

Primate and Human Evolution

Science 201 - Earth, Body & Mind

I. Primate Definition, etc.

A. How many?

B. Classification/Definition

II. Primate Origins

- A. When & from what did the primates evolve? diversification of mammals
ca. 65 mill. years ago; from **tree shrew-like** mammalian ancestor/insectivore
- B. Adaptive radiation in a new adaptive zone - the trees (**Arboreal existence**); new environment, new requirements for survival; rapid evolution
- C. **Primate (including human) characters linked to an arboreal existence**
 - 1. Movement of eyes to front of the head (stereoscopic vision; depth perception)
 - 2. Enhanced vision, visual acuity
(*3-D environment*; ex. birds); color vision (highly visual animals, fruit eaters)
 - 3. Brain expansion and reorganization; cerebral cortex; associated cranial expansion; intelligence at a premium
 - 4. Reduction in the snout (hands; reduction in importance of smell; visual orientation)
 - 5. Opposability of digits & prehensile organs (grasping; climbing; predisposes humans for tool use)
 - 6. Sensitive tactile pads at the ends of the digits and the presence of fingernails
(protects digits; pressure pads; improves touch sensitivity)
 - 7. Free movement of pelvic & pectoral girdles
 - 8. Small # of offspring & reduction in # of lactating structures
 - 9. Long gestation, nursing, & post-natal development periods
(evolutionary compromise between head size and pelvic girdle)
 - 10. Upright or vertical posture (for climbing; predisposes humans for bipedalism)

example of **exaptation** (A character, previously shaped by natural selection for a particular function (an adaptation), is co-opted for a new use)

III. Human Evolution – Introductory Ideas

- A. Tremendous Evidence;** e.g., amazing sequence from chimp-like to modern human; “missing link?”; Other explanations? How do we know what we know? What does the evidence tell us?
- B. Why Important?** self-awareness—we are the only species on earth aware of our origins; understanding of our origins—tremendous intellectual step; explanation for “mysteries of mankind”
- C. We are all “Africans”** - the hominid lineage originated in Africa; all early fossils there
- D. Many of the discoveries are quite recent (e.g., 2004, 2009, 2010);** constantly learning more

IV. General stages of Human (Hominin = humans & our close relatives) Evolution -the human lineage

- A. Earliest Stage** – earliest known representatives of the human family
 - beginning **6-7 million years ago**
 - shortly after split from line leading to chimps (which are our closest living relatives)
 - chimp-size brain; ± bipedal (= walk on 2 legs)
 - cranial capacities/brain similar to apes (e.g., chimps); ape-like in some respects, but in others like humans (teeth, locomotion); big brain is **NOT** the first major adaptation on the path to humans, rather:
 - **bipedal locomotion** (based on position of hole for spinal cord, etc.) = first major adaptation on the path to humans; much *more efficient* in terms of energy; in a drying Africa with shrinking forest and move savannah (= grassland with scattered trees), could move efficiently from forest patch to forest patch; probably chimp-like diet
 - still with many arboreal characters (even more than modern humans which still have many)
- B. Australopithecine Stage ("southern" "ape")**—slightly latter representatives of human family; **possibly on a side branch of human evolution** - [Latin: *australo*, southern; Greek: *pithecus*; ape]
 - early ones with cranial capacities similar to apes; 380-600 cm³; probably chimp-like diet
 - many species; one example is: *Australopithecus afarensis* (Lucy, skeleton 40% complete, discovered 1974 by Donald Johanson) - as old as 3.6 million years ago (mya); in different genus from us
 - Olduvai Gorge (Leakey family - Louis, Mary, Richard, Meave, Louise); African Rift Valley
- C. Pithecanthropine/Homo Stage ("ape" "man")** - more human-like but still not modern human
 - ca. 2 mya to ca. 50,000 years ago or maybe more recent; made tools, used fire; moved out of Africa
 - larger cranial capacity/brains than Australopithecines, but less than modern humans; ca. 680-1100 cm³; in our genus--*Homo*
 - includes *Homo erectus*-first member of human family to leave Africa; better tools but still not as complex as made by later groups; this or a similar species gave rise to modern humans
 - (ex. 1.6 million year old - 12 year old Turkana boy, fossil discovered in Kenya 1984)
 - Larger brain – **Expensive Tissue Hypothesis**; compare our gut and our brain with those of chimps (our closest relatives); surprising differences; connection between large brain and change in diet to eating meat- energy rich; selection pressure? Critical step in evolution of modern large-brained humans
- D. Modern Stage**-includes our species, *Homo sapiens* (all modern humans); we are only surviving species of human family [derivation of *Homo sapiens*: Latin: *homo*, man and *sapiens*, wise]
 - Modern stage stretches from around 500,000 or 600,000 years ago to the present
 - Modern stage has only 2 species: *Homo neanderthalensis* (Neanderthals), *Homo sapiens* (us)
 - the word Neanderthal is from the Neander Valley in Europe (Germany); adapted to cold; stocky, strong
 - Neanderthals were around from ca. 500,000 or 600,000 years ago until at least 30,000 years ago; evidence of hybridization with fully modern humans (some modern humans with 1 to 4% genes from Neanderthal; brain size/cranial capacity as large or larger than modern humans, different skull shape
 - What happened to the Neanderthals? Became extinct, but some hybridization with modern humans
 - ***Homo sapiens***: evolved from *H. erectus* or similar species; ± modern size brains/modern humans by ca. 200,000 years ago; **large brain - evolutionary compromise**
 - we're all very similar – genetic bottleneck
 - “**out of Africa**” hypothesis; “we’re all Africans”
 - modern humans: cranial capacity-average ca. 1350 cm³, range ca. 1000-2000 cm³; sophisticated tools
 - lifestyle and diet—modern hunter-gatherers are a good analogy (e.g., Hadza); implications of “evolutionary appropriate diet”; zoos?
- E. Summary**- “bush” of human evolution - many species; synchronic, sympatric; bipedalism; mosaic evolution, susceptibilities (ex. back pain, hernia); biological holdovers (hair distribution, olfactory ability, sexual dimorphism); cave paintings (“links to the past”)