Anthro 101:
Human Biological Evolution

Lecture 7: Taxonomy/Primate Adaptations

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Here is the PLAN…

• Listen to this lecture and read about Taxonomy in the text
• I will ask you a question(s) in the next class to ensure you did this assignment
• Taxonomy project over the next few days
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)

![Classification diagram](image)
Phylogeny

- **Phylogeny** = evolutionary relationships among groups of species

- When one species splits into 2
  - Share some **ancestral** traits
  - Differ in some **derived** traits

- 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: Anthropoidea
- Infraorder: Catarrhini
- Superfamily: Hominoidea
- Family: Hominidae
- Subfamily: Homininae
- Tribe: Hominini
- Genus: *Homo*
- Species: *sapiens*
What is a Primate?

- [http://www.youtube.com/watch?v=BpnIS_ach-0](http://www.youtube.com/watch?v=BpnIS_ach-0)
Which of these animals are primates?

- Galago
- Tarsier
- Loris
- Possum
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

Primates

Haplorhines

Apes & humans (Hominoidea)

Anthropoidea

Old World Monkeys

New World Monkeys

Prosimii

Tarsiers

Lemurs, lorises

Strepsirrhines
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**

- Forward facing eyes
  - Binocular vision
- Stereoscopic vision
  - Information sent to both hemispheres of brain
- Depth perception

- Color vision

- Limited olfactory senses (except prosimians)
Binocular Vision
Stereoscopic 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
Sociality
Primates are mainly restricted to the tropics
But, monkeys have also adapted to wide range of habitats.
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
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

- **Hominoidea**
  - **Hominidae**
    - **Homininae**
      - **Panini**
        - *Homo*
        - *Pan*
    - **Gorillinae**
      - *Gorilla*
    - **Ponginae**
      - *Pongo*
  - **Hylobatidae**
    - **Hylobatidae**
      - *Hylobates*

- **Superfamily**
  - **Family**
  - **Subfamily**
  - **Tribe**
  - **Genus**

- **Images**:
  - Bonobo
  - Gorilla
  - Orangutan
  - Gibbon
  - Chimpanzee
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
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
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 or 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

Old World monkeys & apes (Catarrhini)
- Africa & Asia
- All diurnal
- Some arboreal, some terrestrial
- Broad habitat range
- Ischial callosities
- Sexual skin

Barbary Macaque © Karyn Sig
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)