



Introduction to Mammal Taxonomy & Evolution

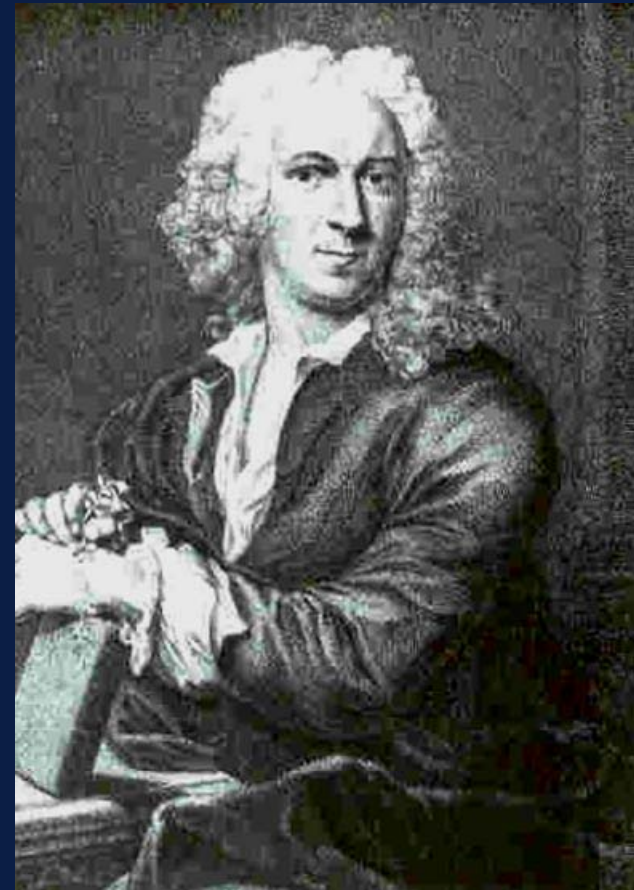
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What is taxonomy?

- Theory & practice of classification
- Carolus Linnaeus
 - *Systema Naturae* (1735)
 - Nested hierarchy
 - Broad to narrow
 - Distantly related to closely related





Classification of humans

Kingdom

Animalia

Phylum

Chordata

Class

Mammalia

Subclass

Theria

Order

Primates

Suborder

Haplorrhini

Infraorder

Catarrhini

Superfamily

Hominoidea

Species

Homo sapiens



How do we classify organisms?

- Based on relatedness
 - Overall similarity
 - Use morphology (and genetics)
 - Shared traits are evidence of shared ancestry



Organisms may be similar because...

- Shared primitive traits
 - Evolved early in a lineage, shared by all
- Shared derived traits
 - Evolved late in a lineage, shared only by some
- Some traits evolve independently

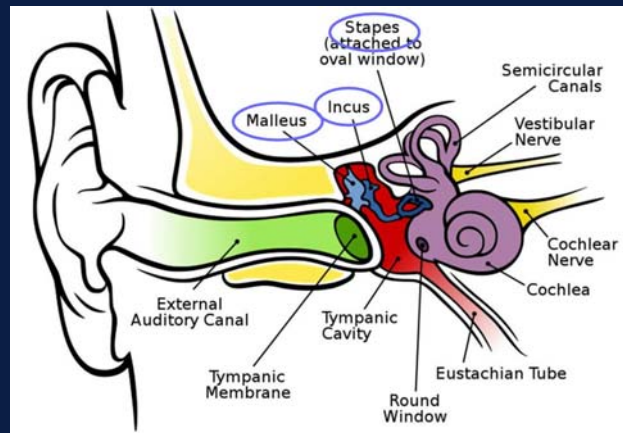
Who 'doesn't belong'?

- Why?
 - Cows, bears, monkeys, wolves are *mammals*
 - 4475 extant (living) species



Class Mammalia: What makes a mammal a mammal?

- Mammals *share* traits:
 - Internal fertilization; most bear live young
 - Mammary glands
 - Fur
 - 1 jaw bone
 - 3 bones in ear
 - Endothermy

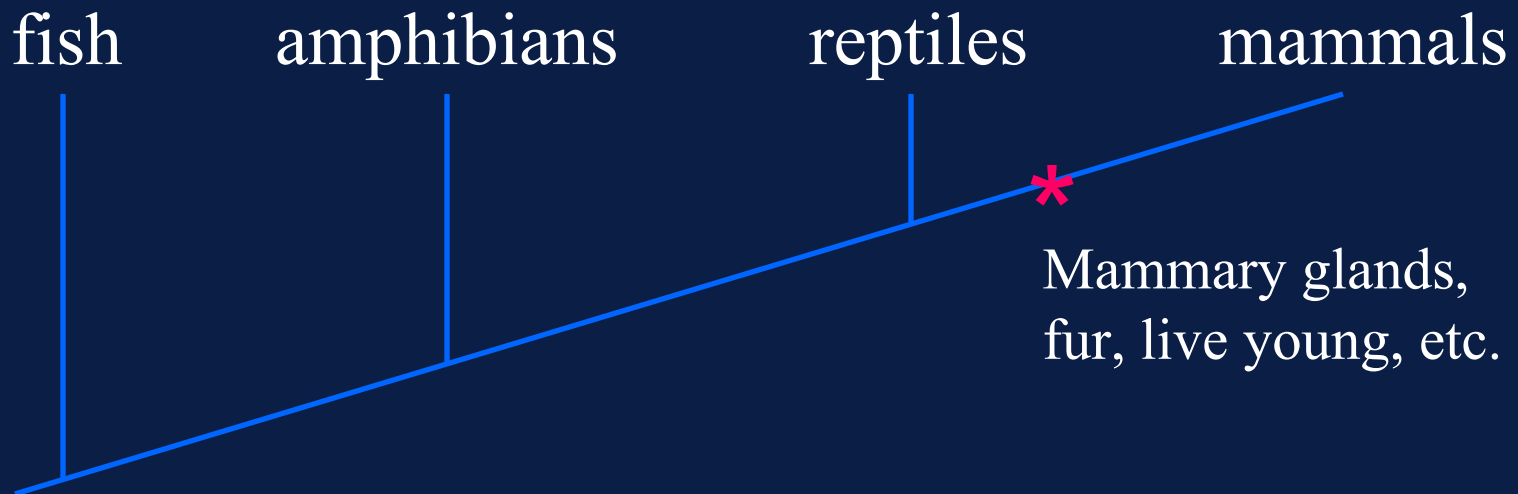


● ● ● | Non-mammals don't have these traits

- Why?
 - Branched off *before* these traits evolved
 - Help distinguish mammals & non-mammals
 - Shared derived compared to non-mammals

● ● ● | Non-mammals don't have these traits

Basal mammal
Hadrocodium (195 mya)



● ● ● | But, shared primitive *for* mammals

- Do not help distinguish *between* mammals
 - Need to use additional traits
 - Evolved in *some* lineages, not others
 - Result: subdivisions of class Mammalia



Class

Mammalia

Subclass

Prototheria

Theria

Infraclass

Metatheria

Eutheria

Order

Monotremata

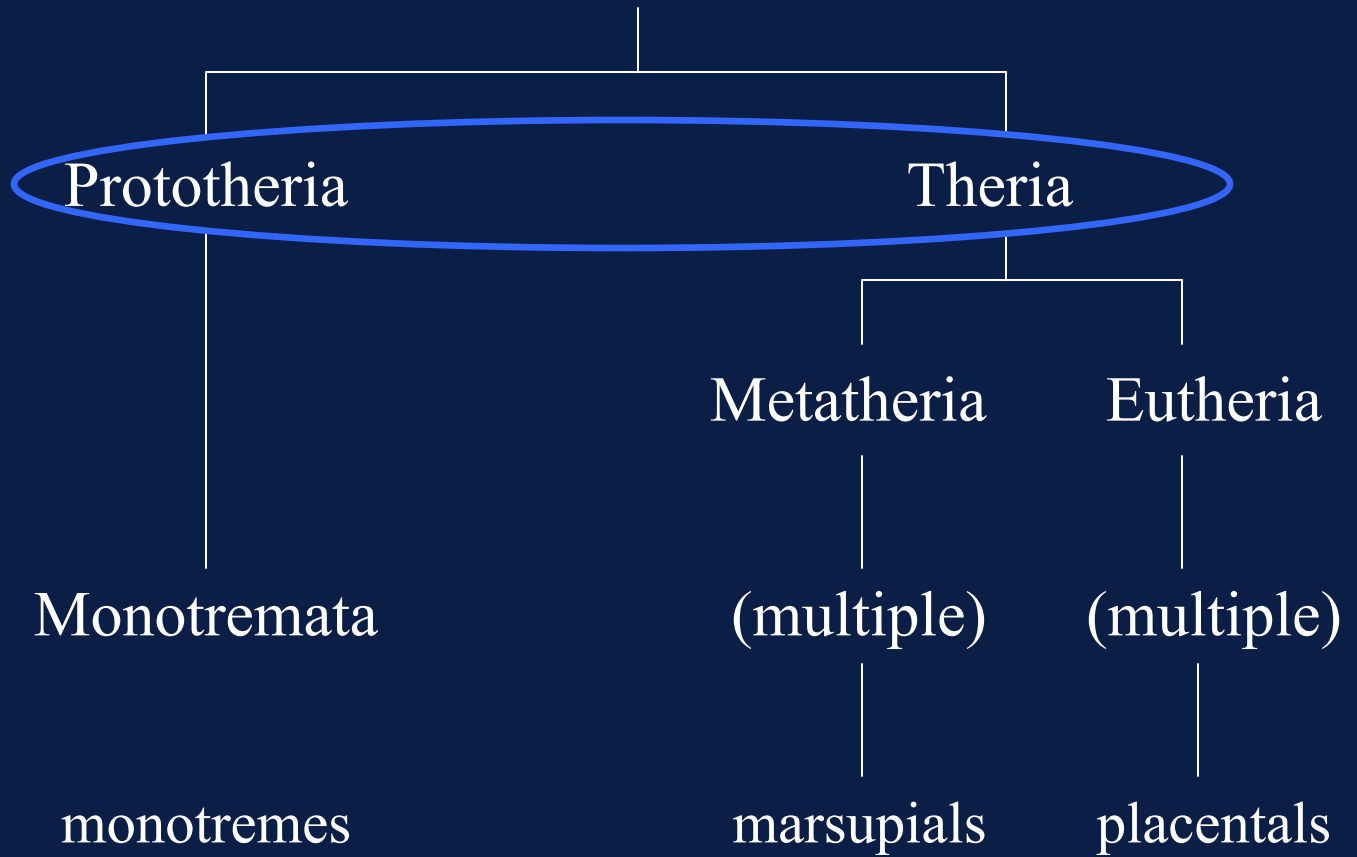
(multiple)

(multiple)

monotremes

marsupials

placentals



- ● ● | Subclass Prototheria: monotremes

- 5 species in 2 families in Order Monotremata
 - Earliest monotreme: 125 mya



Teinolophos

Subclass Prototheria: monotremes

- 5 species in 2 families in Order Monotremata
 - Monotreme = ‘one hole’
 - Lay eggs
 - Open mammary glands
 - No teeth, but single jaw bone
- Australia & New Guinea only



echidna



platypus

Subclass Theria

- 4470 species in 25 orders
 - Give birth to live young
 - Specialized dentition based on diet
- All continents



Infraclass Metatheria: Marsupials

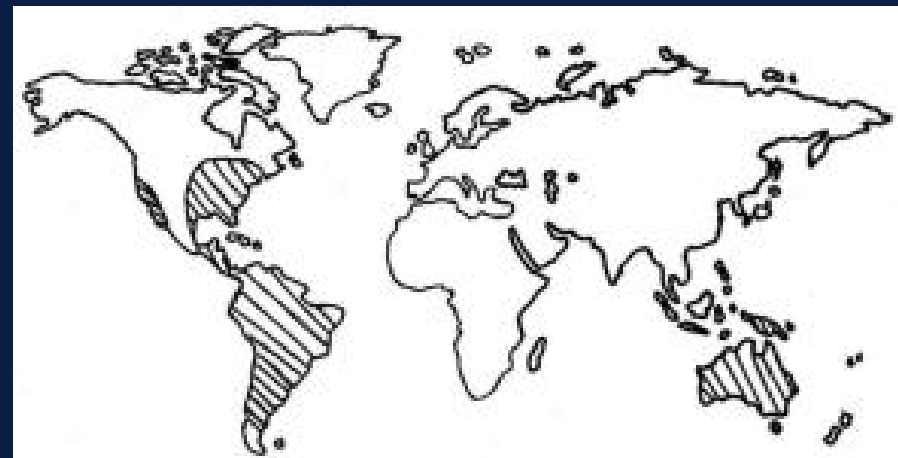
- 334 species in 7 orders
 - Earliest marsupial: 125 mya



Sinodelphys

Infraclass Metatheria: Marsupials

- 334 species in 7 orders
 - Short gestation
 - Babies grow & develop in mom's pouch
 - Dual reproductive system
- Mainly Australia, New Guinea, Tasmania



- ● ● | Infraclass Metatheria: Marsupials

- Order Didelphimorphia

common opossums



Virginia opossum

Infraclass Metatheria: Marsupials

- Order Didelphimorphia
- Order Paucituberculata

shrew opossums



long-nosed shrew
opossum

Infraclass Metatheria: Marsupials

- Order Didelphimorphia
- Order Paucituberculata
- Order Microbiotheria

monito del montes



South American
monito del montes

Infraclass Metatheria: Marsupials

- Order Didelphimorphia
- Order Paucituberculata
- Order Microbiotheria
- Order Dasyuromorphia

most carnivorous
marsupials



Tasmanian tiger



Tasmanian devil

Infraclass Metatheria: Marsupials

- Order Didelphimorphia
- Order Paucituberculata
- Order Microbiotheria
- Order Dasyuromorphia
- Order Peramelemorphia

bandicoots



eastern barred
bandicoot

Infraclass Metatheria: Marsupials

- Order Didelphimorphia
- Order Paucituberculata
- Order Microbiotheria
- Order Dasyuromorphia
- Order Peramelemorphia
- Order Notoryctemorphia
 - Convergent evolution

marsupial moles



southern marsupial
mole

- ● ● | Infraclass Metatheria: Marsupials

- Order Diprotodontia
 - Kangaroos, wallabies, koalas
 - Family Macropodidae
 - Kangaroos & wallabies
 - Family Phascolarctidae
 - Koalas



Order Diprotodontia

Family Macropodidae

- Red kangaroo
 - Largest marsupial
 - Australia
 - Herbivore
 - Males larger, grayer
 - 30 mph
 - Hunted by dingoes & humans



red kangaroo

Order Diprotodontia

Family Macropodidae

- Eastern gray kangaroo
 - Smaller, shaggier
 - E. & S. Australia & Tasmania
 - Males 2x females
 - Herbivore
 - 55 mph



eastern gray kangaroo

- ● ●

Order Diprotodontia

Family Macropodidae

- Bennett's or red-necked wallaby
 - Largest wallaby species
 - E. Australia & Tasmania
 - Feeding 'mobs'



Bennett's or red-necked wallaby

- ● ●

Order Diprotodontia

Family Phascolarctidae

- Koala
 - Arboreal eucalyptus specialist
 - Low metabolism
 - E. & S. Australian coast
 - Koala = ‘no drink’ (?)
 - Have fingerprints
 - Habitat destruction



koala

- ● ● | Infraclass Eutheria: Placentals

- 4136 species in 18 orders
 - Earliest Eutherian: 125 mya



Eomaia

Infraclass Eutheria: Placentals

- 4136 species in 18 orders
 - Longer internal gestation
 - Placenta nourishes embryo
 - Single uterus & vagina
 - More developed infants
 - Altricial vs. precocial
- All continents



● ● ● | Infraclass Eutheria: Placentals

- Order Cetacea

whales, dolphins,
porpoises



beached humpback
whale (Big Sur)

killer whale



California grey whale

Infraclass Eutheria: Placentals

- Order Cetacea
- Order Sirenia

dugongs, sea cows,
manatees

West African manatee



West Indian manatee



dugong

Infraclass Eutheria: Placentals

- Order Cetacea
- Order Sirenia
- Order Tubulidentata

aardvarks



Infraclass Eutheria: Placentals

- Order Cetacea
- Order Sirenia
- Order Tubulidentata
- Order Pholidota

pangolins



Indian pangolin



ground pangolin

Infraclass Eutheria: Placentals

- Order Cetacea
- Order Sirenia
- Order Tubulidentata
- Order Pholidota
- Order Hyracoidea

hyrax



rock hyrax



western tree hyrax

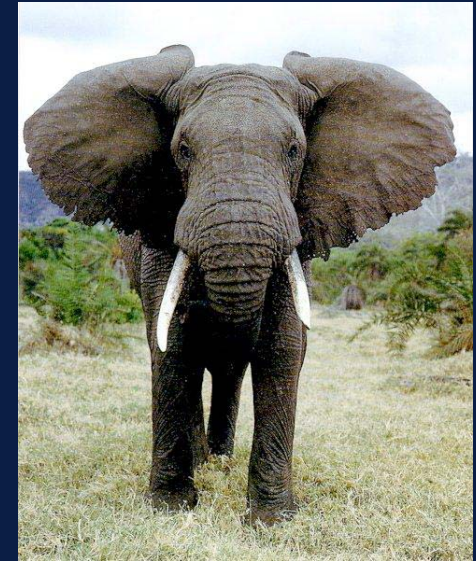
Infraclass Eutheria: Placentals

- Order Cetacea
- Order Sirenia
- Order Tubulidentata
- Order Pholidota
- Order Hyracoidea
- Order Proboscidea

elephants



Asian elephant



African elephant

- ● ● | Infraclass Eutheria: Placentals

- Order Scandentia

treeshrews



pen-tailed treeshrew



large treeshrew

Infraclass Eutheria: Placentals

- Order Scandentia
- Order Soricomorpha

shrews and moles



European mole



southern short-tailed
shrew

Infraclass Eutheria: Placentals

- Order Scandentia
- Order Soricomorpha
- Order Dermoptera



Phillipine colugo

colugos



Sunda colugo

Infraclass Eutheria: Placentals

- Order Scandentia
- Order Soricomorpha
- Order Dermoptera
- Order Chiroptera

bats



Coromo black flying fox



leaf-nosed bat

Infraclass Eutheria: Placentals

- Order Scandentia
- Order Soricomorpha
- Order Dermoptera
- Order Chiroptera
- Order Macroscelidea

elephant shrews



black and rufous
elephant shrew



checkered elephant
shrew

Infraclass Eutheria: Placentals

- Order Scandentia
- Order Soricomorpha
- Order Dermoptera
- Order Chiroptera
- Order Macroscelidea
- Order Erinaceomorpha

hedgehogs



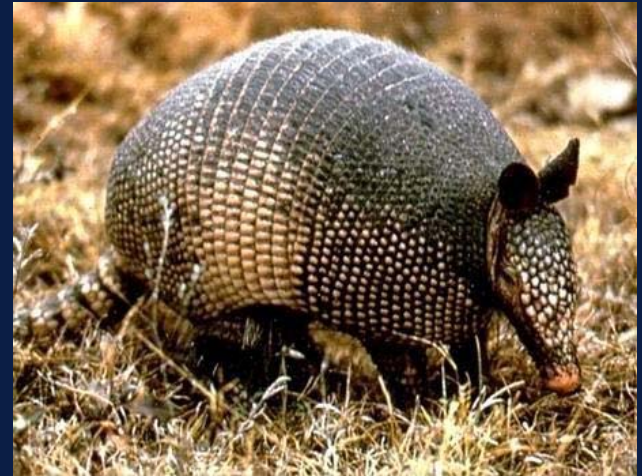
European hedgehog



long-eared hedgehog

Order Cingulata: armadillos

- Nine-banded armadillo
 - 8-10 bands
 - S.W. US, Mexico, C. & S. America, Caribbean
 - Omnivorous
 - 4 babies/litter
 - ARC



Order Cingulata: armadillos

- Three-banded armadillo
 - South America
 - Rolls into defensive ball
 - Pinkish color, hairs on belly
 - ARC



Order Pilosa: anteaters & tree sloths

- Giant anteater
 - Largest, long tubular snout, bushy tail
 - C. & S. America
 - Long claws
 - Defense
 - Ants, termites
 - Puento al Sur



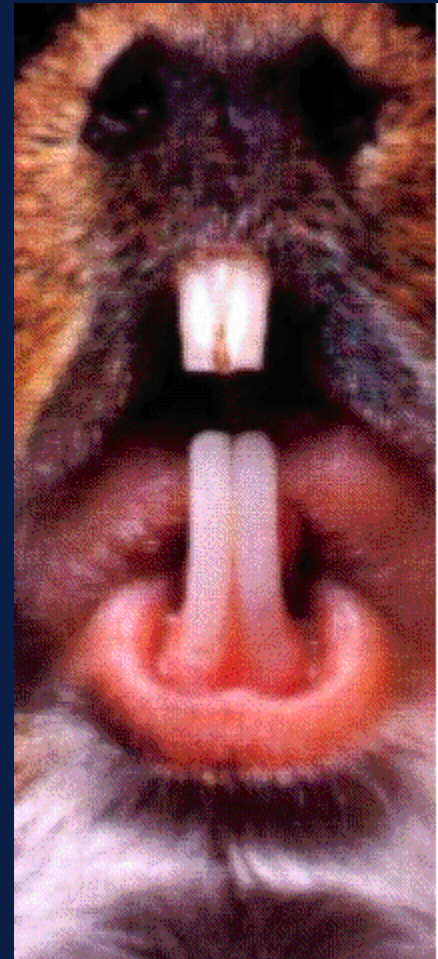
- ● ● | Order Lagomropha: rabbits, hare, pikas

- Domestic rabbit
 - Gnawing & peg teeth
 - Herbivorous
 - High reproduction rates
 - Large litters
 - Induced ovulation
 - Elongated pinnae
 - Children's zoo



Order Rodentia: rodents

- 1700 species; 40% of mammals
- Large, continuously growing incisors
- High reproductive rates
 - Altricial young
- Many colonially living
- 3 groups based on jaw muscles
 - Cavy-like
 - Squirrel-like
 - Mouse-like





Order Rodentia: rodents

- Suborder Hystricomorpha (cavy-like)
 - Most diverse
 - Capybara, porcupine, chinchilla, naked mole rat, guinea pig
 - Africa, Asia, Americas

- ● ● | Order Rodentia: rodents

- Suborder Hystricomorpha (cavy-like)

- Family Caviidae

- Capybara

- Largest rodent

- 150lbs, 5ft

- S. America

- Predators:

- jaguars, anacondas

- 1 female at Puente al Sur



- ● ● | Order Rodentia: rodents

- Suborder Hystricomorpha (cavy-like)
 - Family Caviidae
 - Domestic guinea pig
 - Tail-less, large head
 - Common pet
 - Variety of colors
 - Children's Zoo



- ● ● | Order Rodentia: rodents

- Suborder Hystricomorpha (cavy-like)
 - Family Caviidae
 - Chincilla
 - Thick, soft fur
 - Kept as pets
 - ‘Bathes’ in sand
 - ARC



- ● ● | Order Rodentia: rodents

- Suborder Hystricomorpha (cavy-like)
 - Family Erethizontidae
 - N.A. porcupine
 - Canada & US
 - Leaves, berries, nuts
 - Quills for defense
 - Cannot 'shoot'
 - Strong odor
 - ARC



- ● ● | Order Rodentia: rodents

- Suborder Hystricomorpha (cavy-like)
 - Family Erethizontidae
 - Mexican prehensile-tailed porcupine
 - C. America
 - Smaller & shorter quills
 - Erect to look bigger
 - Prehensile tail
 - Leaves, bark, fruit
 - ARC





Order Rodentia: rodents

- Suborder Sciuromorpha (squirrel-like)
 - Long whiskers & furry tail
 - Squirrel, beaver, woodchuck, chipmunk, prairie dogs, gophers
 - Global distribution

- ● ● | Order Rodentia: rodents

- Suborder Sciuromorpha (squirrel-like)
 - Family Sciuridae
 - Black-tailed prairie dog
 - N.A. plains
 - Colonies
 - Bark like a ‘dog’
 - Small, flat ears
 - Brown, black tail-tip
 - Children’s Zoo



- ● ● | Order Rodentia: rodents

- Suborder Sciuromorpha (squirrel-like)
 - Family Sciuridae
 - Grey squirrel
 - Wild
 - Plume-like tail
 - Nuts, seeds, flowers, fruits, popcorn, etc.





Order Rodentia: rodents

- Suborder Mymorpha (mouse-like)
 - $\frac{1}{4}$ of all mammal species
 - Mice, rats, voles, lemmings, hamsters, gerbils, muskrat
 - Long whiskers, pointed face, long tail

- ● ● | Order Rodentia: rodents

- Suborder Mymorpha (mouse-like)
 - Family Muridae
 - Woodrat (aka pack rat)
 - US & Mexico
 - Complex nests, 'middens'
 - Cactus
 - Other species' burrows
 - ARC



- ● ● | Order Rodentia: rodents

- Suborder Mymorpha (mouse-like)
 - Family Muridae
 - Domestic rat (aka Norway rat)
 - Pets & scientific research
 - Bare feet, ears, tail
 - Variety of colors
 - ARC



Order Rodentia: rodents

- Suborder Mymorpha (mouse-like)
 - Family Muridae
 - Domestic mouse (aka feeder mice, fancy mice)
 - Variety of colors, sizes
 - Children's Zoo



Order Carnivora: carnivores

- 249 species
 - Most meat-eaters, some omnivores, few herbivores
 - Carnassials
 - Baculum
 - Binocular vision, good sense of smell & hearing





Order Carnivora: carnivores

- Suborder Caniformia (dog-like)
 - Family Ursidae (bears)
 - Largest carnivores
 - Males 2x females
 - Europe, N. & S. America, Asia
 - Omnivorous
 - 6/8 species endangered

Order Carnivora: carnivores

- Family Ursidae (bears)

- Polar bear

- Arctic, N. Canada
 - Favorite prey: seals
 - 1500lbs, 11ft
 - Hair, skin, blubber
 - Susceptible to global warming
 - Bear grotto



Order Carnivora: carnivores

- Family Ursidae (bears)
 - Spectacled bear
 - Smaller, S. America
 - Light band on face
 - Vegetation, birds, mammals, insects
 - Human encroachment
 - Bear grotto; SSP



Order Carnivora: carnivores

- Family Ursidae (bears)
 - Brown (grizzly) bear

- West N. America
- Brown, with hump
- 1500lbs, 8ft
- Extinct in CA
- Prey: berries, fish (moose, wolves, deer)
- Montana orphans rescued by SF Zoo
- Bear grotto





Order Carnivora: carnivores

- Suborder Caniformia (dog-like)
 - Superfamily Musteloidea
 - 19 species
 - Raccoon, weasels, red panda, skunk
 - Americas
 - Arboreal
 - Omnivorous
 - Dexterous paws

- ● ● | Order Carnivora: carnivores

- Family Procyonidae (raccoons & allies)
 - Kinkajou
 - S. Mexico, S. America
 - No ringed tail/mask
 - Prehensile tail
 - Woolly brown fur
 - Fruit
 - ARC



Order Carnivora: carnivores

- Family Procyonidae (raccoons & allies)
 - Coati (aka coatimundi)
 - Ringed tail, flexible nose
 - Mexico, C. & S. America
 - Fungus, berries, insects, mice
 - Children's Zoo



Order Carnivora: carnivores

- Family Mustelidae (weasels, badgers, & allies)
 - N.A. river otter
 - Rivers, lakes, coastal
 - Canada, US
 - Fish, frogs, snakes, lizards, insects, small mammals
 - Solitary, but playful
 - Habitat loss, pollution, trapping





Order Carnivora: carnivores

- Suborder Caniformia (dog-like)
 - Superfamily Pinnipedia
 - 24 species
 - Seals, sea lions, walruses
 - Social marine mammals
 - Streamlined bodies, flippers, blubber
 - Agile swimmers, also terrestrial
 - Precocial offspring
 - Common ancestor with bears

Order Carnivora: carnivores

- Family Phocidae (true seals)
 - Gray seal
 - N.E. & S.E. Atlantic, Baltic Sea
 - Fish, mollusks
 - Voluntary respirators
 - 1 at zoo, far end of Pachyderm building





Order Carnivora: carnivores

- Suborder Feliformia (cat-like)
 - Family Felidae (cats)
 - 38 species in Eurasia, Africa, Americas
 - Obligatory carnivores
 - Shortened skull, reduced # cheek teeth
 - Altricial offspring
 - Retractable claws (except cheetah)
 - Vision oriented
 - Jacobsen's organ, 'flehmen' response
 - Highly endangered

Order Carnivora: carnivores

- Family Felidae (cats)
 - Siberian tiger
 - Largest cat: 600lbs, 9ft
 - E. Siberia to China, Korea
 - Lighter orange, more white
 - Individual stripe patterns
 - Water-tolerant
 - Prey: deer, elk, wild pig
 - Lion House, SSP (<200 indiv.)



Order Carnivora: carnivores

- Family Felidae (cats)
 - Sumatran tiger
 - Smallest tiger: 350lbs
 - Island of Sumatra
 - Darkest coat
 - Prey: wild pig, sambar deer
 - 10% success rate
 - Lion House, SSP (<600 indiv.)



Order Carnivora: carnivores

- Family Felidae (cats)
 - African lion
 - Social groups=prides
 - Cooperative hunting
 - Zebra, antelope
 - Sexually dimorphic
 - Males larger, thick mane
 - 20 years in captivity
 - Lion House



Order Carnivora: carnivores

- Family Felidae (cats)
 - Snow leopard
 - Alpine regions in central/southern Asia
 - Prey: birds, hare, sheep, goats, yak
 - Long thick tail
 - Does not roar, purrs
 - Hunted for fur
 - Feline CC, SSP



- ● ● | Order Carnivora: carnivores

- Family Felidae (cats)

- Fishing cat

- S.E. Asia

- Grayish coat, short tail

- Semi-webbed toes

- Fish, frogs, jellyfish, shell fish, insects, waterfowl, mammals

- Feline CC, SSP



Order Carnivora: carnivores

- Family Felidae (cats)
 - Ocelot
 - C. & S. America, US Southwest
 - Nocturnal arboreal hunter
 - Rodents, birds, lizards, monkeys, armadillos
 - Threatened by habitat loss
 - Feline CC, SSP



Order Carnivora: carnivores

- Family Viverridae (civets, genets, mongooses)
 - Meerkat
 - Small, social mongoose
 - Grasslands in southern Africa
 - Complex social system
 - Scouts scan for predators
 - Omnivorous
 - Scorpions, snakes
 - Children's Zoo



Order Perissodactyla: odd-toed ungulates

- Order Perissodactyla (odd-toed ungulates)

- 19 species in 3 families

- Asia, Africa, Americas

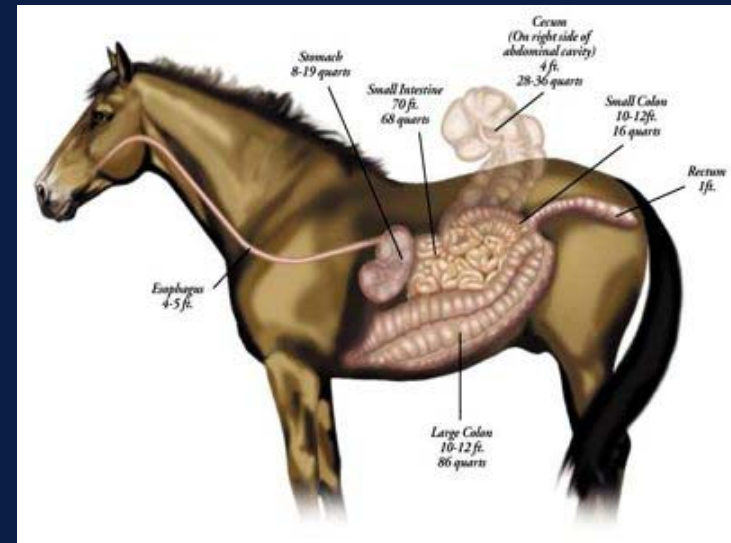
- Herbivores

- Hindgut fermenters

- Digest cellulose in large intestine

- Precocial offspring

- 6 species on IUCN Red List



Order Perissodactyla: odd-toed ungulates

- Family Equidae (horses, asses, zebras)
 - 10 species
 - Africa and Asia
 - Single toe on each foot, manes, tails
 - Mainly grazers
 - Jacobsen's organ & flehmen
 - Excellent peripheral vision
 - Wild asses endangered



Order Perissodactyla: odd-toed ungulates

- Family Equidae (horses, asses, zebras)
 - Plains or Grant's zebra
 - Savanna from Sudan to S. Africa
 - Anti-predator adaptations
 - Coat pattern
 - Strong kick
 - Stallion, females & foals
 - African Savanna exhibit



Order Perissodactyla: odd-toed ungulates

- Family Equidae (horses, asses, zebras)
 - Domestic horse
 - Pack animals, transportation, sport, recreation
 - Donkeys in 3000BC
 - Horse in 2500BC
 - Family Farm
 - Cream draft horse
 - Gotland pony
 - Miniature horse, miniature donkey



Order Perissodactyla: odd-toed ungulates

- Family Tapiridae (tapirs)

- 4 primitive species
- C. & S. America, S.E. Asia
- Pig-like bodies, slender legs, 3 toes, flexible snout
- Precocial offspring
 - Camouflaged
- Good swimmers



Order Perissodactyla: odd-toed ungulates

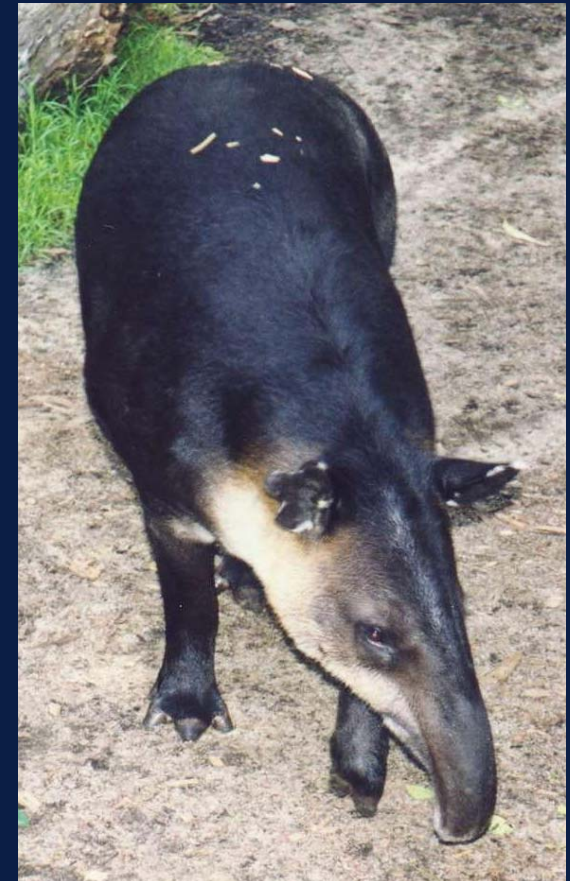
- Family Tapiridae (tapirs)

- Baird's tapir
- C. America
 - 600lbs
- Brown, light chin, neck
- Grass, leaves, fruit
- Predators: jaguars, pumas, humans
- Across from penguins



Order Perissodactyla: odd-toed ungulates

- Family Tapiridae (tapirs)
 - Mt. or woolly tapir
 - Northwestern S. America
 - Woolly brown coat
 - Important seed dispersers
 - Endangered: hunting & deforestation
 - Puente al Sur



Order Perissodactyla: odd-toed ungulates

- Family Rhinocerotidae (rhinoceroses)

- Critically endangered
- Solitary browsers & grazers
- Precocial offspring
- One or two horns
- Poor sight, good hearing & sense of smell
- Tough hide, few hairs
- 3 toes
- Africa & Asia



● ● ● | Order Perissodactyla: odd-toed ungulates

- Family Rhinocerotidae (rhinoceroses)

- Asian or Indian rhino

- Nepal, N.E. India
- Single horn
- Flexible upper lip
- 35 mph
- Heavy skin folds ‘armor plating’
- Human hunting main threat
- Across from otters; SSP



- ● ● | Order Perissodactyla: odd-toed ungulates

- Family Rhinocerotidae (rhinoceroses)

- Black rhino

- E. & S. African rhino
- Hooked, prehensile lip
- Two horns
- Human hunting main threat
- Successful SSP program
 - 14 calves at SF Zoo!
- Next to the grizzlies





Order Artiodactyla: even-toed ungulates

- Order Artiodactyla (even-toed ungulates)
 - 210 species in 6 families
 - Antelope, cows, pigs, hippos, sheep, goats, camels, deer, pronghorn, giraffe
 - Mainly ruminants
 - 4 chambered stomach, foregut fermentation by microbes
 - 20 species on IUCN's Red List

Order Artiodactyla: even-toed ungulates

- Family Suidae (pigs & allies)
 - Eurasia & Africa (introduced to Australia & Americas)
 - Omnivores
 - Non-ruminants
 - 1 stomach
 - Two sets of canines
 - 4 toes
 - Highly intelligent



- ● ● | Order Artiodactyla: even-toed ungulates

- Family Suidae (pigs & allies)
 - Kune Kune pig
 - Smallest domestic breed
 - Originated from European & African wild boars
 - Herbivore
 - Very friendly, likes humans



- ● ● | Order Artiodactyla: even-toed ungulates

- Family Suidae (pigs & allies)

- Warthog

- Southern Africa

- Long legs for visibility

- Named for fleshy bumps on face

- Kneel to graze on grasses and roots

- Two sets of tusks extending from upper and lower jaws



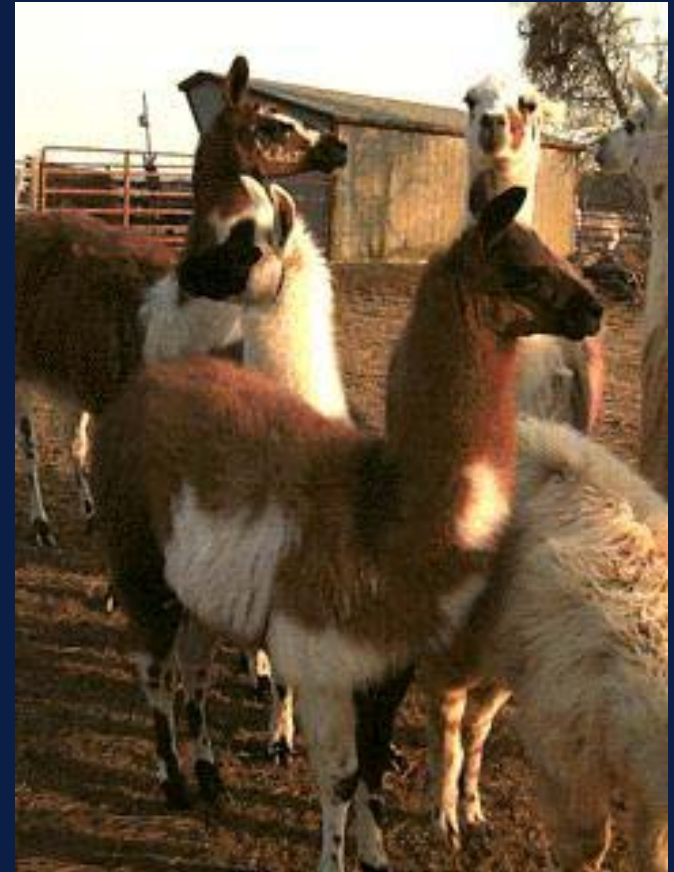


Order Artiodactyla: even-toed ungulates

- Family Camelidae (camels, alpacas, guanacos)
 - 7 species
 - S. America, Mongolia, Africa, Middle East
 - Tall, slender, long-necked ruminants with 2 toes, shaggy coats
 - Long eyelashes block dust & sand
 - Domestication
 - Old World species as pack animals
 - New World species for meat/clothing

- ● ● | Order Artiodactyla: even-toed ungulates

- Family Camelidae (camels, alpacas, guanacos)
 - Llama
 - Domesticated from guanaco
 - In the Yellow Barn at the Family Farm

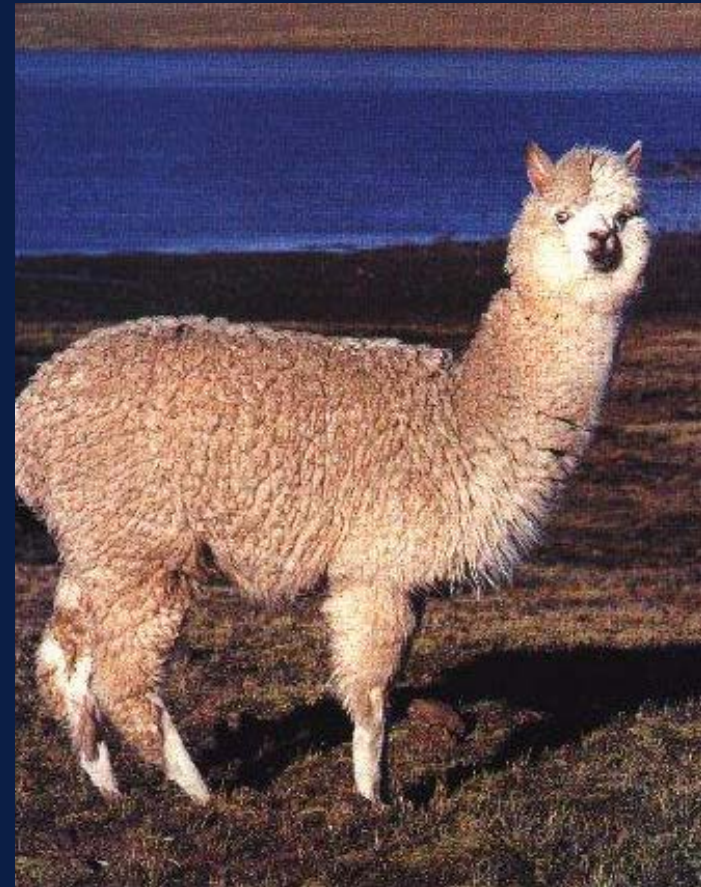


- ● ● | Order Artiodactyla: even-toed ungulates

- Family Camelidae (camels, alpacas, guanacos)

- Alpaca

- Domesticated from vicunas
- Not as bushy as llamas
- Found in the pen next to the Blue Barn in the Family Farm



Order Artiodactyla: even-toed ungulates

- Family Cervidae (deer)
 - 45 species
 - Africa, Eurasia, Americas
 - Antlers grow & shed annually
 - Directly from the skull
 - Larger each year
 - Indicator of individual health
 - 1-2 precocial, camouflaged offspring
 - Population explosions



Order Artiodactyla: even-toed ungulates

- Family Cervidae (deer)
 - Indian muntjac
 - Southern Asia
 - Short, non branching antlers
 - Male has all year
 - Tusk-like upper canines
 - Shoots & grasses, fruits, seeds, eggs, small mammals, carrion
 - Across from the duiker and next to male blackbuck



Order Artiodactyla: even-toed ungulates

- Family Bovidae (cattle, antelope, sheep, goats)
 - 140 species; highly diverse
 - Africa, Eurasia, North America
 - Un-branched horns
 - 4 toes
 - Good peripheral vision
 - 4 chambered stomach, ruminants
 - Many have been domesticated
 - 10 species on IUCN's Red List



- ● ● | Order Artiodactyla: even-toed ungulates

- Family Bovidae (cattle, antelope, sheep, goats)

- Scimitar horned oryx

- Africa
- Only found in zoos
- Named for horn shape
- Kidneys conserve water
- Metabolism allows internal temperature to reach 116°
- African Savanna



- ● ● | Order Artiodactyla: even-toed ungulates

- Family Bovidae (cattle, antelope, sheep, goats)

- Greater kudu

- E. & S. African savannas
- Males: large spiraling horns
- Brownish coat, white vertical bands on back
- Browsers: leaves, flowers, fruits, herbs
- African Savanna



Order Artiodactyla: even-toed ungulates

- Family Bovidae (cattle, antelope, sheep, goats)
 - Blackbuck
 - India, Nepal, Pakistan semi-desert
 - Males: spiraled horns, darker than females
 - Males defend a harem
 - Eat grass, grains
 - Hunting pressure
 - Male: next to the muntjac, female heard: behind warthog



- ● ● | Order Artiodactyla: even-toed ungulates

- Family Bovidae (cattle, antelope, sheep, goats)

- Giant eland

- Largest antelope (900lbs)

- African plains

- Shorter, spiraled horns in both sexes

- Dig up bulbs, tubers with hooves

- 1 across from outdoor lion exhibit



- ● ● | Order Artiodactyla: even-toed ungulates

- Family Bovidae (cattle, antelope, sheep, goats)

- Yellow-backed duiker

- Small African forest antelope

- Seeds, fruit, berries, moss

- Startle responses:

- Jump into brush

- Erect yellow hair startled

- Largest brain to body size ratio

- Across from muntjac & male blackbuck



Order Artiodactyla: even-toed ungulates

- Family Bovidae (cattle, antelope, sheep, goats)
 - Guenther's dik dik
 - Steppes of Kenya & Somalia
 - Small (10lbs)
 - Flexible, trunk-like nose
 - Reddish tuft on forehead stands up when agitated
 - Hides are used for gloves
 - Aviary of the African Savanna



Order Artiodactyla: even-toed ungulates

- Family Hippopotomidae (hippopotomuses)
 - 2 species
 - Large, semi-aquatic African mammals
 - Spend most of the time submerged
 - Mostly hairless, thick skin can crack
 - Secrete pink liquid from skin
 - Highly aggressive
 - Pygmy hippos are endangered due to hunting and habitat loss



- ● ● | Order Artiodactyla: even-toed ungulates

- Family Hippopotomidae (hippopotomuses)

- Nile hippopotamus

- Central & eastern Africa
- 1.5 tons, 9ft
- Grazes at night along river banks
- Not highly social, except when water is scarce



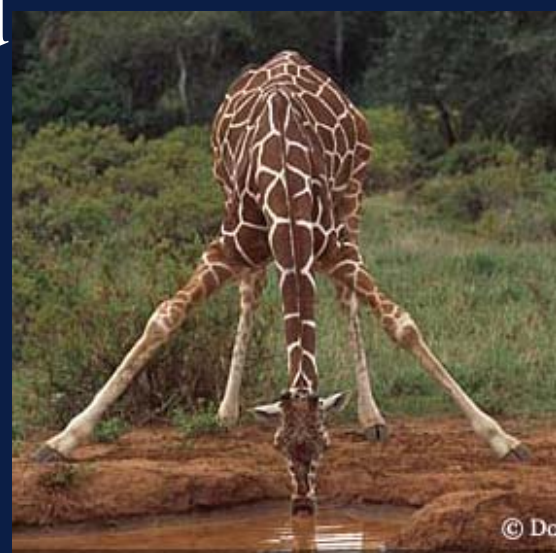
- ● ● | Order Artiodactyla: even-toed ungulates

- Family Giraffidae (giraffe, okapi)
 - 2 species, both African
 - Long legged
 - knobby horns covered in hair
 - Long prehensile tongue



Order Artiodactyla: even-toed ungulates

- Family Giraffidae (giraffe, okapi)
 - Reticulated giraffe
 - Males: 18 ft, newborn: 6 ft
 - Longest neck
 - 1-way valves regulate blood flow to brain
 - 18-inch prehensile tongue
 - 2-4 knobby horns part of skull
 - 9 subspecies
 - African Savanna



Order Primates: primates

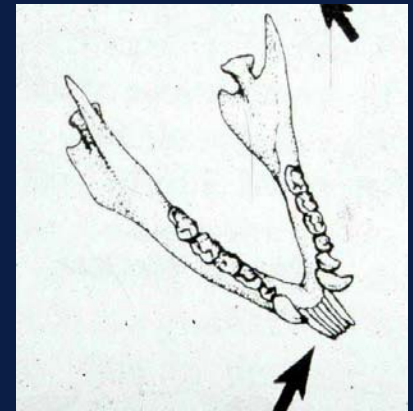
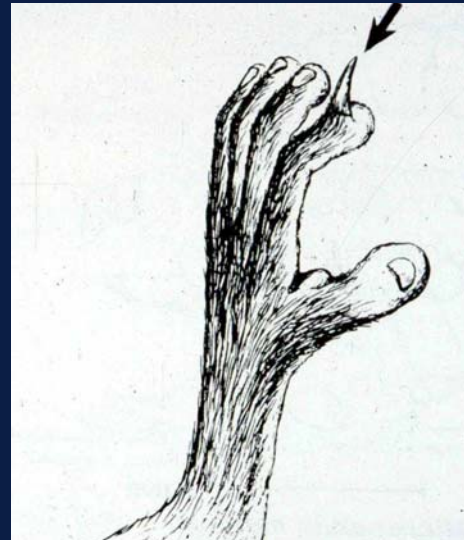
- Order Primates
 - 350 species
 - Primitive, generalized
 - 5 digits
 - Clavicle
 - Binocular vision
 - Nails
 - Opposable digits
 - Large brains



Darwinius masillae, 47 mya

Order Primates: primates

- Suborder Strepsirrhini (lemurs, lorises, aye-ayes)
 - ‘Primitive’ primates
 - Smaller brain size
 - Wet nose
 - Unique traits
 - Dental comb
 - Grooming claw



- ● ● | Order Primates: primates

- Superfamily Lemuroidea (lemurs)
 - All on Madagascar
 - Ring-tail lemur
 - Highly terrestrial
 - Use ringed tail in communication
 - Females *dominant* over males



- ● ● | Order Primates: primates

- Superfamily Lemuroidea (lemurs)
 - Black lemur
 - Sexually dichromatic
 - Males black, females reddish-brown
 - SSP



- ● ● | Order Primates: primates

- Superfamily Lemuroidea (lemurs)
 - White fronted lemur
 - Females all brown, males brown with white tufts
 - Females *dominant* over males
 - SSP



- ● ● | Order Primates: primates

- Superfamily Lemuroidea (lemurs)

- Red-ruffed lemur

- Complex alarm call system

- Eat leaves, fruit, flowers, and seeds

- Masoala Peninsula; separated from the other subspecies by river

- SSP



- ● ● | Order Primates: primates

- Superfamily Lemuroidea (lemurs)
 - Black & white ruffed lemur
 - Loud, hooting alarm call
 - Eat fruit and leaves
 - SSP



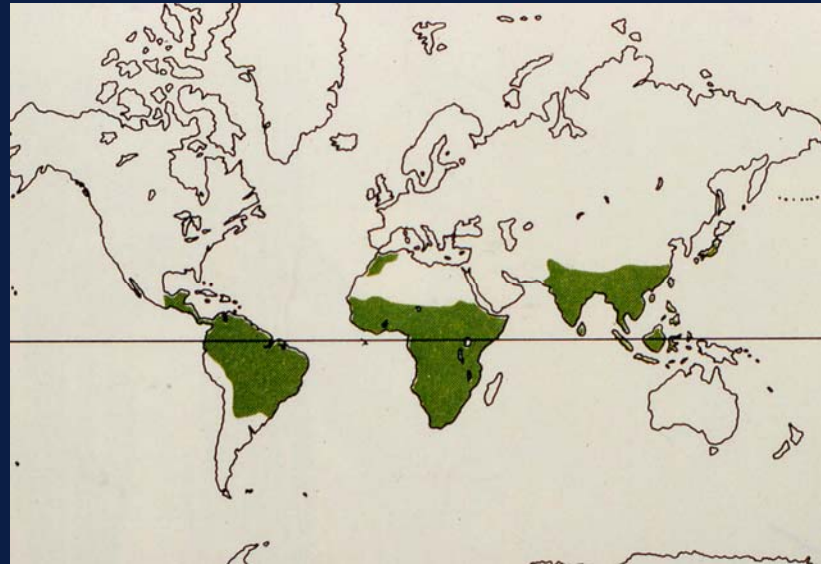
- ● ● | Order Primates: primates

- Superfamily Daubentonoidea
 - Aye-aye
 - Madagascar
 - Nocturnal & solitary
 - Little known
 - Long bony middle-finger
 - Grubs, eggs
 - Primate Discovery Center



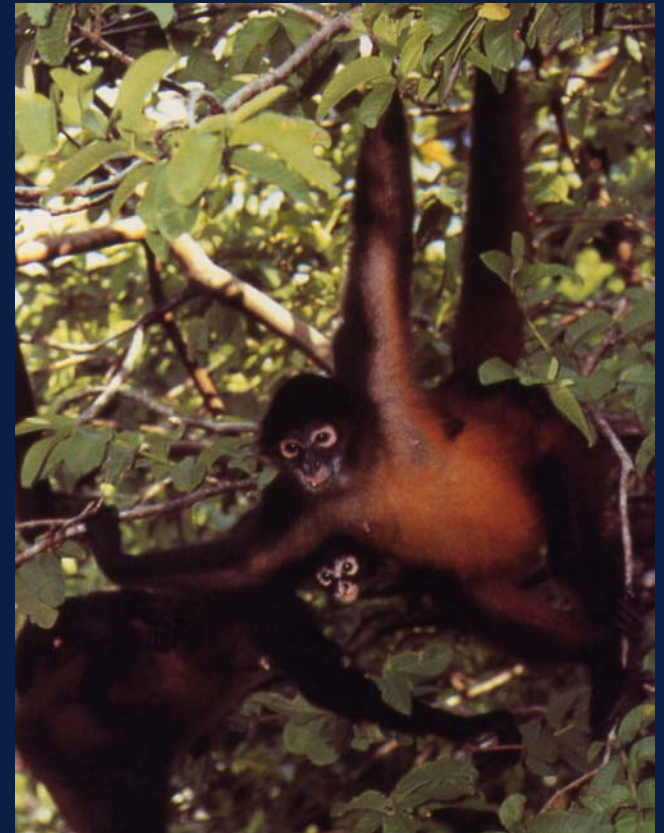
Order Primates: primates

- Suborder Haplorrhini
 - Monkeys, apes, people
 - ‘Derived’ traits
 - Larger brain
 - Shorter snout
 - Dry nose
 - ‘New World’ & ‘Old World’ primates



Order Primates: primates

- Superfamily Ceboidea
 - New World monkeys
 - Capuchins, squirrel monkeys, tamarins, spider monkeys, howler monkeys



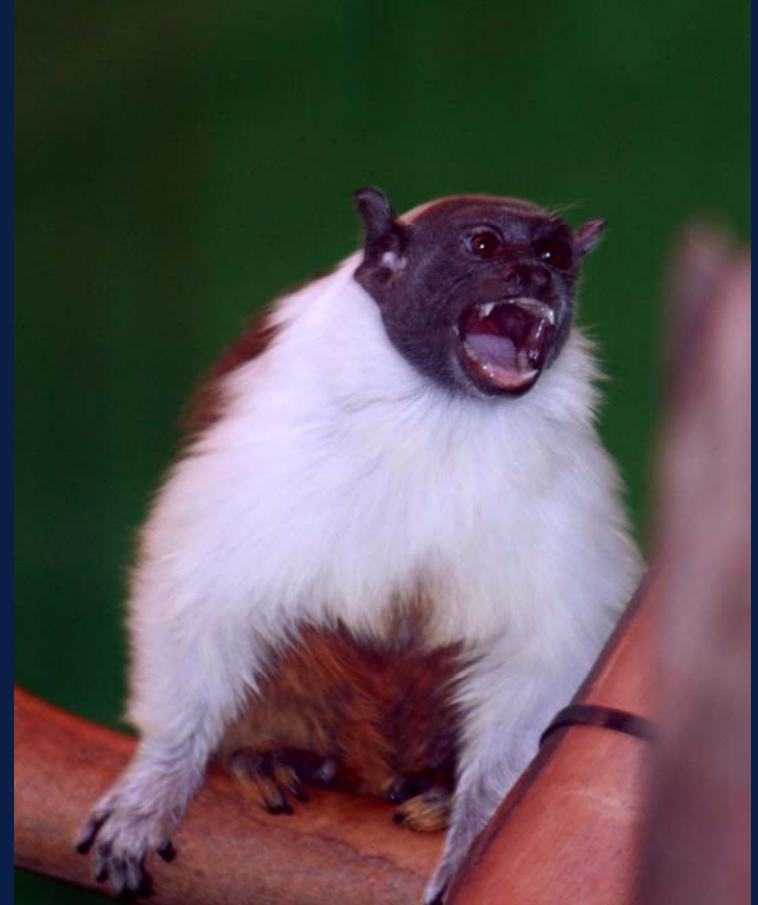
Order Primates: primates

- Superfamily Ceboidea
 - Emperor tamarins
 - Western S. America
 - Specialize on gum
 - Re-evolved 'claws'
 - Produce twins, communal rearing
 - Polyspecific associations
 - Vulnerable due to habitat loss
 - Next to patas



- ● ● | Order Primates: primates

- Superfamily Ceboidea
 - Pied tamarins
 - Brazilian Rainforest
 - Deforestation
 - Largely unknown
 - Successful breeding
 - Next to patas



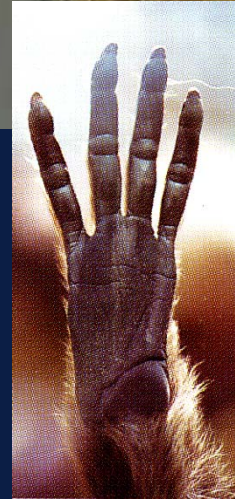
Order Primates: primates

- Superfamily Ceboidea
 - Squirrel monkeys
 - S. America
 - 30-200 per group
 - Insects, also fruit, flowers
 - Associate with capuchins
 - Children's Zoo



Order Primates: primates

- Superfamily Ceboidea
 - Black howler monkey
 - S. America
 - Largest NW monkey
 - Prehensile tail & no thumb
 - Leaf-eating
 - Defends territory via howling
 - Primate Discovery Center



- ● ● | Order Primates: primates

- Superfamily Cercopithecoidea
 - Old World monkeys
 - Baboons, macaques, guenons



- ● ● | Order Primates: primates

- Superfamily Cercopithecoidea
 - Lion-tailed macaque
 - Western India
 - Named for ‘mane’ & tail tuft
 - Most endangered macaque due to habitat loss
 - SSP



- ● ● | Order Primates: primates

- Superfamily Cercopithecoidea

- Francois' langur

- S.E. Asia: China to Vietnam

- Leaf eaters

- Infants are orange

- Encourages allomothering



- ● ● | Order Primates: primates

- Superfamily Cercopithecoidea
 - Black & white colobus monkey
 - Leaf eaters of Africa
 - Bacterial colonies help break down cellulose
 - Hunted for coat
 - Primate Discovery Center



- ● ● | Order Primates: primates

- Superfamily Cercopithecoidea

- Patas monkey

- Africa

- Fastest primate

- 35 mph

- Largest home range

- Primate Discovery

- Center next to tamarins



Order Primates: primates

- Superfamily Cercopithecoidea
 - Mandrill
 - Africa
 - Males 2x female
 - Bright face & rump
 - Groups >200
 - Primate Discovery Center next to patas



Order Primates: primates

- Superfamily Hominoidea
 - Apes & people
 - Able to swing below branches
 - No tail
 - Larger brain than monkeys
 - Gibbons, chimps, gorillas, orangutans, people



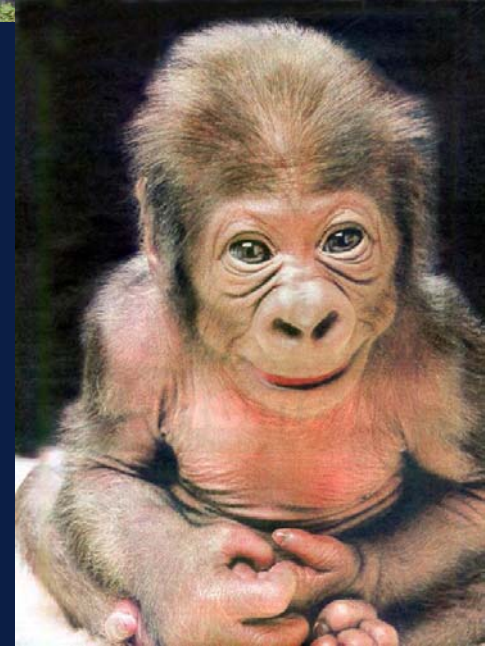
Order Primates: primates

- Superfamily Hominoidea
 - Siamang
 - Closely related to gibbons
 - S.E. Asia
 - ‘Lesser apes’
 - Monogamous family groups
 - Expert brachiators



Order Primates: primates

- Superfamily Hominoidea
 - Western lowland gorilla
 - West Africa
 - Largest ‘great ape’
 - Silverback males: 450lbs
 - ‘Knuckle-walking’
 - Endangered: hunting, habitat
 - Gorilla Reserve



Order Primates: primates

- Superfamily Hominoidea
 - Common chimpanzee
 - Central to West Africa
 - Communities
 - Males cooperate
 - Patrol boundary
 - Hunting
 - Endangered: hunting, habitat
 - Near Lemur Cafe

