

Anthro 101:
Human Biological Evolution

Lecture 7: Taxonomy/Primate
Adaptations

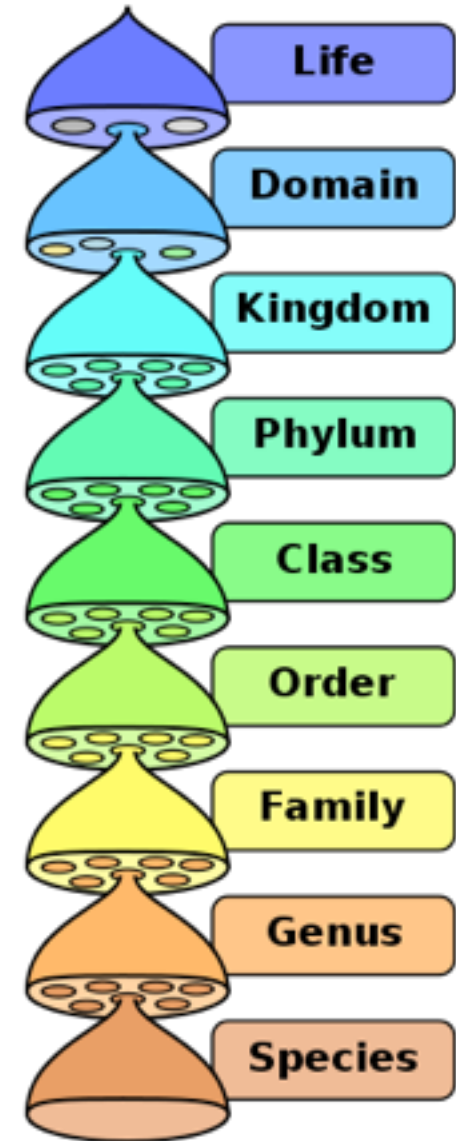
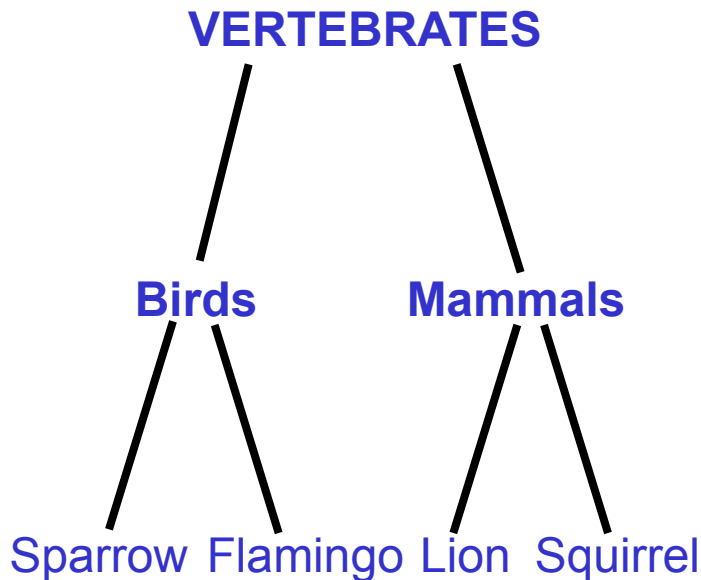
Prof. Kenneth Feldmeier

The Plan

- Read through this lecture and watch the video about Taxonomy

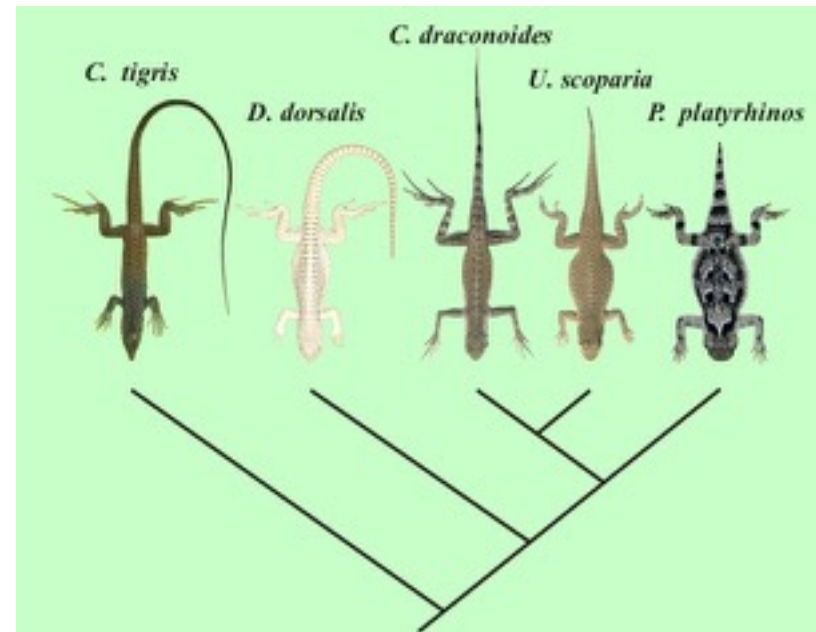
Classifying species into taxa

- **Linnaeus** – classification based on physical similarity
 - ♦ *Genus species*, e.g. *Homo sapiens*
- Nested hierarchies of similarity due to common descent (Darwin)



Phylogeny

- **Phylogeny** = evolutionary relationships among groups of species
 - ♦ Share some ancestral traits
 - ♦ Differ in some derived traits
- When one species splits into 2
- Differences accumulate within evolutionary lineages over time



Homologous traits: shared phylogenetic history

Similar underlying structures can be modified for very different functions



Bats fly



Dugongs swim



Moles dig

All share the same
Basic limb structure because share common ancestor

Analogous traits: different phylogenetic history

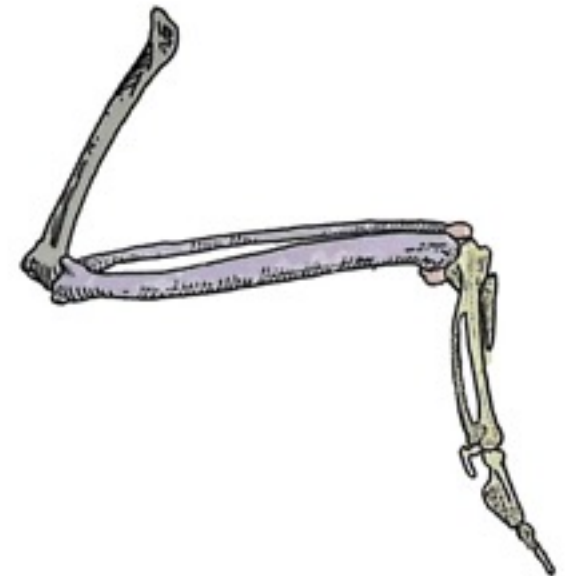


Different structures can be used for similar functions

- Bats and birds fly
- Bat wing is modified from bones of hand

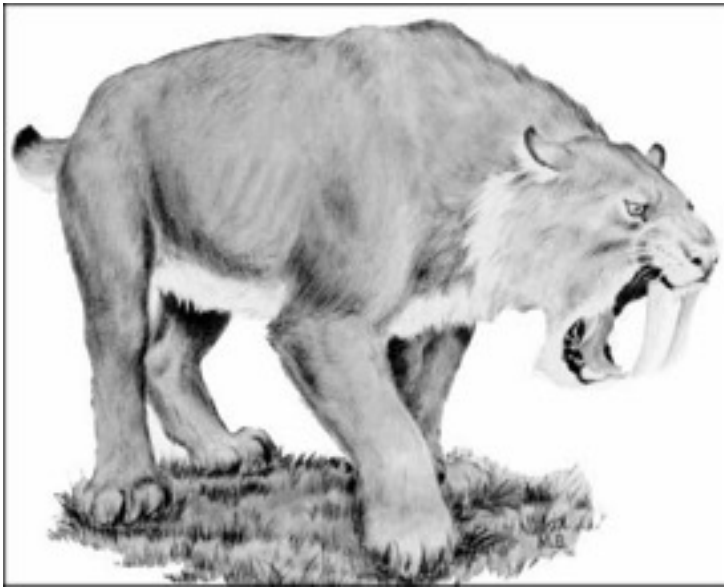


- Bird wings are modified from bones of forelimb

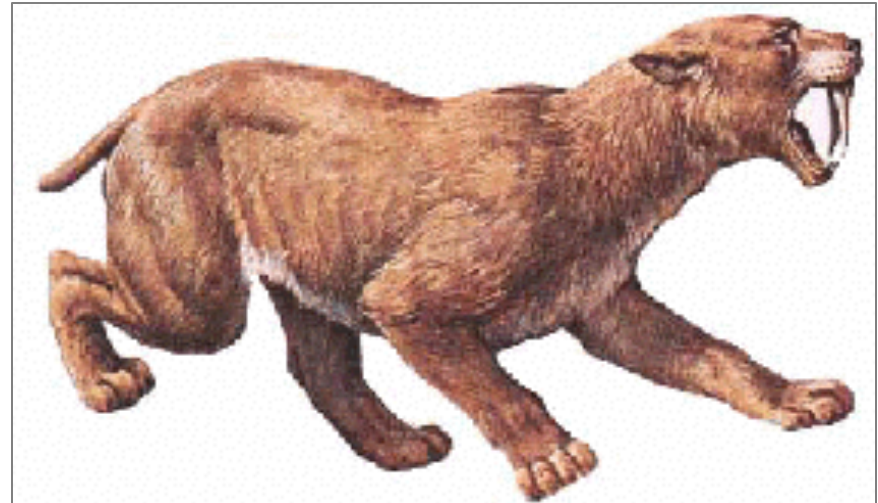


Convergent Evolution: leads to analogous traits

Adaptation to solve similar ecological problems



(Smilodon):
placental mammal



(Thylacosmilus):
marsupial mammal

Both animals adapted to catch large prey with teeth and claws.

Convergent Evolution: leads to analogous traits

Adaptation to solve similar problems



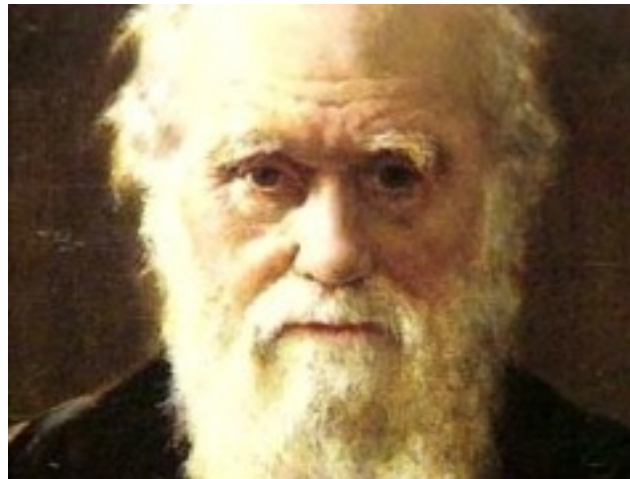
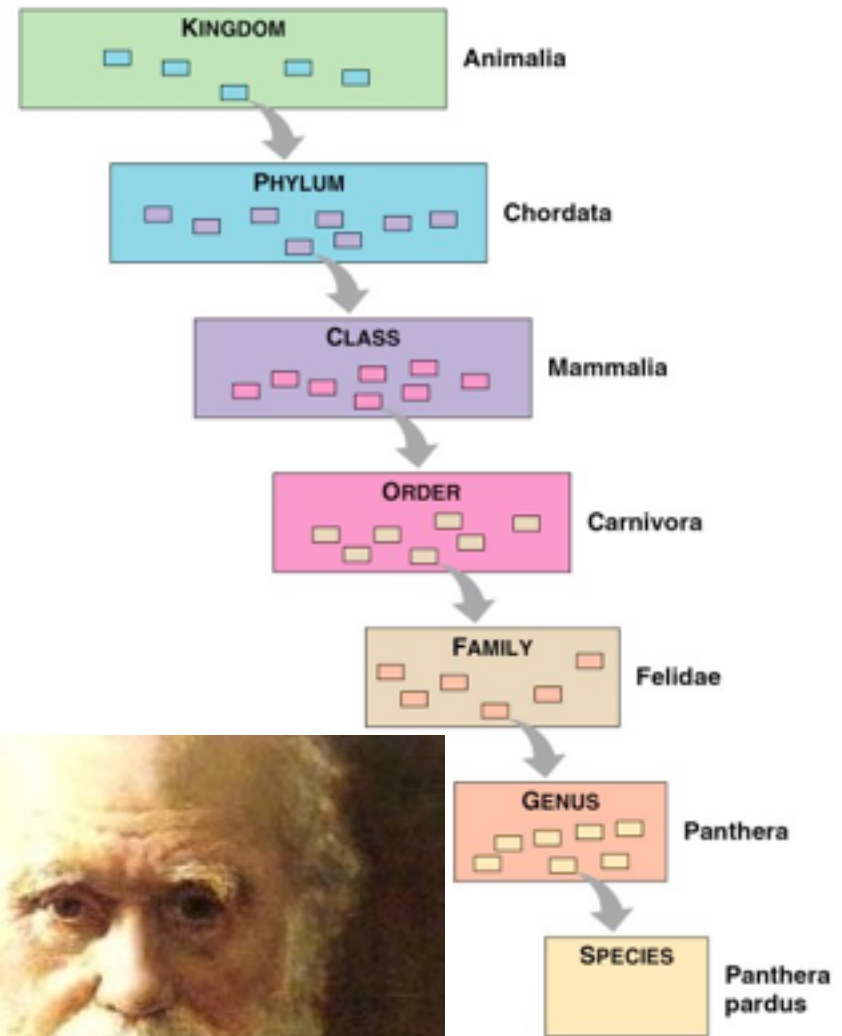
(Smilodon):
placental mammal

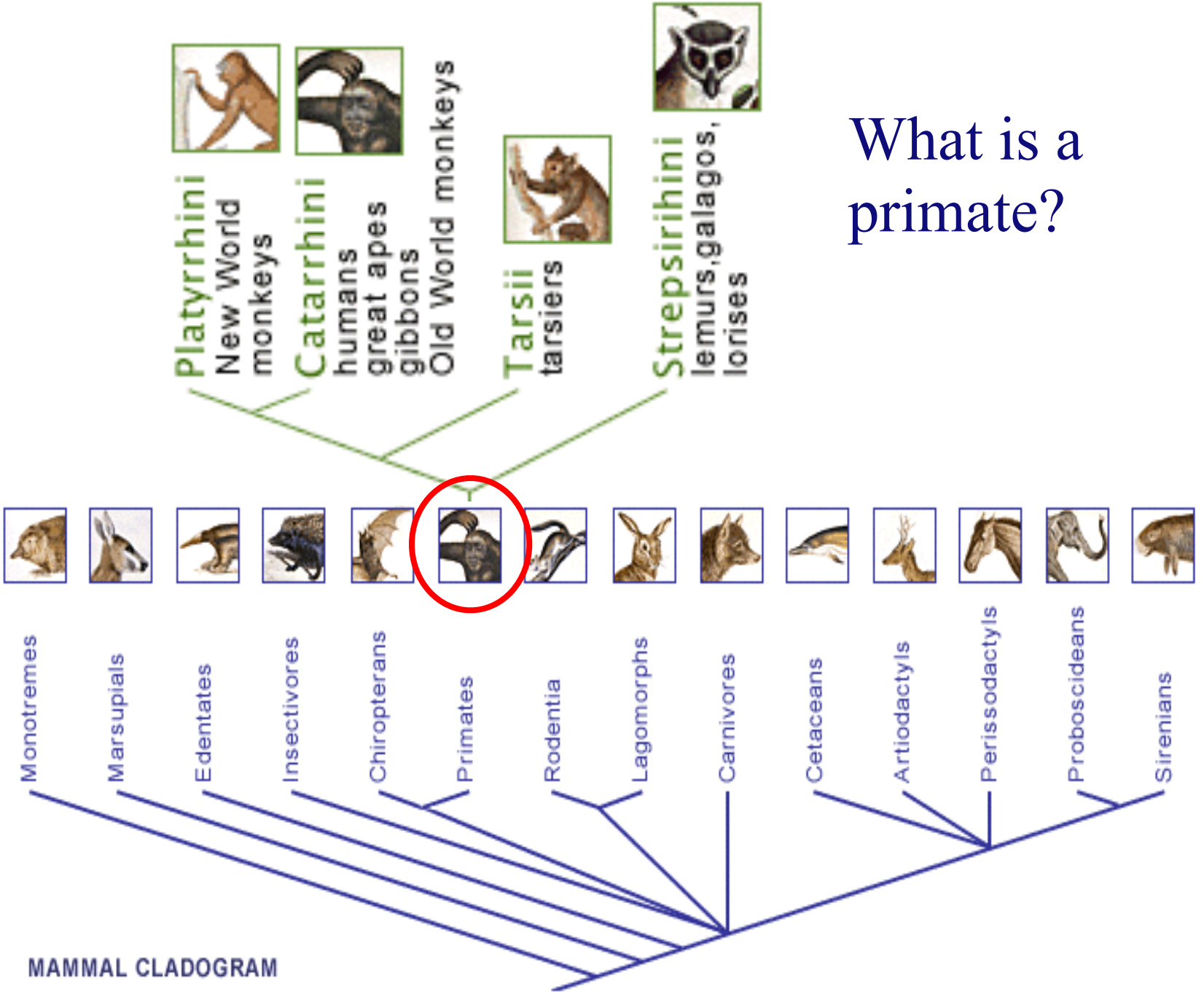


(Thylacosmilus):
marsupial mammal

Where do we fit in? *Homo sapiens*

- Kingdom: Animal
- Phylum: Chordata
- Class: Mammalia
- Order: Primates
- Suborder: Anthroponoidea
- Infraorder: Catarrhini
- Superfamily: Hominoidea
- Family: Hominidae
- Subfamily: Homininae
- Tribe: Hominini
- Genus: *Homo*
- Species: *sapiens*





What is a primate?

What is a Primate?

- http://www.youtube.com/watch?v=BpnIS_ach-0

Which of these animals are primates?



Galago



Tarsier

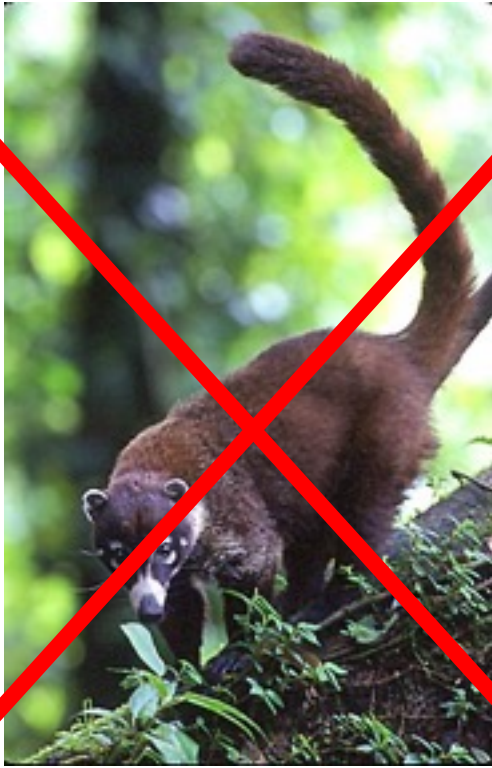
Possum



Loris

Which of these animals are primates?

Coati



Lemur

Red Panda



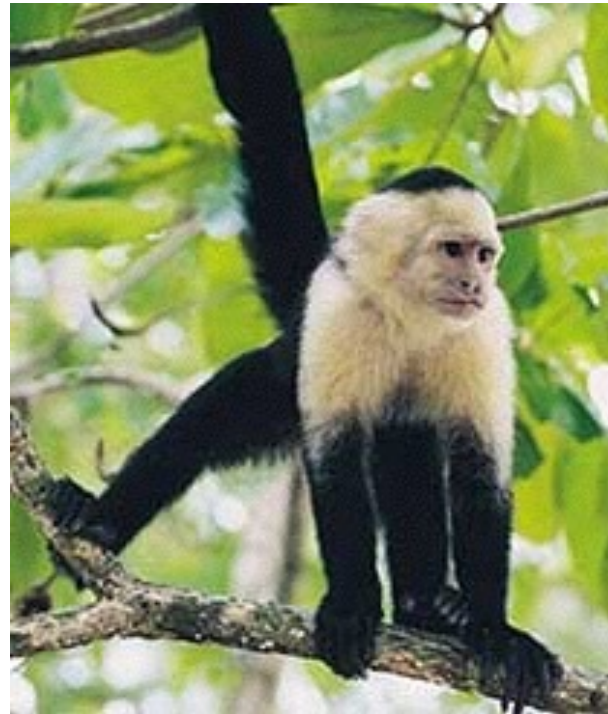
Sifaka



Some primates are easier to recognize

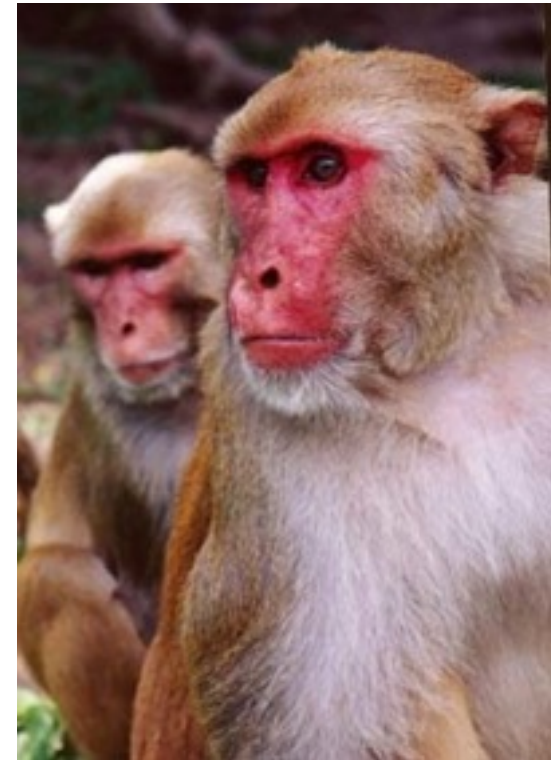


Gorilla

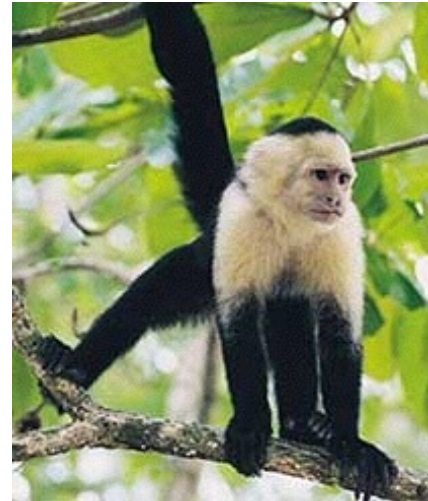


Capuchin

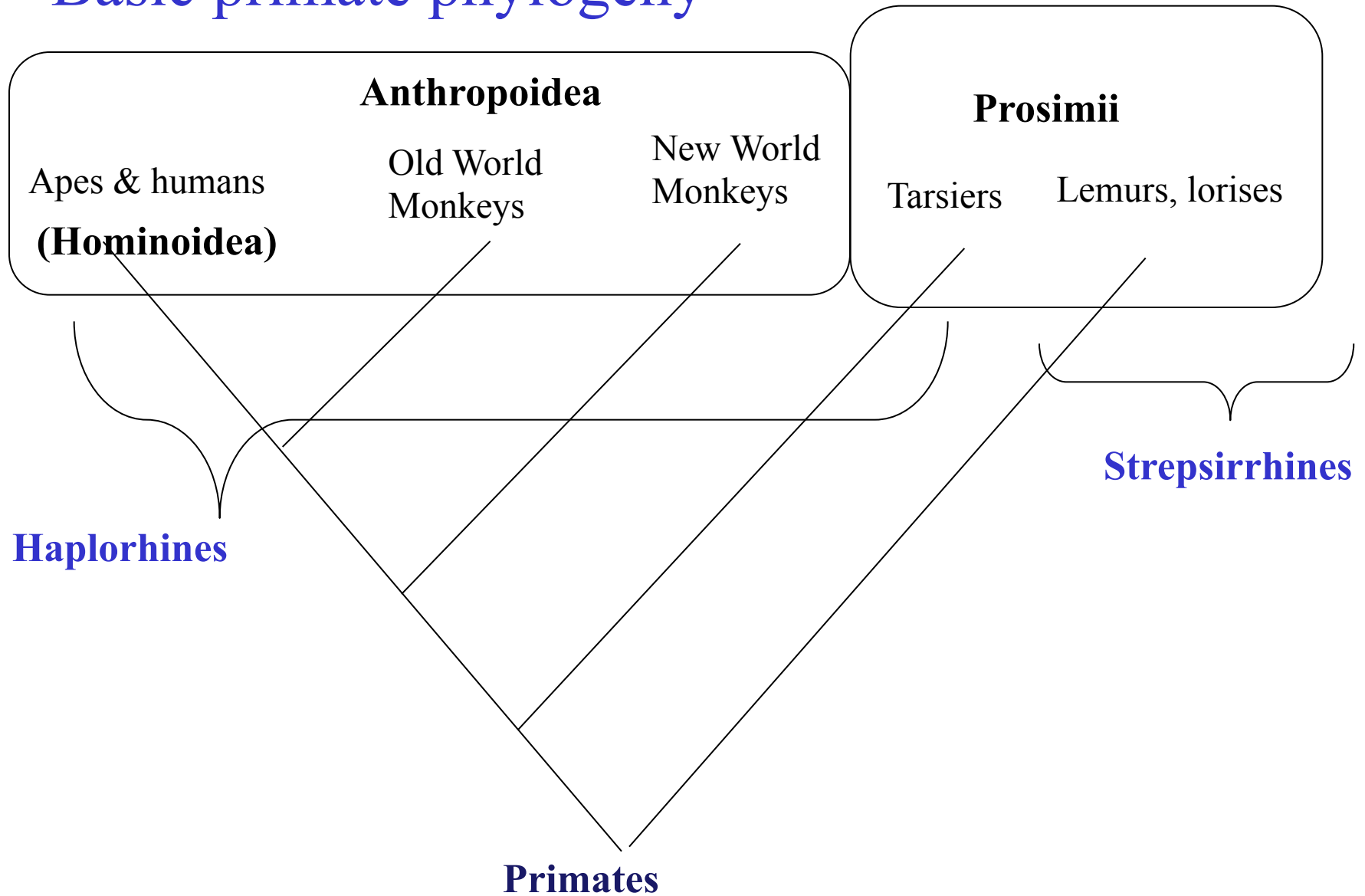
Rhesus



Primates are a diverse order

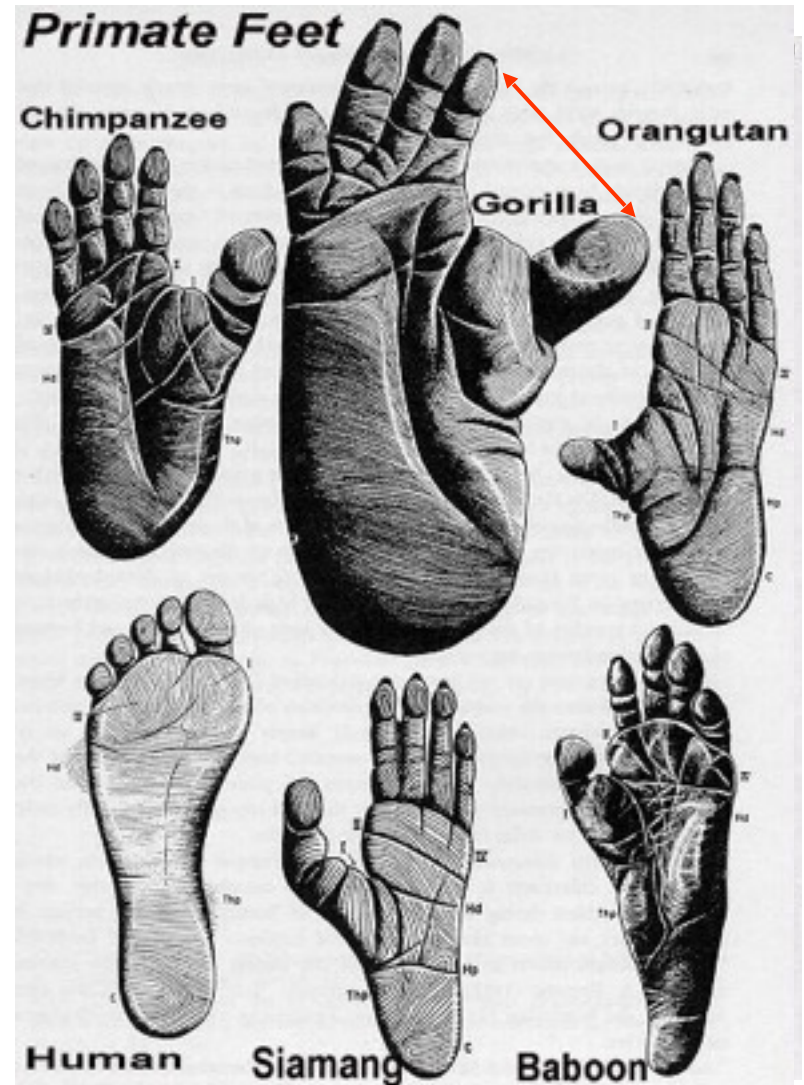


Basic primate phylogeny



What makes an animal a primate?

- Features of hand & feet
 - ◆ Grasping big toe
 - ◆ Grasping hands
 - Some opposable thumbs
 - ◆ Sensitive finger tips
 - Finger prints!



What makes an animal a primate?

- Features of hand & feet
 - ◆ Grasping big toe
 - ◆ Grasping thumb
 - Some opposable thumbs
 - ◆ Sensitive finger tips
 - Finger prints
 - ◆ Flat nails
 - ◆ Generalized limb structure



Squirrel Monkey

What makes an animal a primate?

Features of the sensory organs - **Vision**

Pygmy marmoset

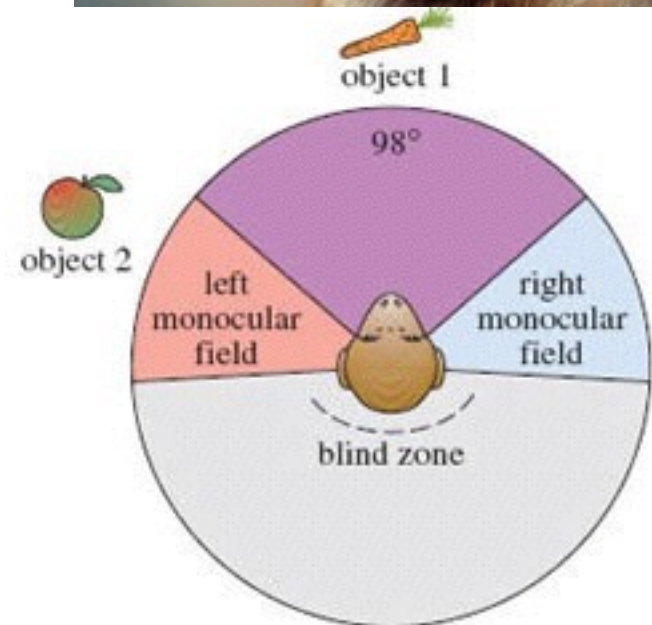
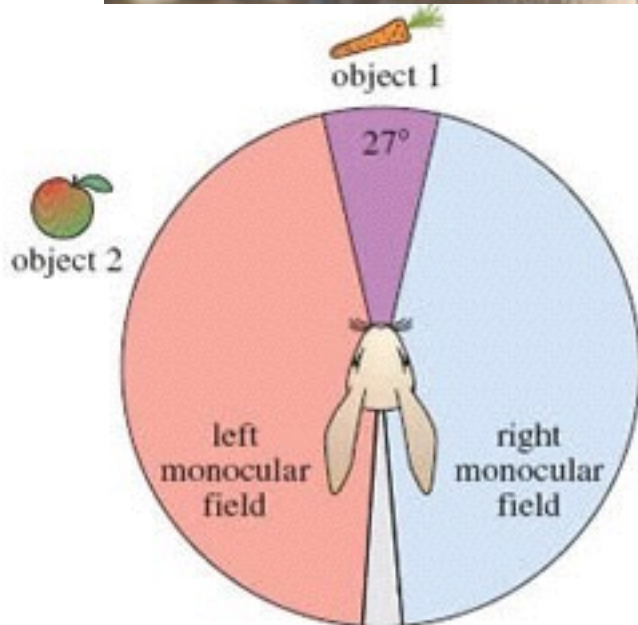
- Forward facing eyes
 - Binocular vision
- Stereoscopic vision
 - ◆ Information sent to both hemispheres of brain
- Depth perception
- Color vision
- Limited olfactory senses (except prosimians)



Golden monkey

Binocular Vision: Primates have binocular vision. I have two pictures here, one of a rabbit and the other is a Capuchin monkey. Why does a habit need eyes on the side of it heads?

Why is that different for primates?



Stereoscopic Vision:

This is how the primate vision functions in the brain. Each eye sends info to the visual cortex. This allows for our 3d vision

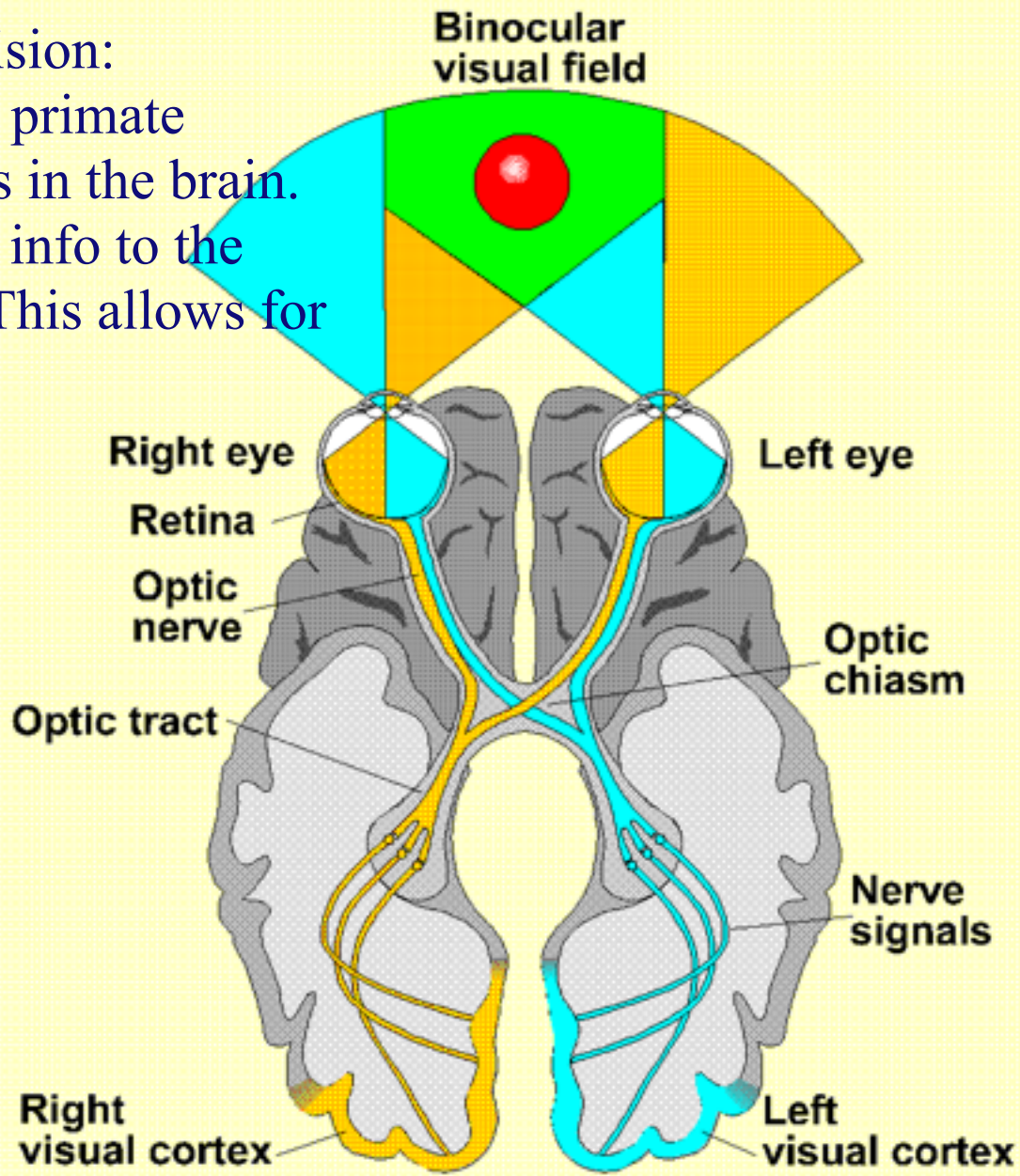


Figure 10: Binocular vision, showing visual pathways in the brain

What makes an animal a primate?

Features of life history

- K-selected
 - ◆ Large maternal investment in care
- small litters
- long pregnancy
- Long infancy
- long juvenile period

- long mother-infant bond

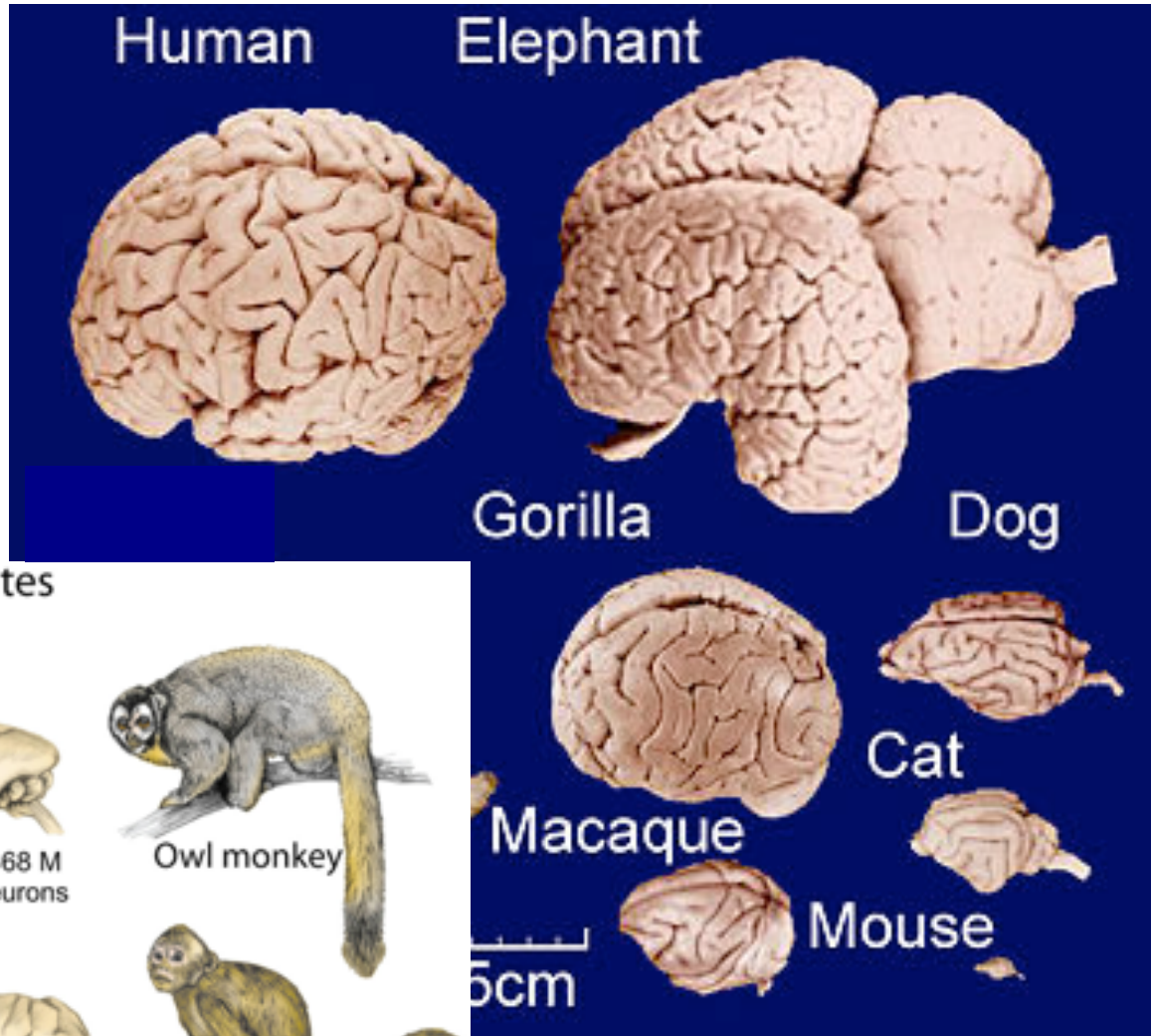
- long life span
- Long reproductive period



Savanna baboon

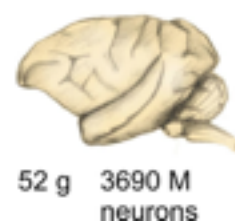
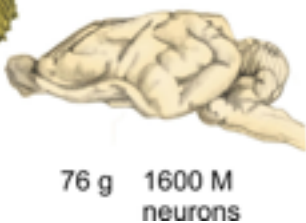
What makes an animal a primate?

Large brain relative to body size & an emphasis on learning



Rodents

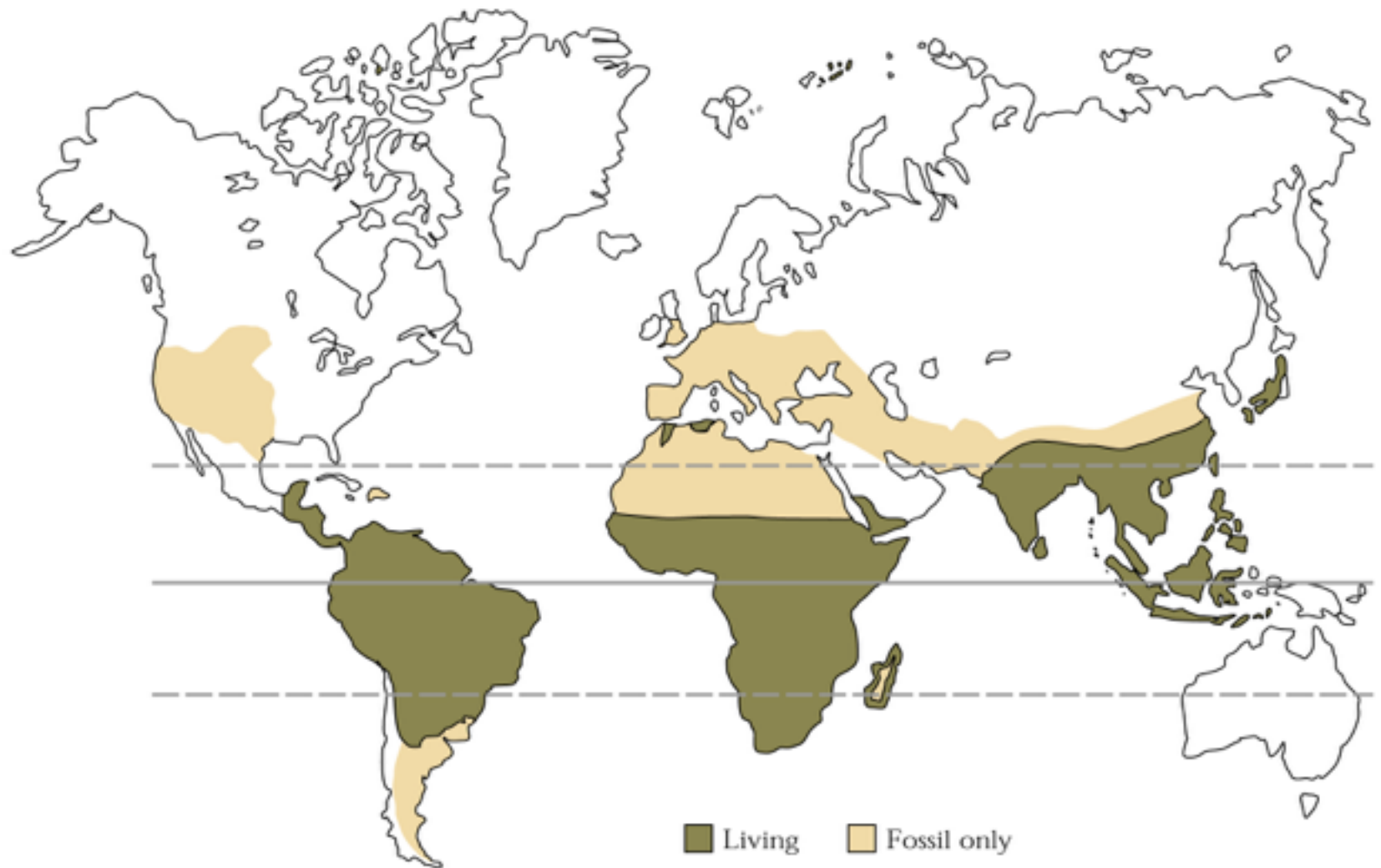
Primates



Sociality



Primates are mainly restricted to the tropics



But, monkeys have also adapted to wide range of habitats



Primary tropical forest



Tem



Desert



Secondary forest

What are these adaptations for?

- **Arboreal Hypothesis**

- ◆ Stereoscopic vision
- ◆ Grasping hands
- ◆ Nails

= **adaptive niche of life
in the trees**



**But squirrels do pretty
well without thumbs...**



What are these adaptations for?

- **Visual Predation Hypothesis**
 - ◆ **Analogy** with insectivores
 - ◆ Stalk and capture insects
 - ◆ Depth perception
 - ◆ Grasping hands**= adaptive niche of catching fast moving prey**



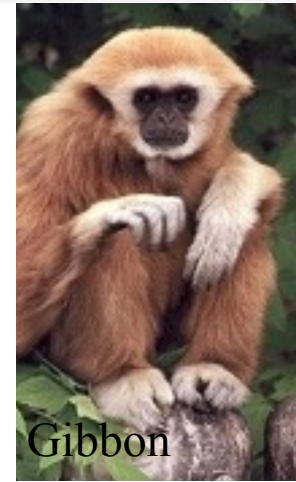
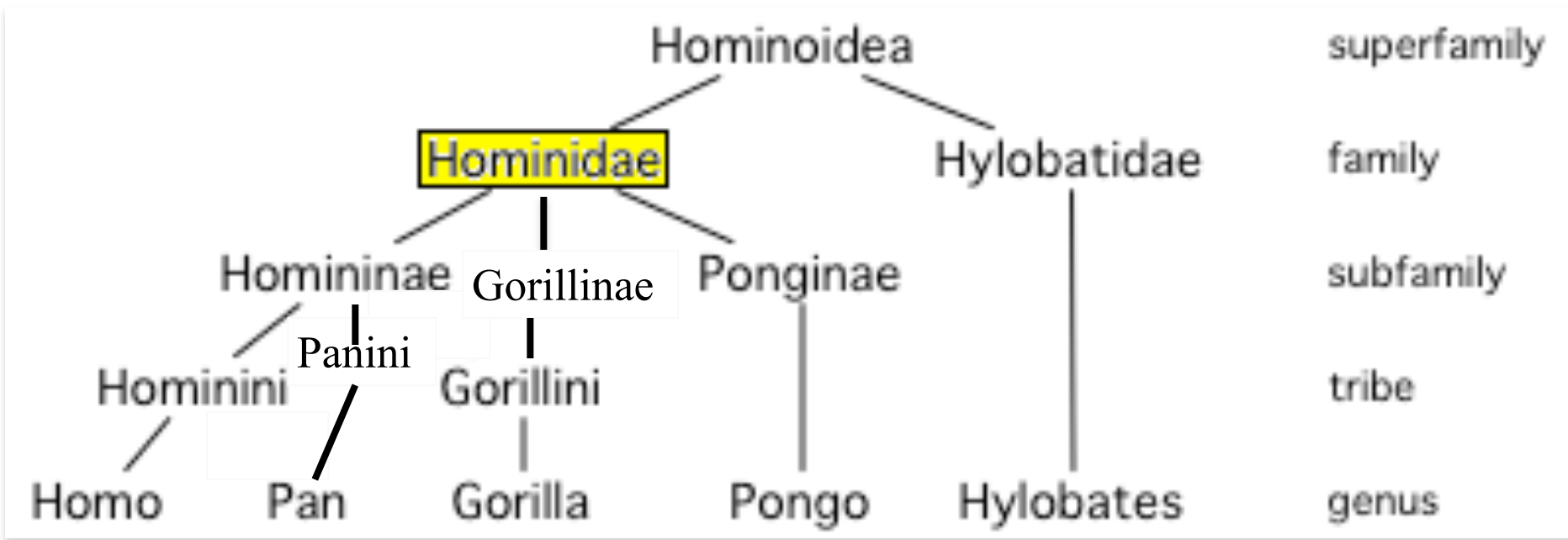
galago

What are these adaptations good for?

- **Angiosperm Radiation hypothesis**
- Adaptive niche of exploiting flowering plants
- Color vision
- Fine visual & tactile discrimination



Phylogeny for apes: Hominoidea



Prosimians are the most primitive primates (Strepsirhines)

The most different from us

- Many are **nocturnal**
- Many are **solitary**
- Some w/ **claws** instead of nails
- Some w/ acute sense of smell
 - ♦ **Rhinarium & philtrum**
 - ♦ Scent marking

Two types:

Lorises

Lemurs



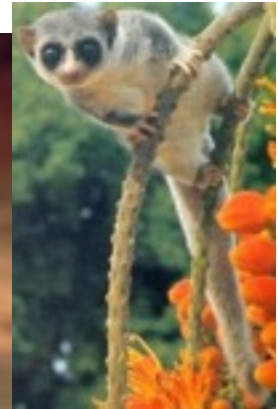
Potto (Loris)



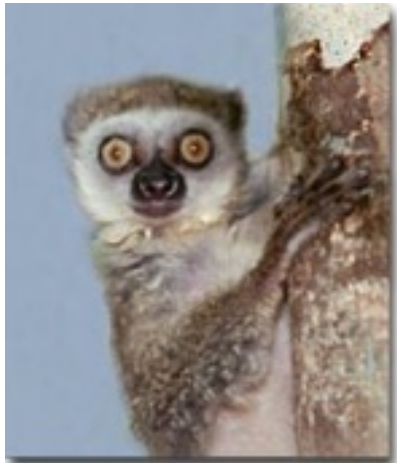
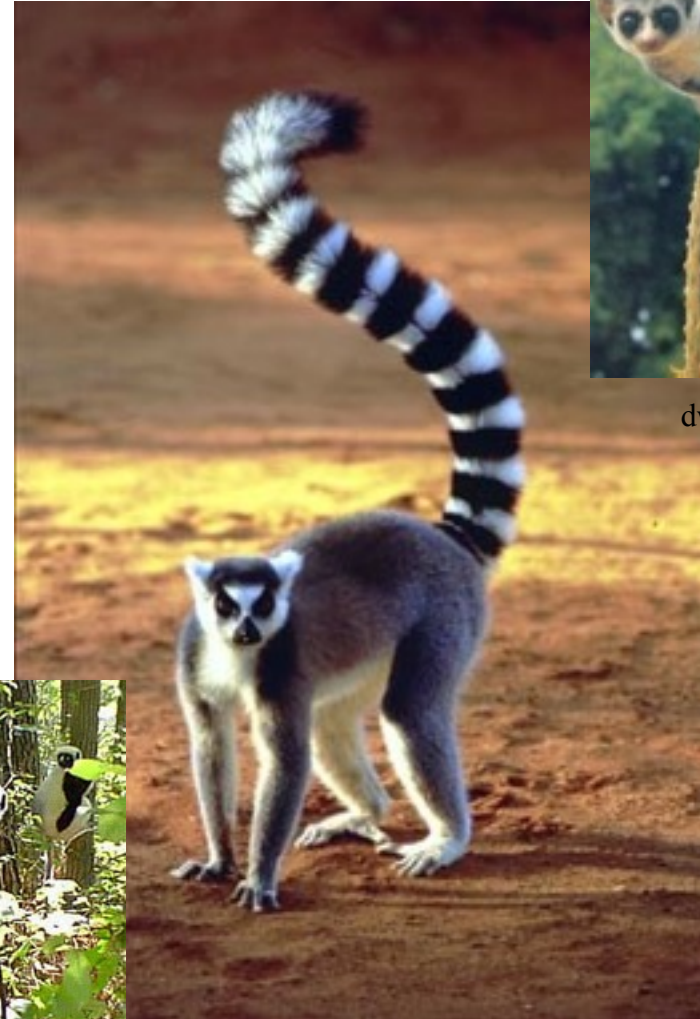
Bush Baby (Loris)

Prosimians divided into two groups: Lemurs

- **only on Madagascar**
- **Adaptive radiation**
- 40+ species evolved in last 100 MY
- No large predators on island, until humans 1500 ya



dwarf lemur



avahi



aye aye



sifaka

Haplorhines: Monkeys, Apes, Tarsiers

Most of the primate adaptations

- Vision > Olfaction
- Eyes surrounded by bone
- Fused midline of lower jaw
- Diurnal
 - ◆ Except Tarsiers
 - ◆ Except Owl monkey
- Social
 - ◆ Except Orangutan
- Larger brain



Red faced spider monkey

Tarsier: Prosimian & Haplorhine

- **Mixture of anthropoid & prosimian traits**
 - Dry nose
 - partially closed eye socket
- **Nocturnal**
- **Only carnivorous primate**
 - eat insects and small vertebrates



Anthropoids: monkeys & apes

New World monkeys (**Platyrrhini**)

- Latin America
 - Diurnal
 - Arboreal
 - Tropical forests
-



Anthropoids: monkeys & apes



Barbary Macaque © Karyn Sig

Old World monkeys & apes (**Catarrhini**)

- Africa & Asia
- All diurnal
- Some arboreal, some terrestrial
- Broad habitat range
- Ischial callosities
- Sexual skin



Spectacled langur



Black and white colobus

Apes: Hominoidea

- Bigger brains
 - Extended life-history
 - Complex social interactions
 - Large body size
 - **No tails**
 - Suspensory locomotion
- Hylobatidae (lesser apes)
 - ◆ Gibbons & Siamangs
 - Ponginae (orangutans)
 - Gorillinae (gorillas)
 - Homininae
 - ◆ Panini (chimps & bonobos)
 - ◆ Hominini (Humans)

