ANT203-Human Evolution
Lecture 1&2 HISTORY

- 18th century- non-religious explanations began
- Linnaeus was a creationist, didn't believe in evolution
- Natural Theology found some things that didn't fit in the genesis
- Lamark- characteristics could be inherited by the offspring (this is wrong). there was a conscious attempt. (what if you lose your arm? your child should be born armless)
- Lamarkianism never could challenge the biblicalism because of these reasons
- Lyell coincides with Darwin. He was influenced from Lyell's book.

DARWIN

- married a rich girl
- he had a mansion where he did his experiment
- the money was provided by the family
- Beagle- british war ship
    - started at the equator up to other coast
    - he ended up collecting 3 ships of biological specimen. it allowed him to see geo. variation in closely related species and geologic differences. ADAPTATION
        - he found ancestor fossils of armadillos. so there had to be a relationship.
- magnitude 8 earthquake made him see an uplift (it changed the geology of the area) so he observed geological processes. he was very lucky.
- essay on population:
    - malthus said the poor should be starved, if not they would affect wealthy educated people.
    - animal populations have a tendency to grow geometrically (so will the poors). the environment will change arithmetically.
    - overly production and high death rate
    - more offspring are born than can survive to reproduce
- evolution by natural selection

5 points (THIS WILL BE ON THE MIDTERM OR ON THE FINAL):

- 1. organisms produce more offspring than can survive to reproduce. (drawn from malthus)
- 2. because the numbers of individuals in a species are usually constant, there must be a high death rate (also from malthus)
- 3. individuals in each species vary in their characteristics. they are slightly different from each other.
    - biology that time (19th century) was about classification but they chose the one that was most common. they would describe it and the description would be used.
- 4. variants that fit their environment better will be favored over those less fit. fitness is defined by DIFFERENTIAL REPRODUCTIVE SUCCESS. By inheritance, better individuals pass on their beneficial characteristics in greater numbers because they have more offspring that survive and reproduce. this process is NATURAL SELECTION.
- 5. following generations will continue to exhibit and refine adaptations realized by their ancestors (this is an ongoing process)

- 2 major unanswered questions: 1- what is the source of individual variation? 2- How are characteristics inherited?

- Darwin never attended scientific meetings. He was very shy. He waited for 20 years to present his argument. At the same time Alfred R. Wallace developed the same theory from his work in Southeast Asia. He sends it to Darwin. Darwin thought he was screwed. They both published a paper so the first paper on evolution is not only published by Darwin.
- Darwin, next year, published his book: Origin of Species. It caused great controversy. He said that certain animals comes from common ancestors.
- Scientific challenges to Darwinian theory stressed his inability to explain inheritance (1st question) and his reliance on a long age for the earth. (Genetics did not exist at that time)
- Darwin believed in "blending inheritance", where characteristics from each parent mixed like liquids, this was a crucial flaw
    - if one parent had a blue eye and the other had black eyes, the offspring should have a color in between. So it was easy to prove wrong.

Opposition to Evolution

- Fleeming Jenkin- said that with blending inheritance, single favorable mutations would be diluted out of existence over time, making Darwin's natural selection impossible. Realizing Jenkins was right, Darwin reverted to Lamarkian explanations of inheritance, undermining his own theory.
- Lord Kelvin (William Thompson)- most influential 19th century physical scientist. Argued that the universe was governed by chemical reactions and had a short history. His paper "the doctrine of uniformity in geology briefly refuted" claimed that the time that the earth took to cool to its present state was as short as 20 million years.
    - his prestige caused geologists to reduce their estimated age of the earth, leaving no time for gradual evolutionary process. At the time, the science world was hierarchical and he was automatically assumed to be right.
    - he was an arrogant egomaniac

Supporting documents for evolution

- In 1900, biologists discover the work of Mendel- foundation of modern genetics- This reestablished natural selection as a viable process.
- Pierre Curie and Albert Laborde discover atomic energy in 1903, making Kelvin's age estimates for the earth meaningless.

Religious opposition to Darwin:

- Many early evolutionists thought evolutionary theory should replace religion as a guide to "moral" behavior. (not Darwin itself thought that)
- Religious progressives like William Jennings Bryan strongly opposed evolution because they thought it would replace morality and ethics with a "Law of Hate". He was really concerned about the way evolution was going to be used. Some people used evolution for their own class and racial biases:
    - Unilinear Evolutionism:
        - thought evolution was directed toward the production of Western civilization
        - considered 3rd world peoples to be "living fossils", inferior to Europeans, who were "naturally" more intelligent and moral (precisely: "fallen behind")
        - they were thought to be closer to apes
        - justified colonialism to "uplift" native peoples.
        - cultural and racial evolution
        - if europeans were moral, what about the crime rates? the answer was Atavism: throwback primitive traits used to explain european crimes etc.

        - museum of criminal anthropology: academic institution to identify apelike characteristics to explain crimes etc.
    - Social Darwinism & the Eugenics movement:
        - Social Darwinism: the concept of "survival of the fittest" justifies exploitation of the weak by the strong
        - Eugenics movement: attempts to prevent "inferior" peoples from breeding.
        - this was close being a mainstream idea.
        - 1920s- ideas of labor camps for low people with low IQs
        - Nazism is the ultimate expression of this.

    we are responsible for these not nature

Search for the "Missing Link" (+slides)

- People started to look for fossils but they were already found. They just couldn't recognize them.
- People thought they would have a human-like head on an ape-like body because they thought large brains evolved first. The opposite was true.
- Eugene Dubois- He thought humans were descended from orang-utans. He went to Java. He was dismissed because of the thought of ape-like bodies with human-like heads. Homo Erectus
- Most people thought our closest relatives are african apes.
- Charles Dawson- what he found was fake, he baked it in his kitchen Piltdown Fraud
- Davidson Black- dragonbones in China were actually fossils so he looked at them. He found a tooth in a Chinese store. Peking Man
- Raymond Dart- claimed humans originated in Africa, not in Eurasia. Skeptiks said it was a baby chimp because the skull was really small that he could carry it in his pocket.
- Louis and Mary Leakey- proved humans originated in Africa. Mary found a dental arcade. Under that level were there were skulls and bones and stone tools. For the first time, there was a connection between primitive skulls and materials.

ANTH 203 Lec 3&4
MECHANISMS

- **Trait**= any physical characteristic of an organism (i.e. eye color)
- **Genes**= the physical structure that transmits hereditary potential from one generation to the next (by Mendel). More precisely: segment of a chromosome that produces a recognizable effect and separates as a unit during the formation of sex cells (gametes). Genes have alternate forms that produce different effects= **alleles**
    - **dominance=** the dominant allele will be the one expressed rather than the **recessive** one. Recessive one will be present but won't be seen. (purple allele is dominant over white allele in flowers)
- **Genotype**= genetic makeup
- **phenotype**= physical characteristics
    - phenotype may be produced by genotype
    - also may be produced by the environment (height is an example of this)
- **Mendel's Law of Segregation**= Alleles separate during the production of sex cells. This contributes to phenotype variation.

- **Independent Assortment of Genes**= each gene at a single location on a pair of chromosomes (one from the father other from the mother) is equally likely to be transmitted when sex cells are formed.
    - not entirely true because pea plants have 7 chromosomes and Mendel experimented them.

Sources of Variation

- **1. Mutation-** Random changes in DNA molecule. This is the only source of truly NEW GENETIC VARIATION
- Mutation can occur in individual genes or in entire chromosomes. (adding or deleting an entire chromosome: numerical change / addition of a segment, loss of a segment etc: structural change)
- **2. Recombination-** the creation of new genotypes resulting from segregation and the exchange of sex cells (meiosis)

- **Species**- Any group of organisms which can interbreed to produce fertile offspring (ON THE TEST)
    - biological species concept- dogs are species according to this
    - considerable variability within species
    - ecological species concept is different. doesn't concern us.
    - sub-populations
- **Mendelian Population**: a population in which genetic material is actually being exchanged. Often equivalent to sub-populations.
- **Gene pool**- all of the genes in a Mendelian population. (Hair colors in a classroom is a simplified gene pool example -see the slides-)
- Most populations are polymorphic for each trait, i.e. there's more than one allele for each trait(eye color example)
- evolution- a change in the composition of the gene pool over time
- **Gene Drift**- changes in gene freq. in a population caused by chance. Primarily impacts small populations. (Bottleneck Effect)
- **Gene Flow**- movements of alleles betw. populations within a species.
- Humans today are one species, but must in the past have been divided into sub-populations. WHY aren't there multiple species of modern humans?
    - Possible explanations:
        - 1. We are all descendants of ONE sub-population that evolved modern form recently
        or
        - 2. Gene flow was always extensive between human sub-populations

- 30,000 genes in humans
- 2% of the human DNA molecule consists of genes. Genetics called the rest "junk" DNA. This junk DNA had no significance. THIS WAS WRONG. Some of these base pairs are switches or triggers that turn protein synthesis on and off in different sequences creating different effects or structures.
- These triggers can activate parts of a gene-> that one gene can make different proteins
- Humans and chimps: shared %99 DNA. 118 base pair sequence in which humans and chimps differed by 18 base pairs. (SLIDES)

SLIDES 19-20 look!!!

- **HAR1**- strong positive selection meaning helping survival and reproduction.
    - this region is implicated in the function of the brain. The size of brain is the biggest anatomic difference between humans and chimps. %50 of the difference is linked either to the growth or the functioning of the brain.
- **HAR2**- not involved in the brain. involved in the development of the wrist and thumb. (differences in hip region and shape and configuration)
- **ADAPTATION**- environment is a filter. adaptation is an ongoing and double sided process. this means it affects every component involved.
- **ALTRUISM**- individuals specifying their own reproductive potential for others benefit. Explaining how altruism could evolve was a problem since it would seem to contradict the idea of survival to the fittest.
    - red ant. grass fire starts. some ants came out of the nest and jumped on the fire.
    - Hamilton explained the existence of altruism using kin selection
    - **kin selection**- close biological relationship.
    - If the gene for altruism occurs in closely related individuals and if an altruistic act by one increases the reproductive fitness of the others, then altruism increases.
    - important in the evolution of social species including humans
    - monkeys make alarm calls. when the call is made, it increases the chance of that monkey being the victim.

EVOLUTIONARY RATES

- Although Darwin says evolution happens slowly, fossil record often shows species with stable morphologies lasting for long periods, followed by an abrupt replacement by a descendant species.
- Stephen Jav Gould- challenged Darwin's concept of gradualism (70s').
- Darwin believed in social change but was a member of the upper class. There was pressure to preserve the social life. He emphasized gradualism because of his liberal but upper class ideology (Marxism, with its emphasis on rapid revolutionary change....) SLIDES
- Gould- "allopatric speciation" no slow gradual change
    - allopatric speciation- species formation that occurs when 2 populations are isolated from each other
    - short- thousands or hundreds rather than millions
    - quick turn-over (slide 26)
    - punctuated equilibrium- ?
    - Gould also challenged notions of the inevitability of "progress": the evolution of intelligent life was inevitable. (marching hominins) evolution is directed toward complex adaptations. (NOT TRUE IT IS ACTUALLY TOWARD SUCCESSFUL ADAPTATIONS)
    - He stressed that random events had an impact on the diversity of life on earth.
    - CLIMATE CHANGE drives evolutionary change. Natural selection operates most strongly in extreme events.
    - crocodiles- listen to the lecture