently congregate with deer or guanacos, and form mixed herds. During breeding season these flocks break up with the females separating off into small groups while the males become territorial.
- Polygamous. Males have many different mates and do not form lasting pairs; tries to attract a harem of 2 to 12 females to mate with. Females will mate with several males leaving her eggs in their nests.
- Male incubates the eggs and cares for chicks. The male will utilize a decoy system and place some eggs outside the nest and sacrifice these to predators.
- They will eat pebbles to help with their digestion.
- Precocial young. The first chick hatches and starts calling, this stimulates the other eggs to all hatch within 24 - 28 hours.
- # eggs nest have 13 – 30 eggs (individual bird 5-10), incubation 6 wks, fledging n/a.

White-Faced Whistling Ducks
Habitat: tropical lowlands, wetlands, with preference for fresh water in open country.

- Webbed feet help to propel the whistling duck through the water faster and with ease to catch prey or escape a predator. The webbed feet can help the whistling duck save energy so it can swim farther.
- Hind toe is longer than most ducks with long legs allow them to perch high in trees at night.
- Even though they spend a good amount of time on the ground and in the water, some whistling ducks prefer to roost or nest in the trees.
- Stand more erect than other birds.
- Waterproof plumage for staying warm in a wet environment.
- Mutual preening.
- Males and females incubate and raise chicks.
- Whistling ducks feeds mainly at night, diving underwater to find most of its food.
- A light skeleton and wings allow the bird to fly in search of food and to escape predation.
- Stand more erect than other ducks.
- Whistle back and forth to keep contact with flock.
- Nonmigratory.
- Bill is high and narrow with large hooked tip for feeding on grasses, seeds, insects and some fruit. They forage for food mostly at night.
- Have three-note whistling contact call (which they use to find other members of their flock).
- # eggs 8-12, incubation 26-28 days, fledging 8 weeks.

Black-necked Swan
Habitat: swans inhabit swamps, lagoons and marshes

- Swans have 25 vertebrae in the neck, while humans have only seven; this allows for much greater neck flexibility. A swan's particularly long neck allows it to exploit a series of depths much greater than those normally reached by smaller ducks; this makes it possible for swans to access food left untouched by other waterfowl. Have an "upending" foraging posture.
- Webbed feet help to propel the swan through the water faster and with ease to catch prey or escape a predator. The webbed feet can help the swan save energy so it can swim farther.
- Short legs are positioned far back on its body, which is an excellent adaptation for swimming, making the black-necked swan the most aquatic and best swimmer of the swans. This leg positioning also makes it the most awkward on land and take offs and landings difficult.
- Swans have long and thick, strong bills for feeding on plants. The edges are jagged, which aids in the consumption of aquatic plants, allowing it to filter feed nutrients from the water.
- Waterproof plumage for staying warm in a wet environment.
- Long neck they do not have to dive for food.
- The cygnets have been known to ride on their parent's back.
- The swans spend the majority of their time in large bodies of water because the placement of their legs makes traveling on land difficult. Their legs are set far back on their body, which helps in swimming.
- Small wingspan, black-necked swans are the fastest of the eight swan species. Black-necked swans are the smallest species of swan. They can fly up to 50 miles per hour.
- Patters over the water to take flight.
- The red knob on the male becomes larger during the mating and breeding season.
- A rough tongue is another adaptation that allows the black-necked swan to grasp and tear the slippery submerged vegetation that it feeds on.
- Swans mate for life, nesting in the same territory year after year.
- Black-necked swans are very social and companionable most of the year, but during breeding season they become territorial and aggressive.
- Migrate in lines or "V" formation, which conserves their energy. Each bird flies slightly above the bird in front of him, resulting in a reduction of wind resistance. The birds take turns being in the front, falling back when they get tired. A flock flying in formation can move faster and maintain flight longer than any one bird flying alone.
- Black-necked swans communicate with gentle whistle instead of honking or squawking.
- The female incubates the eggs, and she can lose quite a lot of weight during this period. Both parents take care of the chicks. But the male usually does most of the "childcare" duties so the female can work on regaining the weight she lost. He will guard the nest while she leaves to feed.
- Herbivorous, aquatic diet. Swan has jagged beak that allows it to filter feed nutrients from the water and a rough tongue is that allows the black-necked swan to grip the slippery submergent vegetation that it feeds on.
- # eggs 4-7, incubation 34-45 days, fledging 100 days.

Cats
Sumatran Tiger
Habitat: evergreen forest, swamp forest, grassland and tropical rain forest

- Their stripes help camouflage them while they sneak up on their prey by blending into their environment. The striping also helps break up their body shape, making them difficult to detect for unsuspecting prey. Their darker coloration may be a hunting advantage within their heavily wooded forest habitat.

- Eyes look forward for better depth perception, so they can accurately leap onto prey. Compare this to the zebra, whose eyes are on the sides of its head for defense.
- The Sumatran tiger is smaller than the Siberian, which helps it move around in densely forested areas.
- Tigers are nocturnal. They have large eyes with a developed tapetum lucidium, which enhances low light conditions by reflecting the light through the eye a second time so see and stalk their prey more easily.
- Large strong paws with long sharp retractable claws enabling them to grab and hold prey once contact is made.
- Large canine teeth and powerful jaws for killing their prey and tearing meat from their kills. Carnassial teeth act as scissor cutting meat, so it can be swallowed.
- The tiger has hind limbs, which are longer than the fore limbs, which is good for pouncing on prey.
- Long tails used for balance when making sharp turns in pursuit of prey.
- The skull is foreshortened, thus increasing the shearing leverage of the powerful jaws.
- Ears have well developed earflaps that are keen sound collectors. Tigers are capable of hearing infrasound, which are sound waves below the range of normally audible sound. Tigers use infrasound to communicate over long distances or dense forest vegetation because the sound is capable of passing through a variety of mediums such as trees and mountains.
- The tongue is coated with sharp-pointed papillae, which retains and lacerates food, and rasp flesh off a carcass.
- Nictitating membrane. It keeps the eye moist while also keeping visibility and removes dust from the eye's surface.
- Excellent sense of smell. They can sense impending danger. Tigers scent mark with their urine.
- Flehman response. Jacobson organ in the roof of their mouth. Scent particles from the air are directed to nerves located within the structure as the tiger inhales. The nerves then transmit the message to the olfactory region in the brain that identifies the scent.
- Tigers have distinctive white circular spots on the backside of their ears. These may function as "false eyes"; making the tiger seem bigger and watchful to a potential predator attacking from the rear.
- This tiger has distinctively long whiskers that are useful sensors in the dark and dense underbrush.
- Tigers are excellent swimmers, easily crossing river 4-6 miles wide and have been known to swim 18 miles. By swimming they are able to increase their territory and available food to them. They have webbing between their toes. Will run hoofed animals into water, which are much slower swimmers.
- Tigers are primarily solitary and males mark their territorial with urine, feces and tree scratching. For males avoidance rather than fighting seems to be the rule.
- Digitigrade locomotion assists the tiger in being generally quicker and able to move more quietly than other mammals. Tigers hunt, depending on sight and hearing more than on smell. Aided by their large paws, they stalk slowly approaching prey from the side or rear then leaping trying to knock it down and grab its throat to either strangle it or bite it at the back of the neck. Tigers fail in at least 90% of their attempts to capture prey.
- Grooming is an important part of the tiger's day. They use their rasping tongue to remove loose hairs and dirt from their fur. The grooming process keeps the tiger's coat in good condition by using their tongues to spread oils secreted from their glands.
- Hyoid bone is partially cartilaginous. Tigers roar to announce they have made a kill or to attract a mate.
- # young 1-6 (usually 3-4), gestation 102-112 days, sexual maturity F 4-5 yrs, M 3-4 yrs.

African Lion

Habitat: grassy plains, savannahs, open woodland and scrub country

- Pelage blends in with their environment, helping camouflage the lions while they sneak up on their prey.
- Male has large mane, which has a primary role of protecting the male during fights, it has been discovered that female lions prefer males with bigger and darker manes. Manes usually are bigger and darker with age.
- Dentition akin to carnivore. Have large incisors for snipping off meat and large sharp canines for grabbing and holding prey. Strong jaws to kill and eat large prey. Incisors are also used for grooming. Carnassial dentition for shearing or cutting meat.
- Strong powerful limbs with large paws for stalking moving prey. Can get low to ground when hiding in grasses stalking prey before they take chase. Only capable of sustaining 35 mph for short time spans.
- C-shaped mandibular fossa (omnivore more flattened) restricts lateral motion of lower jaw and provides strong, powerful vertical action needed for killing and eating prey.
- Digitigrade with large paws and soft pads to distribute weight and to keep movements quiet. This enables the lion to sneak up and stalk prey more successfully.
- Muscular back legs are longer than the front for pouncing on prey while the front legs have short sharp claws designed for grabbing and knocking down prey.
- Long tails used for balance when making sharp turns in pursuit of prey.
- Retractable claws. Claws remain sharp and are not worn down by walking/running. Their dewclaw is used for climbing and gripping.
- Binocular vision. Large forward facing eyes for excellent vision and depth perception.
- Lions are mainly nocturnal. They have large eyes with a developed tapetum lucidium, which enhances low light conditions by reflecting the light through the eye a second time so see and stalk their prey more easily.
- Ears have well developed earflaps that are keen sound collectors. Prey is located by sight and sound.
- Excellent sense of smell. Smell used for communication. Lions mark their territories by spraying their urine. Lions have a Jacobson's organ and exhibit the flehmen response to test the receptivity of the female. This response is adopted when examining scents left by other animals either of the same species or of prey.
- Papillae on tongues. Papillae are tiny hooks on the upper tongue's surface, which point backwards and aid in grooming and holding and lacerating food.
- Obligatory carnivores. Lions have simple stomachs with an undeveloped cecum as meat is east to digest.
- Cooperative hunting groups to help in killing success. Two lions will approach their prey from opposite directions. When a kill is made the males of the pride eat first, followed by the females and finally the cubs. Hunting cooperatively allows the pride to tackle larger prey, easier kills and less chance of injury. It will ensure that enough food will be available for the entire pride. The pride also helps to protect the kill from scavengers such as a pack of hyenas.
- Sexual dimorphism. Male's large mane provides protection his head and neck during fights. It increases apparent size making him more imposing and may protect against potential fights with other males. The primary role of the male is breeding and protection of the pride's territory.
- Female is smaller and more agile. The majority of the hunting done by the females. Digitigrade locomotion assists the lion in being generally quicker and able to move more quietly than other mammals.
- Territorial. Males mark boundaries with urine and other scent markings and protect their pride from other males.
- Partially ossified hyoid bone, which creates anatomical structure for roaring. Lions have a roar can be heard at a distance of 5 miles and is usually heard at sundown, after a kill and after eating. The 'purring' type of noise produced by big cats can only be made as they exhale due to their flexible hyoid bone.

- Live in prides which provide close social groupings that last for years. The lion is the only truly social cat and lives in a group (2-3 males in average size pride of 15). Adult males able to defend territory and gain females better than a lone male. About every 3 years, males of the pride are challenged and driven off by other males. Pride members nuzzle and rub against each other to reinforce bonds.
- Lions are only active 3-4 hours of any given day, the rest of the time is spent resting and sleeping.
- # young 3-4, gestation 100-119 days, sexual maturity 4-5 yrs.

Snow Leopard
Habitat: high altitude cliffs above tree line up to 20,000ft
- Pelage blends in with their environment, helping camouflage the leopard while they sneak up on their prey. The winter coat is overall lighter in coloration and thicker than the summer coat.
- Thick long fur with wooly undercoat to protects the leopard against the elements in the high mountains. Belly fur is up to 5" in length.
- Long flexible tail is round and heavily furred is used for balance when chasing prey and also provides protection for face during severe cold. The tail can minimize water loss by humidifying their intake air by what they have exhaled. It has the longest tail (relative to body length) of any cat.
- Small ears to prevent heat loss in cold winters.
- Large paws with well-developed hairy cushions that not only ideal for padding over snow and distributing the animal's weight but also protects paws from hot rocks during summer heat. Large paws also allow them to walk on snow and not sink into it.
- Excellent sense of smell. They can also sense impending danger. Scent mark with urine.
- Snow leopards have a semi-rigid hyoid bone in their throat, which classifies them as a large cat but they are unable to roar. They do purr and grunt. Loud moans are used to attract mates. The 'purring' type of noise produced by big cats can only be made as they exhale due to their flexible hyoid bone. The lack of a roar may be contributed to avalanches in their territory and loud sounds may trigger an avalanche.
- Cats are solitary (except mother with cubs). The snow leopard hunts alone because the rocky terrain and amount of food available in any one area cannot support large groups.
- Digitigrade locomotion assists the tiger in being generally quicker and able to move more quietly than other mammals.
- Large home ranges. Snow leopards mark their territories. With such rugged territories these cats depend on a range of scent markings to determine who's in the area and their sexual status. Feces and sprays are used to mark areas.
- Dentition akin to carnivore. Have large incisors for snipping off meat and large sharp canines for grabbing and holding prey. Strong jaws to kill and eat large prey.
- Papillae on tongues. Papillae are tiny hooks on the upper tongue's surface, which point backwards and aid in grooming and holding and lacerating food.
- Strong powerful limbs with large paws for stalking moving prey. Their strong, stocky build aids in climbing and leaping. Extremely strong, muscular back legs are longer than the front allowing the leopard to pounce and leap up to 50 feet.
- Front legs with short sharp claws designed for grabbing and knocking down prey
- Retractable claws allow the claws to stay sharp increasing their chances of getting prey.
- Large forward facing eyes for good depth perception. The placement of the eyes is high. This allows the animal to stay low behind cover when stalking prey.
- Enlarged nasal passage with large chest cavity and strong lungs. Lungs adapted to living where oxygen levels are low. Also High red blood cell count so more oxygen can be delivered to the muscles with each breath.
- Nictitating membrane. It keeps the eye moist while also keeping visibility. It protects the eyes from the reflection of the sun off the snow and also in snowstorms.
- # young 1-4, gestation 95-105 days, sexual maturity 2 yrs.

Fishing Cat
Habitat: marshy thickets, mangrove swamps and dense cover along streams and up to 7,000' in Sri Lanka
- Pelage blends in with their environment, helping camouflage the fishing cat.
- Small ears and flattened head with the eyes set closer together than other cats are adaptations for fishing. Eyes look forward for good depth perception.
- Carnivore dentition that is exceptionally strong, considering the animal's size. Excellent for eating fish, small animals, birds, crustaceans, mollusks, frogs and snakes.
- The fishing cat is an eager and skilled swimmer. When swimming, the fishing cat may use its short, flattened tail like a rudder, helping control its direction in the water. The forepaws have digits joined by traces of swimming membranes.
- Fishing cats are terrestrial and diurnal.
- Good sense of smell, which is used more for detecting and communicating with other animals than for hunting.
- Their stocky build with relatively short legs, and a short, muscular tail are good adaptations for their habitat of marshy thickets, mangrove swamps and dense cover along streams.
- The fishing cats lie in wait on the bank or wade into shallow water to catch slippery prey with paws or teeth. They use their paw as a scoop. Semi-retractable claws to keep them sharp. The sheaths are too small to allow for full retraction.
- Two layers of dense fur for insulation. Lower layer is very short and dense to keep the cat's skin dry during time in the water; and longer guard hairs, that give the cat its color pattern.
- Papillae on tongues. Papillae are tiny hooks on the upper tongue's surface, which point backwards and aid in grooming and holding and lacerating food.
- Hyoid bone is ossified. Fishing cats purr for communication.
- Fishing cats are solitary.
- A Fishing cat will imitate a bug on the water by tapping their paw so fish will come up to the surface.
- # young 2-3, gestation 63-68 days, sexual maturity 10-15 mos.

Bobcat
Habitat: prefers wooded areas, but also in semi-desert, urban edge, forest edges, and swamp environments
- Pelage blends in with their environment, helping camouflage the bobcat.
- Large ears for a good sense of hearing.
- Eyes look forward for good depth perception.
- Carnivore dentition for mostly rabbits and hares.
- Good sense of smell, which is used more for detecting and communicating with other animals than for hunting.
- Papillae on tongues. Papillae are tiny hooks on the upper tongue's surface, which point backwards and aid in grooming and holding and lacerating food.

- Hyoid bone is ossified. Bobcats are usually solitary and silent except during the breeding season.
- Each bobcat may have several dens, one main den and several auxiliary dens, in its territory. This provides them with shelter throughout their territory.
- Crepuscular but may vary seasonally, as bobcats become more diurnal during fall and winter. This is a response to the activity of their prey, which are more active during the day in colder months.
- Bobcats are excellent hunters, stalking prey with stealth and patience and then capturing with one great leap.
- Bobcat *directly registers*, meaning its hind prints usually fall exactly on top of its fore prints. This minimizes noise and visible tracks. This also provides sure footing for their hind paws when they navigate rough terrain. Unlike dogs and most mammals, cats walk by moving both legs on one side and then both legs on the other. This allows them to directly register.
- Retractable claws. Claws remain sharp for hunting and climbing and are not worn down while walking.
- Territorial. Ensures there is enough food for the solitary occupant.
- Marks territory with markings, including claw marks and deposits of urine or feces. This ensures that others know who's territory.
- # young 1-6 (ave 3), # mammae 3 pair, gestation 50-70 days, weaning 12 wks, sexual maturity 2 yrs.

Bears

Grizzly Bear

Habitat: High mountainous wooded areas, tundra and alpine meadows

- Large shoulder hump for attachment of strong digging muscles and long sharp claws to help them dig for roots, compete with rival males and dig their winter dens. Lack curved claws for climbing.
- Thick fur helps them to survive in colder habitats
- Long nose for an excellent sense of smell.
- Excellent vision and hearing for detecting predators.
- Bears enter a dormancy period that is triggered by fat store and not cold weather. Grizzly's dens are either dug, are rock caves or hollow trees and are used by all for protection and security in winter.
- Claws grow in winter while in their den. This enables them to continue to have sharp claws for digging for food.
- The teeth consist of flatten molars and piercing canines. This is consistent with a primarily herbivore diet and are needed for grinding.
- Delayed implantation of the fertilized egg allows for timing the cubs births with their dormancy period. It allows the bears to maintain their solitary existence.
- Grizzly bears are solitary and come together for mating in the spring. They will also come together during the salmon run.
- Grizzlys walk flat-footed or plantigrade. The primary advantages of a plantigrade foot are stability and weight-bearing ability; plantigrade feet have the largest surface area. The primary disadvantage of a plantigrade foot is speed but grizzlys can still run as fast as 35 mph.
- Altricial birth. The young weigh ~1 lbs at birth. The den provides them the necessary protection they need until they are large enough. The mother cares for her cubs up to 3 ½ years. She can become very aggressive when protecting the cubs.
- # young 1-4 (2 common), gestation 210-255 days with delayed implantation, sexual maturity 5 years.

Other mammals

California Sea Lion

Habitat: oceans and rocky coastlines

- Streamline, torpedo-shaped body with 4 limbs modified into flippers for maneuverability in the water makes them excellent swimmers. Head is flattened and face shortened to aid in rapid propulsion through the water. Their hair grows in one direction minimizing drag in the water. This allows them to swim fast in pursuit of prey and avoidance of danger.
- Nostrils are slit-like and can be closed along with their ears when going underwater, thus keeping the water out.
- Small external ear flaps to minimize heat loss in cold aquatic environment and minimizes drag for faster swimming.
- The eyes are generally large with a retina adapted for low light conditions. By having rods only they lack color vision which is not needed in the dark ocean. They also have a reflective tapetum lucidum that enhances low light conditions by reflecting the light through the eye a second time. Their eyes are deeply set in a cushion of fat, which provides protection from the pressure changes of the ocean depths and are protected by a mucous secreted by the eye.
- Neck is thick and muscular and flexible. Pinnipeds are able to absorb the impact of ocean waves or when they haul out of the water.
- Dense fur consisting of long coarse guard hairs underlain by shorter, finer underfur. Pelt protects them from abrasions of sand and rocks as they come ashore for reproduction. The underfur traps air, which provides insulation against the chilly waters. Molt is not annual but sea lions renew their pelt gradually all year long.
- Long whiskers, (vibrissae are smooth) loosely attached to the sea lion's upper lip. Each whisker can rotate around with the underwater currents, letting the sea lion "feel" any food swimming nearby.
- Thick layer of subcutaneous blubber for energy reserves, buoyancy and insulation from the cold waters. Countercurrent heat exchange in appendages, blubber, nasal mucosa and reproductive organs. This conserves heat by maintaining a heat differential between arteries and veins.
- Long fore-flippers provide them the power for swimming and maneuverability on land. The bones of the forearm (radius and ulna) have been flattened and the bones of the hand lengthened to provide increased propulsion. Their rear flippers are used to help steer. Sea lions are also able to rotate their hind flippers forward giving them the ability to walk on all fours and maneuver on shorelines by scooting.
- Sexual dimorphism. California sea lion males grow to 850 lbs and 8 ft long. Males grow a large crest of bone on the top of their heads as they reach sexual maturity, and this gives the animal its generic name (*loph* is "forehead" and *za-* is an emphatic; *Zalophus californianus* means "Californian big-head"). Males defend their breeding territory. Males also have manes. Females are significantly smaller, at 220 lbs and 6.5 ft long. Females are lighter in color than the males, and pups are born dark, but lighten when they are several months old. Size is a key factor in defending their territories for breeding rights.
- Dentition akin to carnivorous diet. California sea lions feed on a wide variety of seafood, mainly squid and fish, and sometimes even clams. Teeth are large and peg-like are adapted for their carnivorous diet of the sea. The molars have sharp cusps and are more suitable for grabbing and holding slippery prey than for chewing. Pinnipeds do not slice or chew their prey; it is eaten whole.
- Pinnipeds have well developed senses of sight, hearing and touch, but little is known about their sense of smell. They produce strong odors during the breeding season. Scent is one-way female seals can identify their pups.
- Sea lions don't need to drink water. Marine mammals obtain the water they need from the food they eat. This allows them to avoid drinking sea water and the stress of too much salt in their system. Specialized kidneys that reduce water loss by excreting concentrated urine.
- Otariids (sea lions & fur seals) tend to be shallow, short-duration divers whereas phocids (true seals) are exceptional divers with long, deep dive patterns. Pinnipeds utilizing different food supplies.

- California sea lions are well known for their dog-like barks. They are very vocal, particularly during the breeding season. Adult males make deep, loud barks repeatedly when establishing territories.
- They breed on land or ice with older bulls defending territory and establishing harems of up to 6 females. Pinnipeds have not made a complete transition from land to water. Even though they are agile in the water they are extremely clumsy and vulnerable on land. There is safety in groups on land.
- Delayed implantation to adjust gestation periods so that birth and mating occur in a single period and avoid potentially dangerous time ashore. Ovulation is induced.
- Precocial young. The pups are born with their eyes open and can vocalize with their mothers. The pup is able to swim shortly after birth and is not as dependent on parental car but lack the blubber for warmth in the cold waters.
- Sea Lion mothers have rich milk of 50% fat. The high fat content helps the pup grow that important layer of blubber to keep warm.
- Newborns possess subcutaneous brown fat helps keep the pups warm by means of non-shivering thermogenesis. The pups lack the blubber to stay warm so they stay on shore and nurse with mother's high fat content milk. The brown fat is around the back and neck as well as around the vital organs. Instead of shivering seals metabolize this high energy fat to produce heat. When pups have used up brown fat they have accumulated some insulating blubber.
- Otariid mothers leave pups ashore for variable periods while they search for food at sea but between birth and departure for the first foraging trip remain ashore to feed and protect their newborn. Mating occurs before their first foraging trip during a short estrous of 5 – 8 days. Otariids do not have the body reserves to nurse without feeding. Longer lactation period means pups are nutritionally independent when weaned. The longer development period requires greater maternal investment but a better chance of survival for young.
- Colonial breeders, mother and pups have recognition calls. When the mother returns from a foraging trip, she must recognize pup's call and pup must be able to recognize mother's call as well.
- # young 1, gestation 8 to 11 months, sexual maturity F 3-8 yrs, M 6-10 yrs, life span 20-30 yrs.

North American River Otter

Habitat: Streams, rivers, lakes, estuaries, and salt- and freshwater marshes.

- Long, slender, sleek streamlined bodies with strong muscular tails make them excellent swimmers and divers. Short, powerful legs with webbed feet assist with swimming makes otters well developed for a semi-aquatic lifestyle. Webbed feet can help otter save energy so it can swim farther.
- The dense water resistant pelage provides insulation from the cold water. Otters must continually groom their fur to maintain its insulating qualities. The river otter is almost impervious to cold because of an outer coat of coarse guard hairs, plus a dense, thick undercoat that helps to "water-proof" the animal. They have no blubber - the fur keeps them warm by trapping air. Doesn't do deep dives so pressure does not eliminate the trapped air in the fur.
- Small ears and nostrils can be closed when diving. River otters can remain under water for 6 to 8 minutes.
- Otters have higher metabolic rates than land mammals of similar size, and generate more body heat. This is because in the water one loses body heat more rapidly than in the air.
- River otters have scent glands at the base of the tail. They deposit their musky scent on their dung piles spread throughout their territory. Scent glands under the tail are used for identification, defense, marking territory, and trail marking. Scent is a main form of communication that can determine the sex, sexual status, receptivity of others and is used to determine territorial boundary, as well as the last time the 'marker' was in the area.
- Nictitating membrane covers the otter's eyes when swimming under-water. This gives protection to the eye but allows the otter to see clearly.
- Keen sense of smell in addition to good eyesight and hearing for successful hunting and protection from predators and assessing breeding readiness.
- Numerous stiff whiskers (vibrissae) around nose and snout and in tufts on the elbows are tactile hairs that are sensitive to water turbulence and are used in searching for prey. North American river otter can use its whiskers both on land and in water. On land, they are used to feel their way through narrow channels.
- Carnivorous dentition. Otters have well developed pre-molars are used to crush shells and bones.
- During a dive, their pulse slows to a tenth of the normal rate of 170 beats a minute, thereby conserving oxygen. Remain underwater for up to 6-8 minutes.
- Playful behavior may be a way of reinforcing social bonds within a group, or practicing of certain skills, such as hunting .
- Semi-altricial young open remain in the den until they emerge and begin to swim at 2 months of age. The dens provide protection for their young. Males do not participate in rearing young. Young peep in nest like chicks. Begging, alarm calls and adult mating calls sound like a soft whistle. When threatened they utter a hissing or yelp while challenge calls are deep nasal growls and piercing screams.
- Induced ovulation and delayed implantation insure young are born in dens for maximum protection.
- Males form dominance hierarchy with the highest ranked animal occupying the most favorable range.
- Females do no excavate dens but use abandoned homes of animals such as beavers, muskrats or woodchucks. Beaver ponds make ideal otter habitat. Dens have openings above water in summer, but in winter these are closed and the only entrance is below water. The entrance opens up to a large nest chamber.
- # young 1-5, gestation 60-63 days, sexual maturity 2-3 yrs.

Greater One-horned Rhinoceros

Habitat: floodplains of large rivers, swampy and tall grass areas, reed beds, grasslands and wooded meadows

- Prehensile upper lip used to browse tall grass and shrubs.
- Prominent erect ears are able to swivel to pick up faint sounds for detection of predators. By turning its' ears to and fro Rhinos are able to get a better sense of direction of the sound. Ears are able to move independently.
- Excellent sense of smell protects them against predators.
- Long single horn is made of hardened, and densely compressed keratin, which continues to growth through its lifetime. Horn is used for defense. Thick skin helps protect against aggressive interactions between males.
- Wallowing in mud keeps the skin supple and provides relief from biting insects. It also protects the skin from sunburn.
- Uses graviportal locomotion due to large body. These animals have no digit reduction and deploy the digits in a circle around the axis of the limb for maximum support, like the pedestal of a column to accommodate massive weight.
- Small eyes set on side of head. Rhinos have very poor eyesight. Being nearsighted they are very unpredictable for they may not be able to distinguish a man from a tree at 30 ft. and tend to charge. They are able to reach speeds of 28 - 35 mph.
- Rhinos have herbivore dentition, with vestigial canines and molars with high crowns for grinding and also the ability to graze on short grasses. There are two tusk-like incisors in the lower jaw that can be used for defense.
- Males are solitary, but not territorial.

- Excellent swimmers.
- Rhinos have no sweat glands. Plate like armor increases surface area to help dissipate heat.
- Scentmark. Rhinos spray urine on shrubs and rocks and use communal dung heaps to mark their trails and borders. Males urinate to the rear and can spray a distance of 10 to 13 ft. Trails are further marked by males trampling their fresh dung piles thus soaking the soles of their feet. They have a secretion gland above and behind ball of foot. Scent may orient them in their homeland, as their vision is poor.
- Rhinos are crepuscular and sleep in the shade or wallow in mud during the hot part of the day. Wallowing provides cooling and protection from flies and biting insects. Being solitary avoids overpopulation of a habitat. They are extremely good swimmers.
- Precocial young. Calf can walk in about an hour and when traveling they remain close behind their mother.
- # young 1, gestation 16 mos, sexual maturity F 3-4 yrs, M 7-9 yrs.

Black Rhinoceros

Habitat: bushy & grassy plains, dense brush to open forest, and semiarid regions. Nearby watering places essential.

- Thick skin protects against acacia tree thorns.
- Uses graviportal locomotion due to large body. These animals have no digit reduction and deploy the digits in a circle around the axis of the limb for maximum support, like the pedestal of a column to accommodate massive weight.
- Small eyes set on side of head. Rhinos have very poor eyesight. Being nearsighted they are very unpredictable for they may not be able to distinguish a man from a tree at 30 ft. and tend to charge. They are able to reach speeds of 28 - 35 mph.
- Hooked upper lip protrudes beyond lower lip and is prehensile. Rhinos are browsers, not grazers this prehensile lip is used to browse tall grass and shrubs.
- Prominent erect ears are able to swivel to pick up faint sounds for detection of predators. Ears are able to move independently to differentiate the direction of a sound.
- Rhinos have herbivore dentition, with no incisors, vestigial canines and molars with low crowns for grinding.
- Males are solitary, but not territorial.
- Scentmark. Rhinos have a keen sense of small. Rhinos spray urine on shrubs and rocks and use communal dung heaps to mark their trails and borders. Males urine to the rear and can spray a distance of 10 to 13 ft. Trails are further marked by males trampling their fresh dung piles thus soaking the soles of their feet. Scent may orient them in their homeland, as their vision is poor.
- Rhinos feed morning and evening, sleep in the shade or wallow in mud during the hot part of the day. Wallowing provides cooling and protection from flies and biting insects.
- Rhinos have no sweat glands. Night tends to cool off in habitat so don't need increased surface area as the one-horned rhinos to dissipate heat.
- Wallowing in mud keeps the skin supple and provides relief from biting insects. It also protects the skin from sunburn.
- Precocial young. Calf can walk in about an hour and when traveling they remain close behind their mother.
- Horn is made of hardened, and densely compressed keratin, which continues to growth through its lifetime. Horns are used for defense.
- Copraphagus. Observed eating wildebeast droppings during the dry season. This may indicate a mineral or other deficiency in their diet and is meant to balance their diet.
- # young 1, gestation 15 mos, sexual maturity F 6 yrs, M 8 yrs.

Common Hippopotamus

Habitat: deep water rivers with adjacent reed beds and grasslands, salt water deltas and landlocked springs and lakes

- Sexual dimorphic with male larger and heavier than female. Male competes for breeding rights of the females.
- Hippopotamuses have small legs in proportion to its body. Being mainly aquatic reduces the weight burden of the hippo's body. Four partially webbed toes aid the hippo on land and water. Hippos have a nonstreamlined, barrel-shaped body, and don't swim well but instead walk on the bottom of waterbeds. On land the toes splay out to distribute weight evenly and therefore adequately support it on land.
- Hippos are still extremely fast on land. When threatened the hippo will head to the water for safety.
- Ears, eyes and nostrils are placed high on the head, allow the animal to breathe and keep watch, smell and hear while most of its body remains submerged.
- Ears and nostrils pinch tightly shut when the animal dives underwater, making it easier for them to stay submerged. This allows the hippo to close out the water. A hippo can remain underwater for 3-5 minutes. This longer period enables the hippo to stay submerged and not have to come to the surface to breath as often.
- Eyes have a nictitating membrane. The nictitating membrane protects the eye from debris in the water and at the same time allowing the hippo to see.
- Hippo can move each ear independently to differentiate where a sound is coming from.
- Lower incisors are forward-directed spikes and do not meet the upper incisors or serve in clipping grass but instead for fighting. Molars are akin to an herbivorous diet. Incisors and canines are tusk-like and grow continuously with canines meeting inside the lips. Hippos territorial in the water and tusks are used for fighting.
- Muscular, paddle like tail. Hippo feces are deposited in the water and dissipated by their tail. The feces nurtures abundant growth of tiny plankton that feed the fish that in turn feed humans, otters and crocodiles. The individual is advertising their status and condition.
- Aquatic during the day. The water serves to keep their body cool and hydrated and also gives them buoyancy to ease their weight burden on their limbs. The hippos can dehydrate easily through their thin skin. The hippo has neither sweat nor sebaceous glands but relies on water or mud to keep cool. Hippos spend much of their time in the water, as their skin requires frequent moisture to avoid drying out.
- Terrestrial at night and herbivorous. Hippos are nocturnal, coming on land nightly to feed, traveling more than 5-miles from water when foraging. Not territorial on land. Tend to be solitary when feeding at night.
- Nonruminating. A three chambered stomach aids in the digestion of an herbivorous diet. Hippos use their thick lips to nip at vegetation.
- Thought by the natives to "sweat blood". Skin is glandular and exudes droplets of oily moisture containing a red pigment, which prevents the skin from drying and cracking. This pigment also has an antibiotic property and inhibits the growth of disease-causing bacteria.
- Mating and births occur underwater as does nursing. Hippos feel better protected in the water. The mother helps the newborn to the surface, later teaching it to swim. Newborns often climb on their mothers' backs to rest.
- Bulls have a loud roar that can be heard over great distances designating their whereabouts. Adult males compete for control of a herd and the territory it occupies. The large lower canines are their primary weapons in battles over a herd and are prominently displayed as a warning signal.
- Matriarchial herds. Hippos live in pods of 10-30 mothers and their young. Older high-ranking bulls form a bachelor group outside the nursery and young males further out.

- Vomernasal organ functions in water and land allowing the hippo to sense friend and foe at all times.
- Hippos establish trails on the land to ease movement and marking their territory with feces. Common dung middens on land may assist in communication and orientation at night.
- Calves join crèches where they playfight and participate in chasing games.
- # young 1, gestation 227 - 250 days, sexual maturity M 7 - 15 yrs, F 4 - 11 yrs.

Chacoan Peccary
Habitat: Dry thorn forests with isolated savannahs in Gran Chaco of Paraguay, southeast Bolivia and northern Argentina. Thorny bushes and succulents, with large trees distributed throughout.

- Chacoan Peccaries use their tough snout to roll cacti on ground knocking spines off cactus pads and dig up roots that provide nutrients and water. They may also pull off the spines with their teeth and spit them out.
- Small feet help the peccary to move around the thorny plants of their habitat.
- Specialized kidneys to break down acid from the cacti and can concentrate its urine to conserve additional water.
- Non-ruminating. Has a two-chambered stomach that is specialized to digest cacti.
- Scentmark with dorsal gland. Chacoan Peccary produce an odorous and milky substance, which is dispersed by rubbing and marks their territory. They defecate at dung middens to mark their territory. Peccaries also "bond" by rubbing other group members with the smells produced by their scent glands.
- They frequently bath in mud or dust to protect skin from sun and insects and to keep cool.
- When the Chacoan Peccary is nervous or frightened it flees, while raising the hairs on its back. While escaping the Chacoan Peccary sprays secretions from their dorsal glands. This is thought to be a signal for other peccaries to keep the group together through the dense bush. They may also line up members of a herd in a defensive wall as a defensive strategy.
- Artiodactyla with long legs and hooves indicate that it is adapted for running. They have a third hind toe on their feet.
- Well-developed sinuses to combat dry, dusty conditions.
- Elongated, pointed head plates of the peccary skull allow the peccary to burrow and furrow for food while keeping its sharp incisors and canines in a frontal attack position.
- The bristly brown and grey coat helps them blend in and protects them from the thorny brush and succulents of their habitat.
- Diurnal and travel in groups of two to ten and they are generally not aggressive. There is safety in numbers and avoid their main nocturnal predators of puma and jaguars. During midday, they retire to the shadows of trees and bushes to rest.
- Long ears providing a keen sense of hearing.
- Large head with a large snout provides a keen sense of smell.
- Obtains most of its water from fleshy plants, such as cacti and bromeliads.
- High crowned molars for herbivorous diet.
- Tusks directed downward. Chacoan Peccaries will bite to attack if threatened.
- The peccary seeks out naturally occurring salt licks formed by leaf cutter ant mounds, thus gaining essential minerals of calcium, magnesium, and chlorine.
- Most births occur from September to December, when food and rainfall are abundant.
- Precocial Young. Baby peccaries are capable of running hours after they are born, providing them a better chance of survival.
- # young 1-4, gestation 145 days, sexual maturity Females will breed after their 2nd year, , live 16 years in the wild.

Eastern Mountain Bongo
Habitat: dense tropical jungle with dense undergrowth up to an altitude of 12,800 feet

- Largest of the forest antelopes
- Pelage blends in with their environment, helping camouflage the bongo from predators.
- Hooves protect their feet of these animals and allow for greater mobility than unprotected feet.
- Short legs help navigate the forest environment.
- Primarily nocturnal.
- Ruminating antelope. This allows them to ingest a lot of food and then retire to safety to chew and digest. Use their prehensile tongue to gather food. They are browsers.
- Large ears allow excellent hearing in the dense environment. Ears are able to rotate to pick up direction of sound.
- Dependant on water in their habitat. Often seen wallowing in mud to protect from insects.
- Small groups or in the case of the male usually solitary. Bongos are shy and easily frightened and will disappear quickly in the forest. Smaller groups draw less attention to the animal in a dense forest.
- Calves left alone after birth for about one week to avoid detection. Mother will return to nurse throughout.
- Large eyes on the side of their head allows for detection of predators.
- Large spiral horns. They will perform ritualistic sparring to establish dominance hierarchy. They emphasize their horn size and height by strutting but rarely fight amongst themselves.
- Tilt chin up to lie their horns on their back in order to maneuver swiftly through the forest when fleeing.
- After fleeing will face away from the disturbance and they are better camouflaged in the rear and they can quickly flee away again.
- Require salt in their diet. Often visit natural salt licks. Known to eat burned wood from lightening storms to get salts and minerals in their diet.
- Broad, rounded ears important in hearing in thick woodland for predators.
- No special secretion glands. Do not rely on scent as much as other antelopes.
- Sexual dimorphism. Males are slightly larger and have longer more massive horns.
- # young 1, gestation 9.5 mos, sexual maturity 20 mos.

Wolverine
Habitat: boreal forest and subarctic and alpine tundra

- Primarily carnivores. Scavengers
- Do not hibernate but are well adapted for winter existence. Long, dense oily fur; the fur is hydrophobic and resistant to frost.
- They have reputations for ferocity and strength out of proportion to their size, with the ability to kill prey many times larger than itself.
- Sharp claws enable them to climb steep cliffs and snow-covered peaks or bring down prey and defend their territory ferociously.
- Anal scent glands, which produce musk and are used for marking their territory and sexual signaling.
- Territorial. Males share their territories with several females and are believed to be polygamous. Females do not overlap in their territories with other females.
- Successful males will form lifetime relationships with two or three females and strong family bonds. A male wolverine will interact with his kits even after they have struck out on their own.

- Special upper molar in the back of the mouth that is rotated 90 degrees, towards the inside of the mouth. This adaptation allows wolverines to tear off frozen meat from prey or carrion. They are also capable of eating bones with their powerful jaws.
- Opportunistic feeders, highly effective scavengers and eat a variety of foods depending on availability.
- Good climbers. Will sit in wait to pounce on prey from above.
- Good swimmers
- Unique coloration patterns on their face, neck, and chest for individual identification.
- Solitary except in breeding season. Need a lot of space to roam. Will travel 15 miles/day in search of food.
- Females give birth in alternate years.
- # young 1-5, gestation 30-50 days, delayed implantation, induced ovulation, sexual maturity 2 yrs.

Southern Two-toed Sloth
Habitat: in canopies of humid, warm, well-established tropical and cloud forests; Ranges from sea level up to 7,999 ft

- Primarily folivorous; stomach is four-chambered for digesting foliage with aid of bacteria which helps ferment cellulose of plant matter; a short intestine. Get almost all of their water from juicy plants. Teeth of the two-toed sloth are small, simple molars that are continuously growing but constantly ground down by the mastication. They have no enamel coating on teeth.
- There are no incisors or canines but have premolar that looks like a canine. Will charge a suspected aggressor, pulling them to their mouth with forearms and biting them. These sharp teeth are like canines of carnivores.
- Elongated limbs and trunk are adaptations to acrobatic, hanging lifestyle. Two long curved claws enable the sloth to latch onto tree branches. Leathery soles on forefeet and hind feet. Reinforced lumbar vertebrae make upside-down lifestyle possible (xenarthrous vertebrae).
- Eyes face forward giving them depth perception in the trees. Eyes very mobile and have photoreceptors an adaptation for night vision. Near-vision is poor and they rely on other senses to obtain food and make contact with other sloths; they rely little on vision to carry out normal patterns of behavior.
- Xenarthrous vertebrae with extra articulations between the vertebrae of the lumbar area. In addition, the pelvis connects with more of the spine than in other mammals. These adaptations to the spine give extra support, particularly to the hips.
- Found in trees with interlacing crowns allow for lateral movement without descending to ground. Prefer crowns of trees with lianas to provide cover from predators and shelter from sun during the day. Trees also provide body support for sleeping with no nest building.
- Nocturnal. Algae growth on fur is good camouflage and slow moving provides protection during the day.
- Vestigial tail. Will low activity level, do not need tail for balance.
- Good swimmers, having a streamlined body and fur that has evolved for wet, tropical weather.
- Gripping reflex enables young to climb to mother's abdomen. Young carried for six to nine months.
- Clumsy on ground and vulnerable to predators. Descends to ground to deposit mass of fecal pellets and urinate, which occur simultaneously. Due to its slow metabolism and high-cellulose diet, defecation and urination occur only once a week. Only come to ground to change trees or to defecate.
- Fur parts in the middle of abdomen, growing out and down. Helps to slough off water. Sense of smell well developed.
- Fur provides insulation to protect against cooling; regulate body temperature by moving about canopy, seeking shade or sun; sloths have difficulty maintaining body temperature on rainy days. External coat of long coarse hair and dense smooth undercoat provides good insulation.
- Sloths cannot shiver to keep warm as other mammals do because of the unusually low metabolic rates and reduced musculature. They have the lowest muscle mass relative to overall body weight of any mammal.
- To compensate for a lack of sharp teeth, they use their hardened lips to shear and crop leaves. They have a large thick tongue, densely covered with sharp, backward-directed spines to help in moving food backward for swallowing.
- Young sloths puff up their hair, almost doubling their size, when frightened.
- Light weight for a mammal their size, which is helpful when harvesting leaves from long, thin branches.
- Internal organs including the stomach, spleen and liver are located in different areas, due to upside-down lifestyle.
- # young 1, gestation 10 mos, delayed implantation, induced ovulation, sexual maturity F 3 yrs. M 4-5yrs

Red-rumped Agouti
Habitat: Rain forests, mostly in areas with lots of undergrowth, often near water
The male has long horns to defend his herd from other male blackbuck and attract females.

- Long legs help them void predators. They are fast runners and have sharp hearing and a keen sense of smell to alert them when a predator is near.
- They are capable of leaping vertically to 6.5 feet from a standing position, spin around, land, and dash off in the opposite direction.
- Keen sense of smell. Agouti will bury food when there is a surplus and they are able to find months later. They are important seed dispersers.
- They raise up coarse hair in alarm in response to a predator. Makes them looks larger and in the case of an attack, they have a better chance of escaping harm.
- Rodents with large, sharp incisors that grow throughout their lifetime; teeth are continually sharp and reinforced with a single lateral fold of enamel, making them stronger and capable of cracking open tough nutshells.
- The agouti has five front toes and three hind toes, which resemble small hooves; the first toe is very small. They walk on their toes, traveling swiftly when pursued or threatened.
- Agoutis are adapted to an aquatic lifestyle. They are good swimmers and have a coat covered with a water-repelling oily substance.
- Den in burrows for protection.
- Territorial; will mark their territory with urine. Males defend their territory to ensure the paternity of their offspring.
- Babies are moved to dens that are too small for predators to enter. They will change dens as the young grow.
- The precocial young are able to run one hour after birth. The young stay with parents until the next litter is born, for protection.
- A coughing bark communicated by the first member to detect a predator as an alarm to the rest of the group
- # young 1-4 (ave 2), gestation 3 mos, sexual maturity 11/2 yrs, wean 20 weeks.

Reptiles
Komodo Dragon
Habitat: tropical savanna forests; they live mostly in the lowlands, but have occasionally been found at elevations up to 1,967 feet

- Large lizard with powerful legs. Can reach brief speeds of 13 mph. Strong muscles with powerful claws help bring down prey.
- Keen sense of smell especially for food detection. Komodos can detect the scent of carrion from as far as 11 km. (Decomposition releases volatile oils - wind and size of prey are important factors). The tongue is long, yellow and forked and is connected to a

Jacobson's organ on the roof of the mouth. Komodo will swing head from side to side to enhance their sense of smell. The tongue does not move freely in the mouth, but retracts into a sheath. Varanids (monitor lizards) are unique in using their tongues only as a sensory organ for locating prey and as a socialization tool. Other lizards use the tongue to manipulate food.

- Clay-colored, scaly skin for great camouflage in hot dry climate.
- Sensory plaques connected to nerves to facilitate its sense of touch.
- Scales reinforced with bones (osteoderms) help protect the lizard from damage. The osteoderms provide "chain-mail". Shedding occurs in patches and lasts about 6 months each year.
- Sharp recurved, serrated teeth for carnivorous diet. The 60 short teeth are designed to cut and tear flesh. A dragon will go through four or five sets of teeth in a lifetime. Further rows of replacement teeth lie behind. They have venom in their mouth whose toxins cause the prey animal to go into shock and decrease its blood from clotting. The komodos are then able to track down by their powerful sense of smell for carrion.
- The flexible skull joints, along with loosely articulated jaws and powerful neck and throat muscles, allow chunks of flesh to be consumed quickly without chewing. The stomach expands easily and dragons can eat up to 80% of their body's weight in a single meal. This makes them the dominant predator of their habitat. Komodos eat bones, hooves and swaths of hide. They also eat intestines, but only after swinging them vigorously to scatter their contents. This behavior removes feces from the meal. They eat much more efficiently than other large carnivores, leaving only about 12 percent of the prey (lions leave 30 to 35 percent).
- They can survive on a few meals a year if necessary, allowing a small prey population to sustain many consumers.
- Komodos can throw up the contents of their stomachs when threatened to reduce their weight in order to flee.
- Territorial. Males maintain and defend a territory and patrol up to 1.2 miles per day. Signs of Komodo aggression include puffing out the throat, hissing, adopting a semicircular stance and thrashing of the tail. Venom not poisonous to other komodos.
- When hunting, Komodo dragons rely on camouflage and patience, lying in wait for passing prey. When a victim ambles by, the dragon springs, using its powerful legs, sharp claws and shark-like teeth to eviscerate its prey. Venom toxins are now known to be present in toxin-secreting glands of monitor lizards.
- Short intestine is typical of carnivores (Diets high in proteins and lipids don't require a great deal of digestive processing)
- Juvenile Komodos are slender and agile. Young Komodo dragons spend much of their first few years in trees, where they are relatively safe from predators, including cannibalistic adults. Ten percent of an adult's diet is made up of juvenile dragons. Claws help the young climb trees to safety. The young often roll in fecal material, thereby assuming a scent that the large dragons avoid. Young often roll in fecal material, thereby assuming a scent that the large dragons avoid. This deters the adult Komodos from cannibalizing the young.
- Eyes are placed laterally on the side of the skull and covered by two unequal lids; upper lid has little mobility; lower lid contains a cartilaginous plate which slides over surface of the eye
- The lizards are generally solitary outside of mating season. Come together to feed however.
- Regulate their body temperature through behavior. Kimono dragons dig burrows with their powerful forearms and claws to escape the heat of the day and seek refuge at night. Komodo dragons bask in the morning sun to raise their body temperature.
- Retinas possess only cones, so they may be able to distinguish color but have poor vision in dim light.
- Males are larger and bulkier. Males fight for access to females. Using their tails for support, they wrestle in upright postures, grabbing each other with their forelegs as they attempt to throw the opponent to the ground. They are immune to venom.
- Mating occurs between May and August. Delayed laying in September allows eggs to be laid during the rainy season and not the hot dry weather giving the eggs a greater chance of survival.
- Komodo dragons swim well and have been known to cross the narrow ocean barriers between the islands they inhabit.
- # young 25 eggs, gestation 9 mos, sexual maturity 5-7 years.

Birds

- Four chambered heart, which is the most efficient system, as deoxygenated and oxygenated bloods are not mixed. The four chambered heart allows the blood leaving the heart to have far more oxygen than it would otherwise. This is good for enhancing the faster paced lifestyle that birds and mammals tend to have, giving an advantage to having a four chambered heart.
- Endothermic. A bird has greater stamina and can maintain a higher metabolic activity for a longer periods of time. Endotherms can maintain a constant body temp even in cold weather.
- When tree dwelling birds extend their limbs their toes open and their toes close when they flex due to tension placed on tendons as heel bends. This is an adaptation allowing birds to have a tight grasp when they alit.
- Structurally lightened. Hollow, reduced and fused bones allow for a rigid, light frame. In addition to hollow bones of birds of flight, the femur and humerus receive air sacs from the respiratory system. Wing has reduced digits and moves in one plane to reduce unnecessary expenditure of energy.
- Feathers function to insulate and protect skin and body, provide smooth streamlined surface area required for efficient flight and provide pattern and color, which are important in social behavior.
- Keeled sternum with powerful muscles attached to for flight and strong legs for takeoff and landings.

Chilean Flamingos

Habitat: Shallow, brackish salt water lakes & lagoons, usually in warmer climates

- Long legs are good for wading into much deep water.
- Webbed feet support them on soft mud and allow them to swim with ease.
- Uniquely bent bill with tooth-like ridges and hair-like lamellae for filtering food with bill upside down. With their bill upside the flamingo sweep their bill back and forth and are able to feed without getting their feathers wet. The fleshy tongue works to and fro like a piston, moving water back and forth through the bill's filtering apparatus (lamellae).
- Living in large flocks or colonies up to ten thousand birds or more stimulates breeding and provides "safety in numbers". Having so many individuals increases the possibility of predator sightings, but decreases the probability of an individual becoming prey.
- They have an excellent sense of hearing, but a very poor sense of smell. Flamingos are very gregarious especially in their nesting areas. They will defend their nest during breeding season.
- A lightweight skeleton helps birds to be able to fly. In order to fly, flamingos need to run a few paces to gather speed. They usually take off facing into the wind. In flight, flamingos are quite distinctive, with their long necks stretched out in front and the equally long legs trailing behind.
- Long wingspan provides flamingos with flight, which is used to escape predators and for migratory reasons in search of food and appropriate breeding areas. When flying, flamingos flap their wings fairly rapidly and almost continuously.
- Flamingos often stand on one leg, the other tucked beneath the body. Standing on one leg may allow the birds to conserve more body heat, given that they spend a significant amount of time wading in cold water. They typically will stand facing into the wind or rain so that the water does not get into their feathers.

- Flamingos may stamp their webbed feet in the mud to stir up food from the bottom.
- Every flamingo does not nest every year. When they do nest, they typically lay one large, white egg. The nest is built of mud, small stones, and feathers on the ground and is in the shape of a volcano. Eggs are torpedo shaped so won't roll from nest.
- Young are precocial and can leave the nest to swim easily after several days.
- Chicks gather in large groups or crèches. Parents are able to locate their own chicks in the crèche at feeding time and will feed no other chick. The chicks are recognized by sight and vocalizations.
- Adults feed their chicks a secretion of the upper digestive tract referred to as milk. Milk secretion is caused by the hormone prolactin, which both the male and female flamingo produce. Milk is red in color due to the pigment canthaxanthin. Chicks store this pigment in the liver, to be utilized when adult feathers are grown.
- Flamingos usually fly together in large flocks. The flamingos follow each other closely, using a variety of formations that help them take advantage of the wind patterns.
- Waterproof plumage for staying warm in a wet environment.
- The Chilean flamingo is scarce or absent in lakes with fish. It is present, usually in large numbers, where there are no fish with which to compete for food.
- A flamingo runs several steps, begins flapping its wings, and lifts off into the air. When landing the procedure is reversed: the bird touches down and then runs several paces. A flamingo flies with its head and neck stretched out in front and its legs trailing behind.
- Flamingos excrete salt through salt glands in the nostrils.
- Chicks begin to grow their flight feathers after 11 weeks. At the same time, the bill begins to hook, allowing the chick to feed itself.
- Chicks lose their juvenile gray or white color, and feathers turn pink gradually over one, two, or even three-years. The last part of the skin to turn pink is often the ankle or hock joint.
- # eggs 1-2, incubation 28-32 , fledging 11 weeks.

Magellenic Penguins

Habitat: rocky shores around the southern tip of South America.

- Flightless sea birds, which gave up their ability to fly in the air but have adapted to flying through the water. They have small paddle-like wings, which are broadened and flattened, which they use as flippers to propel them through the water. The muscles that move the wings are very strong and are the largest muscles in a penguin's body.
- Their black and white "tuxedo" coloring helps the penguins hide from predators when swimming in the ocean. The white belly blends in with the bright light coming from above, making the bird hard for seals to spot. From above, the dark back blends in with the dark ocean waves. This countershading allows penguins to warm up by turning their dark colored backs to the sun.
- Streamlined, torpedo shaped body for moving quickly through the water at speeds of 10-15 mph.
- Blubber and skin oscillates to minimize turbulence as they are swimming in the water.
- Solid dense bones, which are heavier than those of birds of flight. This allows them to be able to dive in the water.
- The beak is long, curved and sharp for seizing prey. Inside its mouth and over its tongue are protrusions that enable it to grip slippery prey.
- Three clawed feet give the penguin traction on ice and soft snow.
- Penguins have good hearing and a whole range of sounds from moos, bleats, cackles, and two-toned brays, which may be important for locating mates and chicks. Each bird has a unique sound ID.
- Low light vision to locate and capture prey in the ocean depths.
- Nictitating membrane that protects the cornea by moving vertically to clean, moisten and protect it.
- No binocular vision. Instead penguins continually move their head back and forth, looking from one eye then the other.
- Air sacks of birds reduced to simple lungs in penguin.
- Ability to reduce metabolism to conserve oxygen and be able to stay underwater hunting for food longer. Can stay under water for 5 minutes. Penguins breathe rapidly to restore oxygen when they come up for air.
- Short legs with rudder-like webbed feet that are far back on body maintain streamlining in the water and it allows the penguins to move about land and take big leaps. The feet are used to steer the penguin through the water when it pursues prey.
- Short uniform and dense waterproofed feathering with more than 70 feathers per square inch, each coated with oil for waterproofing warmth. The feathers' quality is maintained by preening using oil from glands at the base of the tail. The feather's shaft is flat which allows for a denser packing of feathers. The thick uniform covering of feathers overlap to cover a penguin's skin and decreases penetration of the cold marine water. Penguins do not have the variety of feathers other birds do. All feathers are all the same as they are only needed for insulation purposes. There are no bare skin or less fethered areas (apteria) between feather tracts.
- Penguins molt from the feet up 1x/yr. Penguins fatten up prior to molting.
- Penguins possess a salt excreting gland, which allows them to drink seawater, and shed the salt.
- Magellanic penguins often travel in large groups when searching for food. There is safety in numbers.
- They are excellent long-distance swimmers and as they swim, they pop out of the water to gulp air and then plunge back into the waves. This kind of swimming is called "porpoising." Effective strategy when searching for food and eluding predators. Penguins can hold their breath for long periods of time.
- Penguins head to land when threatened. If already on land they will waddle away from the threat and not head into the water. This is an adaptation to their most dangerous predators are marine.
- When nesting, they fast, using up stores of fat in their bodies. Both parents care for the chicks, taking turns finding food and regurgitating it for their young.
- Because of their excellent insulation and the warmer climates they live in, magellenic penguins are actually in greater danger of overheating than freezing. When penguins are too warm on land they may hold their wings out and fluffing their feathers. They will also pant through their open bill. The bare areas around the eyes and at the base of the tail facilitate thermal regulation as they are highly vascularized.
- Both male and females develop brood patches in order to keep the egg warm as they share parental care. The parents take turns caring for the egg/chick and foraging for food.
- Countercurrent heat exchange. To conserve heat, blood flowing to the flippers and legs transfers its heat to blood returning to the heart. If the body becomes too warm, blood vessels in the skin dilate, bringing heat from within the body to the surface, where it is dissipated.
- Breed in large colonies (rookery) as an adaptation to predation. There is safety in numbers.
- # eggs 1-2, incubation 42 days, fledging 11 weeks.

Bald Eagle

Habitat: Able to live anywhere there are adequate nest trees, roosts and feeding grounds, including open water such as rivers, lakes or ocean which is a necessity.

- Large, heavily built, strongly hooked bill used for tearing meat. Eagles do not chew their food, but tear it into manageable portions to be swallowed.
- Eagle has strong grasping talons with spiny scales (spicules) on soles of toes for gripping slipper fish, especially during flight.
- Exceptionally powerful large, frontal eyes. They have excellent binocular vision as well as peripheral vision. Bald eagles can see objects three to four times further away than humans.
- Eagle eyes are fixed in the socket and do not move. Instead they can turn their heads 270 degrees, which allows excellent monocular and binocular color vision.
- Excellent hearing for detecting danger and finding food.
- Communication is a high pitched scream, but broken into a series of notes in rapid succession. A greeting call is used by both sexes during breeding season.
- Large wingspan of up to 7 ½ ft. This eagle flies with deep strokes and soars on broad flattened wings reaching speeds up to 44 mph during migration. Females' wingspans are slightly larger than males.
- May reach 200 mph during a dive. Eagles strike their prey with enormous force allowing them to successfully hunt fish and medium sized mammals.
- A light skeleton and wings allow the bird to fly in search of food. The skeleton of an eagle weighs less than half as much as its feathers.
- Eagles store food in their crop prior to its entrance to the digestive system allowing them to gorge at each feeding. They subsequently sit, sleepy or half torpid, to digest their food.
- Large nests are usually in tall trees or on cliffs and usually near water where their primary food of fish is. Females spend a lot of time working on the nest. High perches allow them to scout for food and to spot their predators. Female does all the incubation of the eggs until they eggs are all laid. Then the duties are shared.
- Bald eagles have supraorbital ridges, boney ridges on the skull overhanging the eyes, protecting them from injury when catching and handling prey and also shielding them like a sun visor, reducing glare while flying and searching for food. The ridge enables the eagle to see into the water more easily while searching for fish.
- Reversal sexual dimorphism. The female is bulkier and squarer built. Females have deeper (distance from top to chin) beaks than males. Male does most of hunting so a smaller size is more advantageous. The female while slower can catch larger prey. Female spends more of her time protecting the eggs from predators so a larger size is advantageous.
- Eagles mate for life. The adult eagles can spend there time readying their nest, giving their chicks plenty of time to mature before cooler weather and resources become scarce.
- Eagles are territorial during nesting season. They will keep other eagles out of their own nesting area. Their nesting territory is usually one to two square miles. This is helps to ensure that there is adequate food for the pair and their brood.
- Eagles undergo partial molts, taking almost half a year to replace feathers, starting with the head and working downward. Eagles still need to be able to fly to get enough food.
- Shrill, high pitched vocalizations. Eagles do not have vocal cords. Instead sound is produced in the syrinx. Bald eagle calls may be a way of reinforcing the bond between the male and female, and to warn other eagles and predators that an area is defended.
- # eggs 1-3, incubation 35 days, fledging 10-12 weeks.

American White Pelican

Habitat: Coastal waters, large inland lakes, lagoons and estuaries

- Large pouched bill used for scooping fish. Its capacity may exceed 3 gallons. In flight the pelican normally carries its prey in the gullet so that the pouch can be retracted. The pouch also assists in keeping the bird cool by creating a large surface area for evaporation when it is extended and can be used to collect rainwater. (gular flutter)
- The large wingspan provides powerful flight enabling the pelican to carry fish while flying.
- A light skeleton and wings allow the bird to fly in search of food. Flight is a combination of flapping and sailing, not rapid but steady.
- Adept soaring bird. Furcula is fused to the sternum at its "v" and the arms that are attached to the shoulder are sturdier than most birds. Pectoralis muscle has deep muscle belly with slow twitch fibers that can help hold the wings horizontal for long periods of time.
- Large body size must run vigorously on the water to become airborne. In the air, the pelican are aerial acrobats. The large body in the water gives stability and the dense feathers holds air for buoyancy.
- Long neck allows the bird to rest its heavy beak on its breast, both while resting and flying.
- Forward facing eyes for binocular vision.
- Downcurved hook at the end of the upper mandible. This allows the pelican to help keep the fish in his pouch as they are draining the water from their bills.
- Breeding comb develops during breeding season and is shed with the fall molt.
- Totipalmate feet. Large webbed feet help to propel the pelican through the water faster and with ease to catch prey or escape a predator. The webbed feet can help the pelican save energy so it can swim farther.
- Fish cooperatively. Pelicans can hunt in teams that gather on the water. Pelicans open their wings only partly to cast a shadow making it easier to see their prey. They form a line or large circle to drive fish into shallow water and gradually close in on them. This movement is synchronized, as are their flights that sometimes form a "V" formation.
- Network of subcutaneous air sacs under the skin at the ventral surface including throat breast and underside wings as well as air sacs in their bones. The air sacs serve to keep the pelican buoyant and may cushion the impact of the body when landing.
- Preen glands to help waterproof feathers.
- Both parents share incubation.
- Altricial young the adults that are fed by their parents by dribbling a watery food into their mouths. Chicks tend to have few or no feathers on face to keep them clean from their feeding method. As the chicks become stronger they are able to reach into their parent's gullet to reach the partially digested fish.
- # eggs 2-4, incubation 29 days, fledging 60 days.

Brown Pelican

Habitat: Maritime; salt waters. Strictly coastal and rarely seen inland

- Large pouched bill used for scooping fish. Its capacity may exceed 3 gallons. In flight the pelican normally carries its prey in the gullet so that the pouch can be retracted. The pouch also assists in keeping the bird cool by creating a large surface area for evaporation when it is extended and can be used to collect rainwater. (gular flutter)
- Brown pelicans are unique in that they dive from the air from heights of up to 30 feet for food, keeping their wings partly folded. Under its skin on the breast, the layer of air pockets protects the bird from the force of the dive.
- The large wingspan provides powerful flight enabling the pelican to carry fish while flying.
- A light skeleton and wings allow the bird to fly in search of food. Flight is a combination of flapping and sailing, not rapid but steady.

- Adept soaring bird. Furcula is fused to the sternum at its “v” and the arms that are attached to the shoulder are sturdier than most birds. Pectoralis muscle has deep muscle belly with slow twitch fibers that can help hold the wings horizontal for long periods of time.
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- Downcurved hook at the end of the upper mandible. This allows the pelican to help keep the fish in his pouch as they are draining the water from their bills.
- Breeding comb develops during breeding season and is shed with the fall molt.
- Totipalmate feet. Large webbed feet help to propel the pelican through the water faster and with ease to catch prey or escape a predator. The webbed feet can help the pelican save energy so it can swim farther.
- Fish cooperatively. Pelicans can hunt in teams that gather on the water. Pelicans open their wings only partly to cast a shadow making it easier to see their prey. They form a line or large circle to drive fish into shallow water and gradually close in on them. This movement is synchronized, as are their flights that sometimes form a “V” formation.
- Network of subcutaneous air sacs under the skin at the ventral surface including throat breast and underside wings as well as air sacs in their bones. The air sacs serve to keep the pelican buoyant and may cushion the impact of the body when landing.
- Preen glands to help waterproof feathers.
- Both parents share incubation. Pelicans incubate their eggs with their feet. They hold the eggs under the webs that stretch from the front toes to the hind toe, essentially standing on the eggs to warm them.
- Altricial young the adults that are fed by their parents by dribbling a watery food into their mouths. Chicks tend to have few or no feathers on face to keep them clean from their feeding method. As the chicks become stronger they are able to reach into their parent’s gullet to reach the partially digested fish. Usually only one chick is raised.
- # eggs 2-3, incubation 28-30 days, fledging 5 wks.

Great Hornbill or Great Indian Hornbill

Habitat: Tall evergreen forests canopies

- The hollow yellow casque may be used to amplify their call. In the male this casque has two points in front while the female’s does not.
- Hornbills are the only birds in which the first two cervical vertebrae (axis and atlas) are fused together; this provides a more stable platform for carrying the bill.
- Sexual dimorphism. The male's casque is larger than the female's and his eyes are red with a black rim where as the females is white with a red rim that intensifies during breeding.
- Omnivorous diet of fruits (mainly figs), insects, small reptiles, birds & mammals. Hornbills throw their food into the air then catch it.
- Great hornbills nest in a hollow tree, and the pair seals the entrance to the nest using mud, bits of bark and soft food like fruit pulp. Sealing the nest creates a barrier to predators.
- The female stays inside the nest to incubate up to two eggs, and the male feeds her through a tiny slit in the wall by regurgitation. The female leaves the nest when the older chick is between 15 and 60 days old, then assists the male in catching food to feed the young.
- Nest is kept clean to the point where the chicks will defecate through the nest opening.
- The female has a complete molt during her time on nest.
- Monogamous pairs live in groups of up to 40 individuals.
- Hornbills show their age by folds on their casque, which is made of keratin.
- Most hornbills are strong in flight, and the sound of air passing between the feathers in their wings can be very loud. As different hornbill species give different flight noises, some biologists believe that hornbills use the sound of their flight to communicate with one another, signaling their arrival or departure to other birds.
- Large bill for diet of an occasional insect, small reptile, bird or mouse, but the majority of its diet consists of fruit, especially figs. Bills are used for various functions including feeding, grooming, and nest-sealing.
- # eggs 1-4, incubation 38-40 days, fledging 30 days.

Wrinkled Hornbill

Habitat: Broadleaved evergreen forest, freshwater swamp forest, lowlands

- Hornbills have a casque on their head. The hollow casque may be used to amplify their call.
- Hornbills are the only birds in which the first two cervical vertebrae (axis and atlas) are fused together; this provides a more stable platform for carrying the bill.
- Sexual dimorphism. The female is smaller than the male with a smaller casque. Coloring is different.
- Large bill for frugivorous diet. Bills are used for various functions including feeding, grooming, and nest-sealing.
- Great hornbills nest in a hollow tree, and the pair seals the entrance to the nest using mud, bits of bark and soft food like fruit pulp. Sealing the nest creates a barrier to predators.
- Wrinkled hornbills do not drink water. They get their water requirements from the food they eat.
- The female stays inside the nest to incubate up to two eggs, and the male feeds her through a tiny slit in the wall by regurgitation. The female leaves the nest when the older chick is between 15 and 60 days old, then assists the male in catching food to feed the young.
- Nest is kept clean to the point where the chicks will defecate through the nest opening.
- The female has a complete molt during her time on nest.
- Monogamous pairs live in groups of up to 30 individuals. Females rely on their mate, so courtship occurs throughout the year to maintain strong pair bonds.
- Hornbills show their age by folds on their casque, which is made of keratin.
- Most hornbills are strong in flight, and the sound of air passing between the feathers in their wings can be very loud. As different hornbill species give different flight noises, some biologists believe that hornbills use the sound of their flight to communicate with one another, signaling their arrival or departure to other birds.
- # eggs 2-3, incubation 30 days, fledging 65 - 73 days.

Blue-bellied Roller

Habitat: Wooded areas often on the edge of open or recently burned areas.

- A light skeleton and wings allow the bird to fly in search of food and to escape predation.
- Robust, hook-tipped bill reflects mainly carnivorous. Eats mainly large insects.
- Anisodacty feet for perching. Legs are short and feet small. Spend time perching and not hopping along branch.
- Courtship display involves two birds in fast chases around and above trees, the one following often breaks away and rockets down in fast shallow flight, rolling and calling. This is how they got their name.

- Typically in small groups of three to six exhibiting many social behaviors. This includes calling, chasing, flying together and defending territories together. These activities show territoriality, maintain group unity, and initiate courtship.
- Cavity nesters.
- Males more numerous than females.
- Polygamous. One male mates with one or two females. Parents share in incubation although female does the majority of the work.
- Altricial young. Nestlings fed by regurgitation.
- # eggs 2-3, incubation 22-24 days, fledging 4 wks, totally independent 40 days.

Laughing Kookaburra
Habitat: woods, temperate forests, scrub, often far from water.

- A light skeleton and wings allow the bird to fly in search of food and to escape predation. Laughing Kookaburra is the largest of the kingfisher species but it only weighs ~14oz.
- Their brown coloration allows these birds to blend into their surroundings.
- Very large bill is broad and flattened and hooked at the tip for their carnivorous diet of lizards, snakes, crabs, large insects and small rodents. Most prey is caught on the ground, and larger prey items are stunned with a swift smack on the ground or a perch.
- Large prominent eye, which provides keen sight for hunting by perching on a convenient branch or wire and waiting patiently for prey to pass by.
- Kookaburras are usually seen in pairs, and their characteristic laughing call may be used to remain in contact with one another and establish territory amongst family groups. It can be heard at any time of day but most frequently shortly after dawn and after sunset to dusk.
- Kookaburras tend to live in family units, with offspring helping the parents hunt and care for the next generation of offspring.
- Their selection of habitat depends primarily on the availability of tree hollows for nesting.
- Male and female incubate eggs. They generally lay three eggs at about 2 day intervals. If the food supply is not adequate the third egg will be smaller and the third chick will also be smaller and at a disadvantage to its larger siblings.
- Altricial young. Chicks have a hook on the upper mandible, which disappears by the time of fledging. If the food supply to the chicks is not adequate the chicks will quarrel and the hook can be used as a weapon with the smallest chick being killed by its larger siblings. If food is plentiful the parent birds spend more time brooding the chicks and so the chicks are not able to fight.
- Kingfishers are spectacular divers. They plunge with powerful wing beats into the water, seizing the fish with closed eyes.
- Anisodacty feet for perching with the middle and outer toes joined for most of their length. The fused toes help them in excavating nests, but make walking almost impossible so they hop/jump when on the ground.
- # eggs 2-4, incubation 25 days, fledging 40 days.

Western Gray Plantain Eater
Habitat: Open woodland habitats in tropical west Africa.

- Semi-zygodactylus foot, in that the outer toe of each foot can face either forwards or backwards. When roosting, the typical arrangement is to have three toes facing forward to increase the hold of a perch, when running along branches the toe formation will tend towards two toes forwards and two backwards, again increasing the grip.
- Wings are rounded and their tails long and broad which assists them when foraging in amongst the branches of trees. As a member of the turaco family, they are particularly agile even when flying at speed through thick vegetation.
- Large beak for feeding on fruit, especially figs, seeds and other vegetable matter.
- Play an important ecological role in seed dispersal. Their digestion is rapid and often incomplete, so they need to feed at frequent intervals and on comparatively large quantities of fruit. The result of such an eating pattern is that many plant species have their seeds dispersed.
- Noisy and conspicuous birds. Emit loud “cow-cow cow” sound. Very shy.
- Tree platform nest. Small parties (2-4 birds) roost in treetops.
- Pair bonding is exceptionally strong manifested by greeting displays with bowing and tail-fanning, regurgitated food exchanges and loud calls given on landing in the crown of the tree.
- Both birds in a pair share parental responsibilities during breeding.
- Chicks can leave the nest at about 3 weeks even before they are able to fly.
- # eggs 2-3, incubation 27-28 days, fledging days.

White-cheeked Turaco
Habitat: Dense humid forest and woodlands 7,218’-10,499’

- Turacos are the only birds to possess true red and green pigmentation. When you look at most birds, the color you are seeing is a reflection produced by the feather structure. The turaco's red pigment (turacin) and green pigment (turacoverdin) both contain copper.
- These birds also warn other animals of predators with their bright red wings in flight. When faced with danger, they sit very still and fly away at the last minute with power flaps, revealing the crimson color under their wings. The red wing flash when birds are in flight may be used as a way of keeping in touch with family members and of indicating territory boundaries
- Long tails for balance.
- Semi-zygodactylous foot structure used for obtaining a very good grip on branches. The fourth toe is set at right angles to the foot and can rotate forward or backward in order to have a better grip on their perch and aids their tree-climbing abilities. They climb and run along branches easily, using their wings and feet.
- These turacos live in flocks of up to 12 individuals. They are shy and prefer to perch out of sight.
- Mainly frugivorous. A turacos search for fruit is thorough and systematic. Their feeding habits are very destructive, but they aid in seed dispersal by messily eating fruit. The many seeds that pass through their system create new growth.
- The male will feed female during courtship. They are monogamous in breeding and both parents contribute equally to incubation, brooding and feeding. Once the eggs have hatched, other flock members help the new mother care for the chicks. Chicks are fed on predigested fruit.
- Baby turacos have open, or nearly open eyes and tiny claws on the ends of their wings that assist them in clinging to branches and are lost upon maturity. Young turacos will leave the nest long before they can fly to clamber about the treetops.
- Broad, rounded wings provide weak flight, but turacos run quickly through the tree canopy. Turacos do not migrate.
- They have stable territories, which are defended by calling.
- In spite of their obvious coloring, Turacos are difficult to see among foliage. In trees, they clamber about with considerable agility and are easily overlooked as they perch stationary along a branch.
- # eggs 2-3, incubation 21-24 days, fledging 4 weeks.

Black Swan
Habitat: Lakes & ponds that can be fresh, brackish or salt.

- Swans mate for life, nesting in the same territory year after year. They nest in the center of the lake and rebuild each year.
- Swans have long and thick, strong bills for feeding on salt tolerant water plants.
- Both parents perform incubation duties.
- Swans have 25 vertebrae in the neck, while humans have only seven; this allows for much greater neck flexibility.
- Waterproof plumage for staying warm in a wet environment.
- Webbed feet help to propel the swan through the water faster and with ease to catch prey or escape a predator. The webbed feet can help the swan save energy so it can swim farther.
- Long neck eliminates the need to dive for food.
- The young, or cygnets, are able to fly two months after hatching.
- Parents have a staggered molt with the female going first at the start of laying the clutch. As she regains her flight abilities the male will begin his molt and then regain his flight at the same time as the cygnets.
- A light skeleton and wings allow the bird to fly in search of food and to escape predation. Swans require long running start for flight. In flight, swans do not have maneuvering ability and often collide in mid-air.
- Colonial. Form small colonies of nesting pairs. Other types of swans will not nest in groups.
- Migrate in lines or "V" formation, which conserves their energy. Each bird flies slightly above the bird in front of him, resulting in a reduction of wind resistance. The birds take turns being in the front, falling back when they get tired. A flock flying in formation can move faster and maintain flight longer than any one bird flying alone.
- Male and female share incubation duties. Nests are constructed from twigs & reeds in the center of a lake and will rebuild it year after year.
- Parents have a staggered molt with the female going first at the start of laying the clutch. As she regains her flight abilities the male will begin his molt and then regain his flight at the same time as the cygnets.
- Long, thick, strong bill for feeding on plants.
- # eggs 3-9, incubation 35-40 days, fledging 150-170 days.

Black Parrot or Lesser Vasa Parrot
Habitat: woodlands, dense humid and waterlogged forest including mangroves, but also savanna, dry forest up to 6,700'

- A light skeleton and wings allow the bird to fly with strong wings in search of food and to escape predation.
- Strongly hooked beak, which is used as a hand to aid in climbing trees and perching.
- Feet are zygodactyl. They use their claws for eating fruits, berries, flowers and seeds. They feed on fruit in treetops, sometimes picking it when hanging upside down.
- The black parrot is gregarious and forms noisy groups of from 3 to 15 birds.
- They also have a keen sense of hearing for birds of prey, their primary form of predation on young and smaller species.
- Parrots are monogamous and often appear very devoted to their mate. Mating pairs often nest in unlined hollows of trees, rocks, banks or termite nests. Almost always seen in pairs and are seldom seen alone.
- Both parents incubate the eggs.
- Hatchlings are altricial and only the female feeds the young, and the males forage for food. One hen with eggs or chicks will be fed by several males and during the feeding process copulates with each one.
- When breeding, plumage has iridescent green sheen, the bill turns pale, and birds show a fleshy protrusion from the cloaca. Naked skin around eye is rosy gray. During breeding season, the female sheds feathers on her head and the skin around the beak turns rich saffron yellow; the skin on the male's head turns a very dark grey-black and develops a deep saffron to orange wattle under the lower beak.
- # eggs 2-3, incubation 18 days, fledging 5-7weeks.

South African Black Duck
Habitat: wooded upland fast flowing streams and low land slower streams.

- Webbed feet for aquatic life help the black ducks propel themselves through the water with ease enabling them to swim faster and farther by being energy efficient.
- Feeds both on land and in the water. These birds are omnivores and besides the grasses may also feed on various insects and crustaceans. Feed by dabbling but also by probing with bill, head or neck submerged; occasionally up-ends.
- Waterproof plumage for staying warm in a wet environment.
- Forms breeding pairs, which are territorial in the breeding season. Pair bonds are thought to persist over more than one season.
- The female built nest is made using materials within reach of site. It is built on the ground, in dense grass or other ground cover for protection.
- Only the female incubates the eggs and cares for the altricial young.
- They are strong fliers and partially migratory.
- A shy and territorial duck generally found in pairs. Though it likes to stay in rivers and streams during the day it prefers large open waters during the night.
- # eggs 4-8, incubation 28-32 days, fledging 86 days.

Marbled Teal or **Marbled Duck**
Habitat: freshwater or brackish shallow ponds and marshes with abundant vegetation in arid country.

- Long bill that is wide and fat for eating aquatic plants and aquatic invertebrates.
- Webbed feet for aquatic life help the teal propel themselves through the water with ease enabling them to swim faster and farther by being energy efficient.
- Diving Duck. Teals are good swimmers and skilled divers. They rarely dive for food instead they dive to hide from predators.
- Female raises chicks. Male leaves female early in breeding cycle.
- Nest is close to water and well concealed in tall grasses.
- Teal are generally found in pairs or small family groups.
- Gregarious birds.
- Long neck for reaching aquatic plants.
- A light skeleton and wings allow the bird to fly in search of food and to escape predation. Characteristic low, slow flight.
- # eggs 9-12, incubation 25 days, fledging 25-30 days.

Long-Tailed Glossy Starling

Habitat: open woodland and cultivation

- Anisodactyl feet for perching. All toes are 'locked' by special muscles when the bird alights.
- Gregarious and noisy species whose call is harsh and grating.
- Starlings have an unusual bill that springs open to grip prey or pry plants apart.
- Omnivorous diet of fruits and insects (mostly from the ground).
- Voice box muscles are specialized. Air passed through the syrinx is modified by contraction and relaxation of these muscles.
- Altricial young.
- Nest is built in a hole in 1-3 days. Clutch size 2-4 with both male and female incubating.
- Starlings only molt once a year after breeding.
- In Starlings, the length of the intestinal tract actually varies depending on the season. It is shorter in the summertime (when birds are mainly eating protein-rich) insect foods and larger in wintertime when they are mainly eating seeds, which are rich in carboyhydrates.
- Starling flight is direct and fast, unlike the rising and falling flight of many blackbirds.
- # eggs 2-4, incubation 12 days, fledging 21-23 days.

Keel-billed Toucan

Habitat: canopies of tropical, subtropical, and lowland rainforests, up to altitudes of 6,200 ft

- Zygodactyl feet for climbing. Toucans spend a large portion of time in the trees, this helps the birds to stay on the branches of the trees and jump from one branch to another.
- Bright plumage serves as camouflage in the colorful rain forest canopies.
- Large bill allows them to reach fruit on branches that may not support their weight. It is also used for thermo-regulation and It intimidates other birds, allowing the toucan to plunder their nests.
- Bill is spongy and mostly hollow bone covered in keratin. Fibers are in honeycomb shape making bill extremely strong.
- Tooth-like ridges on edge of bill.
- The last three vertebrae are fused, joined to the spine with a ball and socket joint to help them support their large bill. This joint allows them to flip their tails above their bodies; this compact posture allows many to roost together at night in even smaller hollows.
- Toucans are generally gregarious and fly in small flocks or pairs.
- Wings are wide and short allowing them to fly through trees.
- Sexual dimorphism. Male is heavier and larger than female
- Frugivorous diet. Toucans are seed dispersers.
- Usually in pairs or family groups. They are extremely social.
- Male courtship involves head and tail jerk with vocalization. Male may offer female food in order to get mate.
- Cavity nesters. Will fold up tail over its back and tuck bill under its wing to conserve space. Availability of mature trees with natural nesting sites is of paramount importance to survival.
- Altricial young. Fully feathered at 37 days.
- Young have adequately formed heel pads, which protect them against the pit-covered bottom of the nest.
- Molting 1x/year
- Nest in tree cavities. Male and female do the incubating, feeding and caring for chicks.
- # eggs 1-4, incubation 16-20 days, fledging 42-47 days, sexually mature 2 yrs.

Curl-crested Aracari

Habitat: tropical moist lowland forests

- Zygodactyl feet for climbing.
- Found in gregarious small flocks or pairs.
- Bright plumage serves as camouflage in the colorful rain forest canopies.
- Large bill allows them to reach fruit on branches that may not support their weight. It is also used for thermo-regulation and It intimidates other birds, allowing the toucan to plunder their nests.
- Seed disperser. Eat fruit whole. Larger seeds are regurgitated and smaller ones pass through digestive system.
- The last three vertebrae are fused, joined to the spine with a ball and socket joint to help them support their large bill. This joint allows them to flip their tails above their bodies; this compact posture allows many to roost together at night in even smaller hollows.
- Toucans are generally gregarious and fly in small flocks or pairs. .
- Relatively small wings for flying short distances.
- Excellent eyesight and a keen sense of hearing.
- Allopreening to reinforce bonds.
- Long thin, feather-like tongue extends to the end of the bill. The feathering effect exposes more taste-buds, enhancing the importance of taste to the toucan
- Frugivorous diet
- Altricial young.
- Nest in tree cavities. Male and female share duties.
- # eggs 3-6, incubation 16 days, fledging 43-50 days.

Indian Peafowl

Habitat: Open hilly forest near water

- Sexual dimorphic: Male (peacock) is larger and more iridescent with a tail train during the breeding season. The more magnificent males tend to get the majority of available females (peahen). Females tend to chose the male with the most eyespots. The male also has a spur on their feet used to defend breeding territories. Female cryptic coloration for better camouflage and protection against predators.
- Terrestrial feeders. Bills are short, stout and curve downward for their omnivorous diet of seeds, fruit, berries, roots, worms, insects and snails. The will feed on baby cobras.
- Moderately strong legs and anisodactyl feet. They are strong runners and are able to fly up to perch in trees.
- Male has special display sites and a ritual performed within his territory when it is trying to get the female's attention. Females will display to ward off danger or other female competition whereas males display to attract a potential mate.
- Relatively small wingspan. The short wings are incapable of long flight but are used to fly short distances to escape danger. They are non-migratory.
- Precocial young. Peacock is polygamous and the male takes no part in raising his young.
- # eggs 3-5, incubation 28-30, fledging 115 days.

Temminck's Tragopan
Habitat: Evergreen and mixed forest between 3,000 and 12,000 feet above sea level; with bamboo and rhododendron

- Sexual dimorphic: Male is larger and more colorful. Males perform courtship rituals to gain breeding rites with females.
- Female cryptic coloration for better camouflage and protection against predators and protection when protecting the nest.
- Terrestrial feeders. Bills are short, stout and curve downward for their herbivorous diet of seeds, and plants.
- Moderately strong legs and anisodactyl feet. They are strong runners. Their four-toed clawed feet are adapted to scratch the dirt and leaf litter, uncovering seeds and insects in the ground.
- Tragopan's nest in bushes a few feet off the ground.
- Migrate up and down the mountain slopes according to seasons to better find a food supply.
- Short, rounded wings are used for short flights to escape danger. Wings are not adapted for long flight.
- Precocial young. Young are able to feed themselves and leave the nest hours after birth. They are able to fly within days of birth.
- # eggs 3-5, incubation 26-28, fledging < 1 week.

Satyr Tragopan
Habitat: Moist oak and rhododendron forest with dense undergrowth and bamboo clumps, between 8000 and 14,000 feet above sea level in summer and 6,000 in winter

- Sexual dimorphic: Male is larger and more colorful. Males perform courtship rituals to gain breeding rites with females.
- Female cryptic coloration for better camouflage and protection against predators and protection when protecting the nest.
- Terrestrial feeders. Bills are short, stout and curve downward for their herbivorous diet of seeds, and plants.
- Moderately strong legs and anisodactyl feet. They are strong runners. Their four-toed clawed feet are adapted to scratch the dirt and leaf litter, uncovering seeds and insects in the ground.
- Tragopan's nest in bushes a few feet off the ground.
- Migrate up and down the mountain slopes according to seasons to better find a food supply.
- Short, rounded wings are used for short flights to escape danger. Wings are not adapted for long flight.
- Precocial young. Young are able to feed themselves and leave the nest hours after birth. They are able to fly within days of birth.
- # eggs 3-5, incubation 26-28, fledging < 1 week.

Himalayan Monal
Habitat: Open coniferous or mixed forests with bamboo; elevated forests, cliffs and meadows between 7900 - 14800 feet (6600 feet in winter).

- Sexual dimorphic: Male is larger and more colorful. Males perform courtship rituals to gain breeding rites with females.
- Female cryptic coloration for better camouflage and protection against predators and protection when protecting the nest.
- Terrestrial feeders. Bills are short, stout and curve downward for their herbivorous diet of seeds, and plants.
- Moderately strong legs and anisodactyl feet. They are strong runners. Their four-toed clawed feet are adapted to scratch the dirt and leaf litter, uncovering seeds and insects in the ground. They tolerate snow and will dig through it to obtain plant roots and invertebrate prey.
- Nest is a scrape in the ground.
- Migrate up and down the mountain slopes according to seasons to better find a food supply.
- Short, rounded wings are used for short flights to escape danger. Wings are not adapted for long flight.
- Precocial young. Young are able to feed themselves and leave the nest hours after birth. They are able to fly within days of birth.
- # eggs 3-5, incubation 26-28, fledging < 1 week.

Blue-throated Piping-guan
Habitat: Tropical forests including riverine forests in lowlands (occasionally as high as 1000 m). Favors the edges where the forest meets open land or a river.

- Almost completely arboreal in the canopy. It walks nimbly or hops with help from its wings in the canopy or sub-canopy.
- Mainly frugivorous. Mostly seen in trees with fruit that they eat.
- Solitary or in small groups of up to 12.
- Visit salt and clay licks to possibly supplement diet.
- Precocial young. Unlike most species with precocial young, they are fed by their parents.
- Monogamous. Both parents share reproductive duties
- # eggs 3-5, incubation , fledging

Blue-headed Macaw
Habitat: humid lowland evergreen forest, along rivers and by clearings from the lowlands up to an altitude of 5100 ft

- Strongly down curved beaks that are light weight in proportionate to large size. The beak is used as a hand to aid in climbing trees and perching.
- Macaws feed on seeds and fruits. Macaws often flock to mountains of clay known as "macaw licks". Such licks contain minerals and salts essential to the bird's diet. Macaws are able to eat some poisonous fruits, as the clay appears to neutralize the toxins.
- Found in groups of 2-3 in the nonbreeeding season.
- Zygodactyl feet. Members of this family are the only birds to use their claws for feeding.
- The body is compact with strong wings
- Excellent eyesight and a keen sense of hearing.
- Thought to be cavity nesters
- # eggs 2-4, incubation 1 mos, fledging 3 mos.

Cuban Amazon
Habitat: woodlands and dry forests

- Strongly down curved beaks that are light weight in proportionate to large size. The beak is used as a hand to aid in climbing trees and perching.
- Macaws feed on seeds and fruits. Macaws often flock to mountains of clay known as "macaw licks". Such licks contain minerals and salts essential to the bird's diet. Macaws are able to eat some poisonous fruits, as the clay appears to neutralize the toxins.
- Found in gregarious flocks in the nonbreeeding season.
- Zygodactyl feet. Members of this family are the only birds to use their claws for feeding.
- The body is compact with strong wings
- Excellent eyesight and a keen sense of hearing.
- Cavity nesters.

- # eggs 2 - 5, incubation 26 – 28 days, fledging 56 – 60 days.

Vinaceous-breasted Amazon
Habitat: woodlands and dry forests
- Strongly down curved beaks that are light weight in proportionate to large size. The beak is used as a hand to aid in climbing trees and perching.
- Found in gregarious small flocks in the nonbreeeding season.
- Zygodactyl feet. Members of this family are the only birds to use their claws for feeding.
- The body is compact with strong wings
- Excellent eyesight and a keen sense of hearing.
- Cavity nesters.
- # eggs 3 - 4, incubation , fledging .

Severe or Chestnut-fronted Macaw
Habitat: woodlands and dry forests
- Strongly down curved beaks that are light weight in proportionate to large size. The beak is used as a hand to aid in climbing trees and perching.
- Found in gregarious small flocks in the nonbreeeding season.
- Zygodactyl feet. Members of this family are the only birds to use their claws for feeding.
- The body is compact with strong wings
- Excellent eyesight and a keen sense of hearing.
- Cavity nesters. Both male and female share duties
- # eggs 2 - 3, incubation 28 days, fledging 70 days.

Crested Oropendola
Habitat: lowland forest edges and clearings, grasslands, savannas, and marshes.
- Males are crested allows and have a slight gloss allowing them to attract females.
- Each colony has a dominant male. Colonies stay close for protection.
- Courtship involves elaborate vowing display. Male bows over branch while shaking tail and vocalizing to attract female.
- Gregarious and live in large flocks
- Musky smell from oil of preen gland.
- Long teardrop nest woven from grasses and suspended from tall isolated tree. Protects chicks from predation.
- Females incubate eggs while male protects nest from predators
- # eggs 2, incubation 15-19 days, fledging 24-36 days.

Green Jay
Habitat: Dense forest and thick scrub; in Texas open woodland and brushy mesquite thickets
- Well concealed nest for protection of the chicks.
- Females incubate eggs but both care for altricial young
- Strong bill for omnivorous diet of insects worms, acorns, seeds and fruit
- Sturdy legs for hoping along branches in the forests.
- They will rarely consume food immediately but will carry it in their bill to a perch where they then hold it in their feet and peck it apart before swallowing in smaller bits.
- Green Jays have been observed using sticks as tools to extract insects from tree bark. Other crows have been seen with this same behavior.
- # eggs 4, incubation 17 days, fledging 19 – 22 days.

Glossary

Adaptation: Specialization of an animal's physical structure or its behavior, which helps the animal survive.

Altricial: Helpless and naked when born or hatched.

Anisodactyl: A bird's foot in which three toes point forward and one points backwards.

Behavior: Any action performed by a living thing.

Camouflage: The color and patterns of an animals' skin, feathers or fur, which makes them harder to see when in their natural surroundings/habitat.

Climate: The prevailing set of weather conditions in any place.

Competition: The struggle between two or more animals using the same limited food source, shelter or other resources.

Crepuscular: Active at twilight or before sunrise.

Defenses: the methods/characteristics an animal uses/ has to protect itself.

Digitigrade: Walking so that only the toes touch the ground.

Diurnal: Active during the day.

Evolve: To change over a long period of time through many generations.

Feature: A part of the body.

Habitat: The place in which an animal or plant normally eats, drinks, sleeps and moves around. Habitat is an animal's home.

Locomotion: The act of moving from place to place.

Natural selection: The survival of individuals or groups who are best adapted to their environment. This process perpetuates desirable genetic (hereditary) qualities and eliminates undesirable ones.

Nocturnal: Performing most actions at night.

Pectinated: having teeth like a comb.

Precocial: Birds covered with down and capable of moving about when first hatched.

Predator: An animal, which must hunt other animals for food.

Prehensile: Adapted for seizing or holding by wrapping around an object.

Prey: An animal, which is hunted by other animals as food.

Survival: Continuing to live as a species.

Trait: A distinguishing feature.

Zygodactyl: Having two toes projecting forward and two projecting backward.