

ZOO LAB – DIVERSITY OF LIFE

Today's Lab – Zoo hours 9AM-5PM, \$9.00 admission with a NM-issued ID, maps available in the office. It might be easier to plan on going on two separate days. I really would like you to enjoy the zoo, and the packet is long! Read the lab before going, refer to cabq.gov/culturalservices/biopar/zoo/exhibits for information, look up terms you don't know in your text, and go in a group, if possible. If any animal is not present, simply write "not on display." Do not leave sections blank!

A zoo is an ideal place to study adaptations possessed by animals and, to a lesser degree, plants. The Rio Grande Zoo have a variety of birds, primates, reptiles, amphibians, grazing animals, cats, bears, wolves, kangaroos, elephants, sea lions, people (not in cages!), and a few fish. All are in environments that are fairly similar to their natural habitats. All have many adaptations to finding food, processing food, avoiding being eaten, attracting mates, coping with the weather, etc.

Zoo Visit – Tour (Plan to spend most of the day here. Bring a bottle of water, sunscreen, and a snack.) Consider questions in this handout, but also write other questions as well about the various zoo animals. Please write new questions in the margins of this packet in areas that correspond with the animals' locations in the zoo. Please highlight these questions! You should write at least eight new questions.

You may visit exhibits in any order. Be sure to look at all signs, including those that are part of an overall display (not just the ones describing the animals).

➤ **The Flamingo Pond**

Why do you think colonial nesting is an advantage? If predators aren't an issue, then why can't small groups of flamingos successfully nest in captivity?

Suggest a reason why they stand on one leg. (Note where they are standing.)

What advantage do you think webbed feet give them?

How do these birds excrete excess salt?

[Turn left just after the flamingo pond, there is a sign that says, "To Exhibits."]

➤ **Tropical America**

As you enter this display, there is a sign to your left. What percentage of earth's species inhabit tropical rainforests? _____

Look at the very first enclosure across from the door. How do black howler monkeys use their tails?

Interestingly, prehensile tails like those of the black howler monkey are found only in some North and South American primates. This tail is hairless on the underside and sensitive enough to identify small objects, yet strong enough to support the monkey's weight. Consider the fact that the "New World" (North and South America) and the "Old World" (Eurasia and Africa) were connected until 55 million years ago – there was no Atlantic Ocean! Did the prehensile tail of the New World primates evolve before or after the formation of the Atlantic Ocean?

Note the grooming behavior in the howler monkey (and in all primates at the zoo). What are some benefits of this behavioral adaptation?

How do rainforests keep the earth's ecosystems in balance? (There is a sign to the right that will help.)

The Andean tinamou, along with many ground-dwelling and ground-nesting birds tend to be camouflaged. This adaptation is known as cryptic coloration. This adaptation has also evolved in many mammals. Is cryptic coloration an advantage to herbivores, carnivores, or both? Explain.

These birds have a unique reproductive strategy. What can you infer about mating behavior in this species? Which competes more, males or females? Which has a larger investment in offspring?

The basilisk lizard can run on the water to escape predators. What else can it do?

How do the yellow-footed tortoise and the red-footed tortoise illustrate the competitive exclusion principle?

How does an arowana catch birds?

How do piranha cope with living in water low in dissolved oxygen?

The green anaconda is a great swimmer. A tree-climbing snake will generally have a heart very close to its head so pumping blood to the brain is possible. Where do you think this snake's heart is located? Why?

The South American lungfish is an ancient species that will drown if kept from the surface. (One that is easier to see is in the Triassic display at the Museum of Natural History) What is meant by "lungfish"? What does it do in times of drought? How long can it survive without food and water?

What has led to the Micronesian kingfisher's extinction in the wild?

How do the eating habits of the Toco toucan help maintain the forest?

➤ **The Reptile House**

Many of these animals are highly venomous. Antivenin is expensive and generally expires annually, but they must keep each type of antivenin on hand in case of emergency. Not many zoos would maintain such a collection.

People used to think that the Komodo Dragon's bite was only toxic because of its habit of eating carrion. What does its venom actually do?

Why do farmers welcome the Mexican Lance-Headed Rattlesnake?

What is unique about the Quince monitor's jaws?

How many species of rattlesnake are native to New Mexico?

How many people die from rattlesnakes each year?

What is the difference between neurotoxic and hemotoxic venom?

The matamata turtle is piscivorous. What does this mean? What adaptations does it have to support this habit?

The color changes in the Madagascar Giant Chameleon are more an indication of stress than of trying to match its surroundings. What hunting adaptations does it have?

What diseases could be helped by the venom of the Green Mamba? How does it work?

The Black Mamba has venom so toxic that one bite can kill 30 grown men. How fast can it move?

How fast is the strike of the Puff Adder?

Why is a king cobra called a king?

What rhyme can remind you whether a Mexican milk snake is venomous or harmless?

What medical problem could the Terciopelo venom help?

What does the Alligator snapping turtle use its tongue as?

What medical problems could Gila Monster venom help cure?

Draw the teeth of the Chinese Alligator. What does it eat?

What is the greatest threat to the Sand Dune Lizard?

➤ **Outside the Reptile House— the Aldabara Tortoise and the crocodile: The crocodile is fed at 3:45 every Friday.**

Giant tortoises occur on two remote island groups, the Galapagos in the Pacific Ocean and the Aldabara Islands in the Indian Ocean. These islands do not have abundant food for these very large animals. What physiological adaptation allows the Aldabara tortoise to persist despite the sparse and inconsistent food supply?

Because these animals are ectothermic, they don't use a lot of calories. The low paintings of crocodile outlines on the back wall are accurate in terms of the size of these animals. Crocodiles are distinct from alligators in many ways. List them.

How do crocodiles stabilize the food chain?

What are crocodile tears?

How do baby crocodiles let their mothers know that they have hatched?

What percentage of hatchlings survive to reproduce?

Write three things that you find interesting on the 'Ready for Ambush' poster.

➤ **The Parrot House**

There are many varieties of parrots on display, both in the Parrot House and in the Australian exhibits. Many parrots show no sexual differences in coloration, they are sexually monomorphic. Why might this be?

All parrots possess a distinctively shaped bill, which is short and very deep. Why is this bill type considered to be an adaptation? Namely, what is it especially good for?

What might be the advantages of the bright colors that many parrots exhibit? Keep in mind that most members of the parrot family gather in large flocks.

Other than what you wrote above, what are possible advantages and disadvantages to living in a large flock, rather than living a solitary or mated pair life style? What other animal groups you observed at the zoo contained both social and non-social species?

➤ **Phoenix Plaza – The Pheasants**

While some bird species we observed were sexually monomorphic, most species of birds exhibit sexual dimorphism. Pheasants, curassows, wild chickens, ducks, and other wildfowl are typically sexually dimorphic. Females are cryptically colored while males tend to be very showy. Do you think both sexes share nesting and chick-rearing responsibilities? _____. Explain.

Based on what you have seen in the various bird exhibits, do birds have color vision? _____
How do you know?

Do you think wild pheasants spend most of their time on the ground or in the air? What structural or behavioral observations support your answer?

How might helmets be adaptive for the Northern helmeted curassow?

As you wander through the zoo, you will probably encounter one of several peacocks (the cryptically colored peahens tend to be more elusive). What are the advantages and disadvantages of bright beautiful plumage that we see in many male birds?

If female peafowl (peahens) prefer males with the longest tails, why don't tails just get longer and longer over evolutionary time? Note that peacocks live in the same habitat as tigers and other Asian woodland predators.

Describe a controlled experiment that you might design to test the hypothesis that peahens prefer peacocks with longer tails.

In addition to flight, what are two other benefits to having feathers?

➤ **The Raptor Roost**

Compare the bald eagle or the golden eagle with the Andean condor. Condors do not kill prey; they consume only carrion. If the talons are visible for both species, suggest a reason for their differences.

Contrast the feet of the raptors to the feet of other birds, such as the pheasants, ducks or flamingos.

Bald, as in bald eagles, originally meant white. They can fly at speeds up to 30 mph and dive at 100 mph. How far can they see?

Look at the display board opposite these birds (behind you as you face the birds.) It states that every habitat is patrolled by a raptor. What facial features do falcons have that assist them in hunting?

Why do barn owls have a facial disk?

What skull features allow owls to have binocular vision?

Write one fact you found interesting from the 'Be a Hawkwatcher' display.

List adaptations of condors mentioned on the 'Plight of the Condor' display.

➤ **Mexican Wolves**

How many cases of healthy, wild wolves attacking humans have been documented? _____

The display board says that in the 1950s the use of the poison Compound 1080, also known as sodium fluoroacetate, reduced wolf numbers drastically. Search the Internet and see what other information you can find about this chemical.

How do wolves communicate?

Wolves hunt in packs, chasing faster prey such as wild deer, antelope, elk, or bighorn sheep. One wolf chases until it tires and then another takes over, exhausting the prey so they can catch it. Modern dogs were domesticated from wild wolves. What aspects of dog behavior remind you of their wolf ancestry?

[Note: Until just a few years ago, the Mexican wolf had been extinct in the wild. The only populations of wolves were kept in zoos like the Rio Grande Zoo and other captive breeding facilities. The U.S. Fish and Wildlife service has successfully reintroduced the Mexican wolf into the Gila wilderness in southwestern N.M., thanks in part to the conservation efforts of the Rio Grande Zoo.]

[Before continuing to the left to see the Polar Bears, go around the grassy area to the right to see the Roadrunners. Then turn back and go to the Polar Bears.]

➤ **Birds of America**

What is one way you can help protect these birds?

What are two ways in which roadrunners particularly adapted to the desert and semi-desert habitats?

How is the blue hyacinth macaw camouflaged?

➤ **Polar bears: Feeding time 2:30 every day**

Most reptile and amphibian offspring generally hatch as fully functional independent organisms, a characteristic known as precocial. For example, crocodilian hatchlings have all the necessary muscles and instincts to swim and hunt. Bird and mammal offspring are highly dependent on parental care, which is termed altricial. A 600 lb. Polar bear will give birth to a 2 lb. cub. What are the advantages and disadvantages of precocial and altricial reproductive strategies? Keep in mind that a crocodile can lay over 50 eggs at a time, while a polar bear will give birth to only one or two cubs.

Precocial:

Altricial:

What accounts for the majority of polar bear deaths each year? _____

Bears are the largest land carnivores in the world. Describe five characteristics of the polar bear that make them particularly adapted to their arctic habitat.

What other animals share some of these adaptations?

➤ **Red Kangaroos and Emus**

Red Kangaroos are the largest living marsupials. How do they cope with the extreme temperatures of the outback?

Describe the adaptations in the red kangaroo's digestive system.

Convergent evolution happens when animals that are not very closely related develop similar adaptations to their environment because they fill the same niche. What animals in North America share the same niche with the red kangaroo?

What are animals in South America that share the same niche as the Emu?

➤ **The Cat Walk**

The African Lion is the only truly social cat. Why is the whisker pattern important to people who work with these animals in the wild?

Bobcats are the most abundant wild cat in the US. They can harbor the rabies virus for more than a decade without showing symptoms of the disease. Because of this fact, zookeepers cannot take these animals to schools without knowing their full history. Note the broad paws of the bobcats, which are montane (mountain-dwelling) predators. How is this adaptive?

The rock hyrax is most closely related to manatees and elephants. Why do humans harvest their dung piles?

Snow leopards eat pika, which are related to rabbits. They also have large paws to walk on sharp rocks and icy ground. What are two ways in which snow leopards use their tails?

Many of the cats on display, such as the tiger, snow leopard, serval, jaguar, and ocelot, exhibit striking patterns of coat color. Other species are rather plain. The beautiful coat pattern in cats, specifically the fur trade, is one cause of their population decline. Poaching is still a major threat to most cat species, and most are threatened or endangered. What is the evolutionary function of the spotted or striped pattern that we observe in these predators?

How does the size of the carnivore relate to its prey choice?

The binturong smells like buttered popcorn. How can this be adaptive?

Crested porcupines, hedgehogs, and echidnas are all mammals with modified hairs known as quills or spines. The protein fibers grow together to form large, hard, pointed quills. Features such as these probably do not arise rapidly, but rather through gradual evolution. The fact that these species are not closely related means that this is an example of convergent evolution—when different populations develop similar solutions to the same type of environmental challenge. Speculate what intermediate adaptive stages might have led to such an effective defensive adaptation.

Interestingly, the quills of crested porcupines are hollow, to create a rattling sound. How are these animals born, considering they have quills?

The jaguar is the only cat in the western hemisphere that roars. Compare its historical distribution to its current distribution.

Don't forget to look at the great horned owl before you get to the tigers! Write one interesting thing about these animals.

The tigers at the zoo eat horse meat, not cow meat. How does this diet compare to their diet in the wild?

➤ **The Camels – Note: If you weigh more than 175 lbs. you can't ride the camels. If the camels that you can ride aren't there, as you enter the elephant area, look to the right after the train tracks and you'll see the Bactrian camels.**

The camel has humps on its back that contain fat. The more fat, the longer the camel can live without access to drinking water. One reason fat is useful to the camel is that when it is metabolized (broken down for energy use), it releases more metabolic water per gram than carbohydrates. What is a second way that fat is useful in a hot, arid environment?

[Go towards the elephants and the play structure. Turn left just before the structure.]

➤ **Amphibians: Life on a Limb**

How many mass extinctions have amphibians survived?

One third of amphibian species are currently threatened with extinction. What are some of the causes?

How do amphibians help humans? (On 'Amazing Amphibians' poster)

The coqui conservation lab is a biosecure lab. What does this mean?

What is the amphibian chytrid fungus?

What does the milky substance that the Amazon milk frog secretes when threatened do?

Why are poison dart frogs not toxic when raised in captivity?

How is a greater siren similar to a lungfish in its behaviors?

Aquatic caecilians are called "rubber eels" but they are true amphibians. Unlike fish, which have two-chambered hearts, they have three-chambered hearts. They are unique because they will shed their outer layer of skin to nourish their young. They are also oviparous. What does this mean?

Why is the lemur leaf frog medically important?

What type of coloration does the golden mantella have?

[Cross back toward the giraffes, there is a small path through rocks just east of the twiga outlook.]

➤ **The Prairie Dogs**

Prairie dogs are a primary food source of foxes, hawks, owls, eagles, badgers, ferrets, snakes, and coyotes. What types of animals use their abandoned burrows?

➤ **The Twiga Outlook**

The giraffe is the tallest land animal, in part due to its long legs and, more strikingly, due to its amazing neck. (They have the same number of cervical vertebrae as we do!) Explain why "tallness" is an adaptation.

What does 'reticulated' mean? How is it adaptive? What other types of animals are reticulated?

What are a giraffe's defenses against predators?

Why would a giraffe need a prehensile tongue?

In many horned animals, females choose mates based on horn length. Why might this be adaptive? What do larger horns indicate?

➤ **The Elephant Watering Hole**

Elephants only sweat between their toenails. What adaptive capacity could wrinkled skin serve? (Look closely at behaviors!)

How many sets of teeth are worn out during an elephant's lifetime? _____

List the different types of adaptations for Asian vs. African elephants.

Asian elephants –

African elephants –

The elephant's hearing is not especially acute, although they can hear much lower frequencies than we can. Speculate a different adaptive reason why they have such large pinna (earlobes). Can you think of similar adaptations in other animals?

[Turn back towards the amphitheater and turn left to go see the seals and sea lions.]

➤ **Seals and Sea Lions—These animals are fed at 10:30 AM and 3:30 PM every day.**

All marine mammals evolved from land mammals. The semiaquatic pinnipeds are descended from land carnivores. As with many vertebrates, they exhibit morphological structures that are homologous to other vertebrates. The flippers of seals and whales, the hands of humans and lemurs, and the wings of bats each contain five digits, each made of finger bones (phalanges) projecting from wrist (carpal) bones. Clearly there is a common ancestry, although the modern functions of the organs may differ. Reptiles, amphibians, and even birds share arm, wrist, and finger bones. Homologous structures have a common origin, but may have different functions. Analogous structures have similar functions, but different origins. Give two examples of analogous structures within the animal kingdom.

What are the basic characteristics of the Order Pinnipeda, other than flippers?

What are the 'unnatural enemies' of these animals?

Observe the seals and sea lions swimming underwater. In addition to the obvious specialized appendages for swimming, what other structural adaptations are present in these species that allow them to be so successful in a marine environment?

How can you tell the difference between seals and sea lions?

seals –

sea lions –

[Walk past the seals and sea lions, go down the ramp and turn left.]

➤ **The Tasmanian Devils**

The Tasmanian Devils are the largest carnivorous marsupials, and they have the largest vocalization range of any marsupial. They stalk their prey to exhaustion, going up to 10 miles, and eat every part of their prey, including bones. One of their prey animals is the wombat, just behind you, be sure to notice it. Tasmanian devils give birth to 30 bean-size joeys, but only the first four survive. Why do you think their pouch is rear-facing?

Why are Tasmanian Devils endangered?

➤ **Koala Creek/Australian Birds, Reptiles, and Fish**

How is the Major Mitchell's cockatoo like human children in terms of food choices?

Biotic factors are those which are living, such as bacteria, animals, fungus, etc. Abiotic factors are things like soil type, temperature, etc. Read the sign in the free flight display. What abiotic factor gives rise to the breeding season of budgerigars? Why do you think this may be adaptive?

Marsupials give birth to very immature young, only a couple of centimeters long. The newborn joey climbs into the marsupium (pouch), adheres to a nipple, and completes its development. There is only one marsupial group outside Australia, New Guinea, and other nearby islands—opossums—which are cosmopolitan (found all over the world). In Australia, which was separated from the other continents before placental mammals evolved, there was a great radiation among marsupials to fill niches now occupied by placental mammals elsewhere in the world. This is another example of convergent, or parallel evolution, in which unrelated evolutionary lineages develop similar characteristics.

Draw a koala forepaw. What about a koala's lifestyle makes this odd shape adaptive?

Where is a koala's pouch? Why is this placement effective for these animals?

What does a caecum do in koalas? Why is it important?

Koalas eat only eukalyptus leaves. They don't even drink water. Eukalyptus leaves are nutrient-poor. What behavioral adaptations that you observe allow the koala to survive solely on this foliage? How do they avoid leaves too high in toxins?

How does the Matschie's Tree Kangaroo cool off?

[Go in to the little room attached to the koala enclosure.]

The carpet python shivers around its eggs. Why does it do this?

What is the function of a barrier reef, in terms of nearby land masses?

Giant Clams and tritons eat the Crown of Thorns sea stars, which would otherwise eat huge sections of the reef. What factors have reduced the number of the Giant clams and tritons?

[Now go back through the seal area and turn right at the zebra towards the African Plains.]

➤ **White Rhinoceros**

What is the purpose of a communal midden?

The rhinoceros' horn is made of solid keratin, which makes up our hair and fingernails. They are the only animals with solid horns. In other animals, horns are hollow, with keratin on the outer surface. They are also the only animal with horns on their noses. What are the horns used for? What if it is knocked off?

What is a rhinoceros' primary means of communication?

What is the difference between a browser and a grazer? Which are rhinoceros?

Who hunts them? Why? Why is this hunting especially ironic?

➤ **Chimpanzees**

How do chimpanzees communicate with one another?

Draw an aggressive facial display vs. a nervous, submissive, or frightened display.

Draw a chimpanzee hand and a foot. How are they like ours? How are they different?

A chimpanzee was actually the first “American” in space. They don’t like water and usually can’t swim. They have been observed feeding on medicinal plants when they are ill or injured. They are also the only animals other than humans and crows to make tools. These are very complex behaviors. How do they learn them?

There is a large display about the bushmeat crisis near the window with wild African dogs. Define bushmeat.

Why is eating bushmeat a potential human health crisis?

What can you do to help stop this crisis?

➤ **Cheetahs**

Cheetahs have very reduced clavicle bones. This fact allows a longer stride and allows the forelimbs to play a larger role in the production of movement. These are the only large cats that can turn in midair during a chase. They also have no need of water, as they get all they need from their prey. They can run up to 70 mph for short distances. Compare physical characteristics of the cheetah to those of the other big cats, for instance, their spine and nasal passages.

Why do you think these cats have round pupils, unlike other cats?

➤ **The Spotted Hyena**

The Spotted Hyena is the largest of the three hyena species. It can gallop up to 31 mph for a couple of miles, and has at least 11 different calls. The cackling giggle for which they are known typically expresses fear or excitement. A hyena clan is a stable community of related females, among which unrelated males reside for varying periods. The highest-ranking female and all of her descendents are dominant over all other animals. Only hours after birth, siblings of like sex battle for dominance. The one that wins keeps the other from nursing until it weakens and dies. How can this behavior possibly be adaptive for the species?

With its powerful teeth and jaws and efficient digestion, the spotted hyena can utilize virtually everything on a carcass except the rumen contents and horn bosses. Their excrement contains so much calcium from digested bones that vultures are dependent on hyena populations for this mineral. Even desiccated carcasses yield protein and minerals when they can't find prey. They can digest bones, horns and even teeth. In what other ways can animals be efficient predators?

➤ **African Hunting Dogs**

No two African hunting dogs have the same coat pattern. Unlike many other types of pack animal, these give special privileges to those most in need of care: the very old and the very young. How is taking special care of the older dogs advantageous?

These dogs do not rely on a sense of smell, as do most other dogs. How do they find prey?

Only the highest-ranking male and female within a pack normally breed, but all members of the pack, including males, take care of the young. How does taking care of young that are not their own help the species survive?

Why would females emigrate to other packs? What advantage does it give their young?

➤ **The African Birds**

How could the habitat of the Wattled Crane here at the zoo be improved, based on its wild behaviors?

How many items can the nest of the Hamerkop contain? _____ How much does it weigh? _____

How high can a Marabou stork fly? _____ feet

The largest bird in Africa is the Lappet-faced vulture. What is its wingspan? _____

What does the Black Spur-winged goose use its spurs for?

➤ **The Warthogs** [On the south side of the bridge which overlooks the hippopotamuses.] Warthogs are extremely adaptable to various environmental conditions, intelligent, and strong. They have longer legs than most other kinds of swine, so they can run as fast as 34 mph! They usually back into their burrows so they can run out at top speed in case a predator is waiting for them. Their tusks are modified teeth. What do they use tusks for? Why do they have 'warts'?

➤ **The Hippopotamus**

What are the functions of the red secretions that come out of the hippopotamus' skin?

Hippopotamus' eyes, ears, and nostrils are on top of their head, and they have webbing between their toes. Typically, common hippo calves are born underwater. They must quickly swim to the surface to catch their first breath, then submerge to nurse. Do adult hippos swim?

Hippos live in rivers, and leave the water at night to graze for as many as six hours. How do the hippos sustain their aquatic environment?

➤ **The Klipspringer**

These antelopes are so small that their calves are vulnerable to both eagles and baboons. They are not dependent on drinking water. What is special about their hooves and the way they move?

Can you think of a function of the large, black preorbital gland by the Klipspringer's eye?

➤ **The Red River Hog**

Red River Hogs have many predators including humans, spotted hyenas, leopards, lions, and pythons. Why might their numbers be unusually high in their native area in recent years?

➤ **DeBrazza's Monkey**

The DeBrazza's Monkey is an old world monkey. Old world monkeys are found in Africa, Central to Southern Asia, Japan, and India. New world monkeys are found in Mexico, Central America and South America. If you were looking at a monkey, without being told from what country it came, you could tell if it was Old World or New World. Use the Internet and find out how to distinguish between the two, based on the following characteristics:

Old World:

New World:

Noses:

Rump pads:

Tails:

Cheek pouches:

What is the biggest threat to monkeys of all types—be specific!

➤ **Ankole A.K.A Watusi cattle** [just past the Matunda cafe.]
How do Ankole protect their young at night?

➤ **Apes**

The Siamang apes (Gibbons) are considered 'lesser apes.' They are the smallest of the great apes, a group that includes bonobos, chimpanzees, orangutans, and gorillas. What are the differences between apes and monkeys?

Gibbons are closely related to man. Notice their brachiating movement from arm to arm. Identify at least three structural characteristics of the gibbons that make them well adapted to their almost exclusively arboreal (tree dwelling) life.

How do the orangutans react to people? How do they wean their young?

Lowland gorillas require companionship, but not personal friendships. In what ways are Lowland gorillas similar to humans regarding their offspring?

Compare the apes displayed: siamang, orangutan, and gorilla. In the order listed, these three species represent decreasing arboreal habitats. **Describe and draw** differences in morphological proportions that you observe that make each ape adapted to life on the ground or life in the trees. Include length of arm, leg, and torso, overall size, hands and feet.