

## Lecture Human Evolution

- I. Although modern human behavior is almost totally learned and cultural, it rests on a biological basis
  - A. The processes of human evolution shaped humans' brain and body
    1. Accurate depth perception and hands with opposable thumbs allow for the ability to manipulate objects with great precision. The use of tools
      - a) Is basic to human life
      - b) Helps shape the patterns of subsistence, learning and communication within society
    2. Charles Darwin's theory of evolution by natural selection proved the most convincing scientific explanation of the variety and history of life on earth.
      - a) **Natural Selection**:--the mechanism of evolutionary change; changes in traits or characteristics of living organisms that occur over time as the result of differences in reproductive success among individuals
      - b) Speculation about evolution dates as far back as the sixth century.
  - B. Darwin's evidence and assumptions.
    1. Observed that no two living things, even those of the same species, are quite alike. Sources of variation:
      - a) **Mutation**:--a random change in genetic material; the ultimate source of biological variation
      - b) **Gene Flow**:--sexual reproduction and the movement of individuals and groups from place to place result in a mixing of genetic material
      - c) **Genetic Drift**:--changes in the frequencies of specific traits caused by random factors.
    2. Observed that most creatures, human and non human, did not survive long enough to have offspring.
      - a) Organisms fell victim to predators, contracted diseases or perished through some defect in their biological makeup.
      - b) Before the development of sanitation in the 19<sup>th</sup> century and antibiotics in the 20<sup>th</sup> century, vast number of human children also died young.
      - c) In the world's poor nations, large numbers of children die before they reach the age of 5.

3. Darwin argued that those who won the struggle for survival were able, in some way to pass some of the traits that led to their success to their offspring
  - a) Darwin reasoned that, over the course of millions of years, this process gave rise to new species and all of the tremendous variation in the natural world.
  - b) Darwin's theory is sometimes referred to as "survival of the fittest", but this phrase was coined by social theorist Herbert Spencer, not by Darwin himself.
  - c) Strength and intelligence do not necessarily guarantee reproductive success and are not important for all creatures.

- II. Modern day humans, gorillas, and chimpanzees evolved from common ancestors.
  - A. All animals are all equally evolved in different ways and under different environmental circumstances
    1. The belief that intellect or ability to alter the environment is the most important criterion of evolution is an extremely human-centered (and thus short sighted) way of looking at biology.
    2. If producing the greatest number of related species or the greatest number of individuals is the best measure of evolution, it would be clear that insects are far more "evolved" than humans
  - B. Biological anthropologists use the fossil record, DNA studies, and immunology to try and determine the common ancestry of humans and other primate species.
    1. Creatures that became humans and apes split from those that gave rise to monkeys of Europe, Asia and Africa about 20-25 million years ago.
    2. Humans and the great apes (orangutans, gorillas and chimpanzees) share a common ancestor that existed around 13 million years ago
    3. Human ancestors diverged from ancestors of chimpanzees around 7 million years ago.
    4. Primates (human and non-human) share an arboreal – tree dwelling – ancestry. Commonalities include
      - a) Grasping hands and feet for climbing
      - b) Hands and feet with fully opposable thumbs
      - c) Acute eyesight, color vision, and accurate depth perception
      - d) Reliance and hand/eye coordination that developed along with the expansion of the areas of the brain

involved in vision, motor skills, and the integration of the two

- e) A reduced sense of smell as compared with other mammals.
- C. Primates, particularly humans and apes, have larger brains relative to their body weight than do other animals, thus impacting their behavior.
1. Almost all primates live in social groups
    - a) Gorillas live in groups consisting of a single adult male and numerous adult females and their offspring
    - b) Chimpanzees live in groups that include several adult males, several adult females and their offspring
    - c) Gibbons as well as several species of monkey live in monogamous pairs
    - d) Several species of monkey from Central and South America live in groupings of with one female and two males.
  2. The core of primate societies is the bond between mothers and their offspring.
    - a) Another adult female (often a relative) will adopt an infant if the mother dies.
    - b) Young primates learn initially by imitating their mother's action when finding food and water and learning which animals are dangerous and which can be approached safely.
  3. As primates grow older, play becomes central to their interaction with their age mates. Through play, primates
    - a) Refine their physical skills, explore their world, and practice solving problems.
    - b) Are motivated to learn because much learning, like play, is enjoyable and highly pleasurable for them
  4. In most primate societies, both males and females develop dominance hierarchies; that is, they are ranked as superior and inferior to one another
    - a) Overall, hierarchies serve to limit the amount of aggression within societies; once the hierarchy is established, lower ranking individuals are less likely to challenge those with more status than might otherwise be the case.
    - b) The critical benefit of high rank is greater access to food, sex, and other resources

- c) There is evidence that high-ranking individuals reproduce more frequently than those of low rank, however this is controversial
  - d) Rankings are not absolutely fixed and are context specific.
- 5. In addition to displays of aggression, primates have many means of reconciliation
  - a) Grooming is common among members of the same sex as well as members of different sex
  - b) Among chimpanzees, baboons and others, friends may hug, pat each other, or hold hands.
  - c) Lip-smacking and male-male mounting behaviors are used to establish, reestablish, or to maintain friendly relations between individuals and cohesion within the group.
- D. Non-human primates also use tools, different both from the behavior of animals such as the sea otters and humans
  - 1. There is a wide variety of complex actions requiring foresight and planning.
    - a) the use of sticks and branches by monkeys to threaten others or to defend themselves when they are threatened
    - b) Food washing ( the use of water to separate grains of wheat from sand, and playing with rocks) by some Japanese macaques
    - c) **Termite fishing** – the learned use of twigs or blades of grass to extract termites from their mounds – by some groups of chimpanzees.
    - d) **Making leaf sponges** – by taking leaves, chewing them, and then using the resulting wad of material to soak up water from tree hollows – by chimpanzees
    - e) **Using hammer stones to break nuts**
  - 2. Such practices are learned behaviors passed along as part of the knowledge of the social group, very much like human culture
    - a) Some groups of chimpanzees do some activities and others do not
    - b) Among all primates who use tools, it is the female who first develops tool-using skills and generally becomes more adept at tool use.

### III. The evolution of Humans

A. Early ancestors were relatively few in number and demographically confined to Africa. They

1. Did not depend heavily on tools, and their culture left few material remains.
  - a) The range of their learning was probably small
  - b) Our ability to learn is vastly greater than that of our ancestors and our social environment demands that we innovate.
2. Spread from our African origins to inhabit most of the globe.
  - a) This means humans have adapted to living in many different climates and ecosystems
  - b) Humans and their ancestors adapted to the different demands of environment by finding new foods, making new tools, developing clothing and controlling fire.

B. All human ancestors, as well as, current day humans, are members of the biological family *Hominidae*

1. Within this family, ancestors are known by the names of their
  - a) *Genus – a group of similar species*
  - b) *Species – a group of organisms whose members are similar to one another and are able to reproduce with one another but not with members of other species.*
2. Human ancestors and modern day people fall into two genera: *Australopithecus* and *Homo*
  - a) *Ardipithecus* the earliest of human ancestors, may fall into a third genus, but whether their fossils are different enough from *Australopithecus* to constitute a separate genus is still debated
  - b) Modern people, *Homo sapiens*, are members of the genus *Homo*
3. **Bipedalism** – walking on two feet, a distinctive characteristic of humans and their ancestors.
  - a) Although chimpanzees, gorillas, and some other primates are capable of walking or running on two legs for short distances, their habitual stance is on all fours.
  - b) This form of locomotion involves substantial anatomical changes

- c) Appeared far earlier in the fossil record than increased brain size or the use of stone tools
  - d) Freed the hands, allowing human ancestors to carry things for long distances and make tools
  - e) Creatures standing on two legs have a wider view of their surroundings and can walk efficiently for long distances.
4. In addition to bipedalism, particular aspects of tooth number size, shape, and enamel are critical in tracing human ancestry
5. *Sahelanthropus Tchadensis (Toumai)* is
- a) The earliest evidence currently available for a creature considered ancestral to humans
  - b) Dated between six and seven million years old.
  - c) Found in Chad, 1,500 miles west of where almost all other extremely ancient human ancestor fossils have been found
6. Very early evidence of an ancestor from Kenya includes:
- a) *The Lothagam mandible*, dated approximately 5.5 million years ago
  - b) Several additional bone fragments found at Mabaget and Tabarin dated from between 5 and 5.1 million years ago
7. The earliest substantial evidence for human ancestors is the *Ardipithecus ramidus* in northeastern Ethiopia.
- a) Tim White discovered the remains of more than 40 individuals who lived approximately 4.4 million years ago.
  - b) These ancestors had large-shaped jaws, small brains, and teeth similar to those of modern day chimpanzees
  - c) Evidence from their pelvic bones, skulls, and forelimbs indicates they were bipedal.
  - d) Reconstruction of the environment they lived in shows a flat plain covered with open woodland and dense forests, reinforcing the notion that Bipedalism first evolved in wooded areas rather than on grassy plains

**C. *Australopithecines* – members of an early hominid genus found in Africa and characterized by bipedal locomotion and small brain size.**

1. Beginning with Raymond Dart's discovery of "Taungs Child" in 1924, more than 10,000 individual australopithecine fossil bones have been found, comprising several hundred individuals
  - a) The earliest australopithecine fossils are from northern Kenya and are between 4.2 and 3.9 million years old
  - b) The most recent, from South Africa, are about one million years old.
  - c) Although australopithecines are found only in Africa, they were a diverse and complex group of creatures that persisted for a very long stretch of time.
2. In 1974, at Hadar in Ethiopia a team led by Donald Johanson found the australopithecine skeleton "Lucy"
  - a) Is unusually complete; more than 40 percent of the bones are present.
  - b) Allowed anthropologists to answer definitely many questions about the way australopithecine, looked, stood and moved.
3. Mary Leakey, working at Laetoli in Tanzania found a well-preserved bed of volcanic ash that was deposited about 3.5 million years ago
  - a) One trail was from two individuals who were probably walking together
  - b) Another trail was from three individuals
4. Traits of the "gracile" australopithecines include
  - a) Heights between 3.5 and 5 feet tall and weighing between 65 and 100 pounds
  - b) Relatively small brains as compared to modern brains
  - c) Protruding faces with relatively large and slightly overlapping canine teeth
  - d) Bipedalism with hips and lower limbs a bit different from modern people
  - e) The ability to live in arid and semi arid environments in eastern and southern Africa
  - f) That they were omnivores – animals that eat both plant and animal foods – as suggested by the size and shape of their teeth
  - g) A diet of dried fruits and vegetables, insects and small animals and the perhaps scavenged remains left

by larger predators because of a lack of stone tools, relatively small size and lack of claws or very large canine teeth

- h) That they were social animals living in small groups, since the remains of numerous individuals were commonly found together
5. About 2.5 million years ago, the “robust” australopithecines or *Paranthropus* tended to be slightly larger than “graciles” but the range for both height and weight clearly overlap
- a) The presence of heavier skulls, reinforced with boney ridges with substantially larger teeth and jaws, suggest that these creatures were adapted for chewing heavy, course material and were vegetarian
  - b) “Robust” australopithecines lived in Africa until about 1 million years ago and do not seem ancestral to modern humans.

**D. *Homo habilis* – a species of early humans found in Africa present between 2.5 and 1.8 million years ago.**

1. Emerged between 2.3 and 2.5 million years ago and was quite similar to *Homo rudolfensis*
2. Several features distinguish between *Homo habilis* and australopithecines. Their
  - a) Brains were quite large compared to the size of their bodies
  - b) Teeth were smaller than australopithecines
  - c) Skulls were higher and their faces protruded less
  - d) Legs tended to be longer and arms tended to be shorter
3. In the course of evolution human ancestors developed both the fine motor and the mental skills to make and use tools
  - a) *Habilis* were making fairly sophisticated sets of tools as early as 2.3 million years ago.
  - b) By using tools, human ancestors could match the biting and chewing abilities of much larger, more powerful animals,
  - c) With far fewer trees than were available to the earlier “gracile” australopithecines, human ancestors omnivorous diets allowed *habilis* to compete with members of other species for plant and animal foods.
  - d) Oldowan tools are designed for cutting and bashing rather than hunting, strongly suggesting that *habilis* rarely killed larger animals

- e) Stone rings found at Olduvai indicate that *habilis* probably built shelters for protection from predators and cold weather
- 4. The earliest remains of *habilis* are from east and southern Africa but it is possible that they spread to other areas
- E. ***Homo erectus*—a species of early human found in Africa, Asia, and Europe.** *Homo erectus* was present between 1.8 million and about 300,000 years ago (however, *Homo floresiensis* may be a smaller version of *erectus* that existed 13,000 years ago)
  - 1. Their features may have been roughly the same size as modern day people
    - a) The 1.6 million year old skeleton of a 12 year old *erectus* boy was found in the mid 1980s, at Lake Turkana in Kenya
    - b) *Homo erectus* brain size increased along with body size based on the first *erectus* fossils found by Eugene Dubois in the 1890's
    - c) The *erectus* skull is larger and heavier than *habilis* with a heavy ridge of bone above the eyes and a thick cranial bone
    - d) For modern humans, the maximum width of the skull is above the ears, but in *erectus* the maximum width is below the ears
  - 2. In order to thrive in the various habitats of the Ice Age, *erectus* developed and increasingly sophisticated complex culture
    - a) Zhoukoudian was inhabited between 450,000 and 230,000 years ago, its inhabitants made choppers, scrapers, points and awls from stone
    - b) Most anthropologists agree that *erectus* was capable of controlling and using fire; however it is not known if they were able to make it.
    - c) *Homo erectus* almost certainly lived by hunting, scavenging and gathering.
    - d) Although no animal skin clothing has survived, there is some evidence of needles among the bone tools found at Zhoukoudian
    - e) The fact that they killed large animals suggests that social groups were relatively large and probably included complex mechanisms for distributing food and perhaps other goods.

- f) The brains of some Zhoukoudian individuals were removed after their death but why this was done is unknown.

F. *Homo sapiens – a species of human found throughout the world.*  
*The earliest Homo sapiens appeared 500,000 years ago*

1. On average, *Homo sapiens* have substantially larger brains than *erectus*. Modifications to the skeleton include:
  - a) A lack of the heavy bone ridging above the eyes and the thick skull bone of the *erectus*
  - b) A high and vaulted skull with a large forehead
  - c) Lighter bones which were favored as human ability to learn increased and weaponry improved and animals could be hunted from greater distances.
2. *Neanderthals – members of a population of archaic Homo sapiens* that lived between 130,000 and 35,000 years ago.
  - a) Bones from locations throughout the Old World attest to ancestors who had lighter-boned, more rounded skulls than *erectus*, however the fossils continue to show the bony ridging above the eyes typical of *erectus*
  - b) Brain size, sometimes larger than those of modern people, appeared in Europe and in some parts of the Middle East,
  - c) Appeared in Europe at about the same time as anatomically modern people *Homo sapiens sapiens*
  - d) The number and complexity of their tools pales in comparison to tools made by *Homo sapiens sapiens*
3. By about 35, 000 years ago, *Homo sapiens sapiens* had spread throughout the range of all other *Homo* and was the only form present. Various theories explain their origin:
  - a) Multiregional model – a theory that seeks to explain the transition from *Homo erectus* to *Homo sapiens* by arguing that different populations of *Homo sapiens* are descended from different populations of *Homo erectus* (*this model is consistent with the fossil record and seems to explain some of the anatomical differences among modern human population*)
  - b) Replacement model – the theory that modern people evolved first in Africa and then spread out to inhabit virtually all the world, out competing or destroying human populations in the process. Sometimes called the “Out of Africa” model and is based in molecular

and genetic data( *this model is based on mitochondrial and Neanderthal DNA evidence*)

- c) Hybridization model – a theory that seeks to explain the transition from archaic to modern *Homo sapiens* by proposing that modern and archaic forms interbred

#### IV. *Homo Sapiens* culture

##### A. Even archaic forms such as the *Neanderthal* were clearly cultural

1. Several examples of burial of the dead by Neanderthals have been found
  - a) The remains of nine individuals, four of which were intentionally buried, were found at Shanidar Cave in Iraq (these remains are between 45,000 and 60,000 years ago)
  - b) High Concentration of pollen in the graves show that the bodies were buried with flowers, suggesting that Neanderthals had complex, symbolic rituals and a belief in the afterlife
2. A severely injured Shanidar individual nevertheless survived this condition for many years, strongly suggesting that Neanderthals cared for and supported this individual
3. New evidence from Moula-Guercy cave in France shows that some Neanderthals practice cannibalism

##### B. *Homo sapiens sapiens* made tools of much greater sophistication and efficiency than any prior species. These include:

1. *Atlatl – a spear thrower*, a device used to increase and extend the power of the human arm when throwing a spear
2. Stone blades. Scrapers. Chisel-like tools called burins. As well as tools of bone, awls, needles and tools for scaping and smoothing leather
  - a) In addition to utility, many of these tools show clear aesthetic qualities
  - b) Although many of the best known early tools come from Europe, some of the earliest examples come from Africa between 180,000 and 75,000 years old.
  - c) Shortly after modern people appeared, more than 50 genera of large mammals became extinct and it is possible that hunting by humans was responsible for these extinctions

- C. In addition to tools, early people left many symbolic and artistic remains and domesticated plants and animals
1. "Venus" figurines – small stylized statues of females made in a variety of material by early modern humans between 30,000 and 20,000 years ago
    - a) About 40 intact figures have been discovered along with fragments of at least 80 more
    - b) Many depict woman with exaggerated breast and buttocks.
    - c) They have been variously interpreted as art for art's sake, fertility magic, representation of female deities, erotic images made for male pleasure and ordinary women's views of their own bodies.
  2. Cave paintings are perhaps the most spectacular of the cultural remains left by early *Homo sapiens sapiens*
  3. About 10,000 years ago, some people turned increasingly to the domestication of plants and animals.
    - a) Dogs were domesticated between 14,000 and 10,000 years ago
    - b) People in the Middle East were beginning to use rye by about 13,000 years ago, but did not become dependent on farming until about 10,000 years ago
    - c) The move from hunting herd animals to domesticating plants and animals involved a substantial increases in the amount of work humans had to do
    - d) Domestication of plants and animals led to an increase in disease, physiological stress, a reduction in well being, and a decline in nutrition
    - e) With this subsistence shift, larger populations could be supported