Topic 16 - Human Evolution
The history of ourselves

For Final exam: “The Evolutionary Future of Humans”, and “The Effects of Humans on Evolution” for the exam (Interlude D)
Evolution: The Great Apes

Hominoidea (Apes)

Hylobatidae
(Lesser apes)

Hominidae
(Great apes)

Ponginae

Gorillini

Hominini

Hylobates
Gibbons

Pongo

Gorilla

Pan

Homo

pygmaeus
Bornean

abelii
Sumatran

gorilla
Western

beringei
Eastern

troglodytes
Common

paniscus
Bonobo

sapiens sapiens
Us

32 teeth, tailless, opposable thumbs, 8-9 month gestation

18 MY

14 MY

7 MY

6 MY
Orangutan

Largest arboreal animals
  Males, 170 lb
  Female, 81 lb
Borneo and Sumatra
Solitary (breeding, rearing young)
Highly endangered
  Logging, habitat destruction, poaching
Some learning capabilities, tool use
Gorilla

Largest existing great ape
Male, 350 lb
Female, 200 lb
Two species of Gorilla in Africa
  Western Gorilla (Lowland)
  Eastern Gorilla (Mountain)
Ground dwelling, mostly quadrupedal
Family groups of 50
Endangered: habitat loss, poaching
Highly intelligent (learn sign language)
Project Koko
Began in 1972 (Koko born 1971)
she has learned > 1,000 words
Understands spoken English (2,000 words)
Communicates with phrases
Invents new combinations
Shows emotions and feelings
Few primates to keep a pet
“All Ball” pet cat, others
Chimpanzee

Two species of chimpanzees in Africa
Common chimpanzee (100 to 150 lbs)
Bonobo or pygmy chimpanzee (70 to 90 lbs)

Ground and tree dwelling, quadrupedal, bipedal

Highly organized social society
Endangered (habitat loss, bush meat trade)

Highly intelligent, capability for conceptual learning (5 year old human)
Respond to spoken language
Communicate with sign language
Abstract thought, tool use
Humans and Chimpanzees

Chimpanzee genome (2005)
Chimpanzee and Human genome size are equal
  3 billion base pairs
  99% identity between human and chimpanzees
    40,000,000 bp differences
    3,000,000 bp differences in coding regions (genes)
Other similarities (besides biology):
  Social structure (morality, empathy)
  Cognition (abstract thinking) and self awareness
  Upright walking
  Tool making/use
1. Split between chimps and human ancestor (6 mya)

2. *Australopithecus anamensis* walked upright (4 mya)

4. Stone tool use *Homo habilis* (+ 3 others) (2.5 mya)

5. *Homo erectus* leaves Africa (1.8 mya)

*H. erectus* gives rise to *H. sapiens*, and *H. neanderthalensis* (1 mya)

Spoken language (200,000 years ago)

Early *Homo sapiens* lived in Africa. *Homo neanderthalensis* and *Homo erectus* in Europe (100,000 years ago)

8. Cave paintings appear, burial rituals (50,000 years ago)

9. Other hominids extinct, leaving only us *Homo sapiens sapiens* (25,000 years ago)
Bipedelism

Evolved prior to larger brains, tool use
Why?

12 hypotheses (not mutually exclusive)
   Change in habitat (loss of trees)
   Movement among habitat types
   Carrying objects
Would have to confer a survival advantage

Was not sudden:
early hominids had a mix of anatomy for
upright walking and tree climbing
Other primates show this mixture
Tool use

*Homo habilis* (2 mya)
Developed the skill to make hand axes
Multiple task: cutting, digging, butchering
Same tools made > 1.5 mya (no progress)
Lacked creativity, innovation, culture, spoken language
Spread of Modern Humans

Out-of-Africa Model

Multi-regional Evolution Model

Homo erectus

modern H. sapiens

2,000,000 years ago

500,000

1,000,000

100,000

50,000
Spread of Modern Humans

“Out of Africa” hypothesis most likely

Why?

1. All humans are highly genetically related
   DNA of two randomly chosen individuals differ by 0.1%
   0.5% among chimpanzees
   0.7% among gorillas

2. More variation within than among populations
   85% within the population
   15% between population (Africans versus Europeans)

Conclusion:
   All modern humans arose from a single population
   Less than 10,000, East Africa about 100,000 years ago
Homo neanderthalensis

Neandertals physically different from modern humans
- larger, more robust
- 99.5-9% identical genome
They were well suited for Ice Age living
Lacked complex symbolic thoughts
- example: simple burials, no art
Why did they go extinct?
- primitive tools (inefficient stone spear points)
  - Outcompeted by H. sapiens
Language?
- possess hyoid bone in throat
- FOXP2 gene (speech in humans)
Emergence of the Modern Humans

Comparing skulls:
100,000 year-old human to modern: very different
40,000 year-old skull to modern: indistinguishable

50,000 years ago: behavior of humans changed

Art (abstraction)
Brain
Language
Modern Humans: Art

Technology for information transferred across great distance and time

Establish rituals, beliefs, culture, society
Modern Human: Brain

Series of small mutations led to change in brain wiring over time.
The wiring of the human brain is important.
Size does not matter.
Human Language

Language is a universal human trait
  Babies can learn any language
  Ability decreases after 1 year

Human brain is equipped to use language syntax, to organize thoughts, to tell a story, and to utilize symbolic representation

Ability to manipulate syntax is a genetic endowment for expression and creativity

Natural selection favors language if it promotes reproductive fitness
Next Time: Behavior