

## 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.