Anthro. 101:
Human Biological Evolution

Lecture 5: Microevolution
Prof. Kenneth Feldmeier
Hidden variation allows species change

New combinations extends the range of variation
= new material for NS to act upon
Let's Check What Causes Evolution: The Five Fingers

Some forces redistribute existing variation

- Natural selection
- Gene flow
- Genetic drift
  - Founder Effect
- Sexual selection
- Nonrandom Mating
Gene Flow

- Exchange of genes between populations
- Can be one-way or two-way
- Not *exactly* the same as migration
  - Amish: Migration without gene flow
  - Vietnam War: Gene flow without migration
- Maintains variation within populations
- Reduces variation between populations
Genetic Drift

- In small populations, random processes affect variation

- Frequencies in small samples show small random differences from large source population
  - 5 red:5 black
  - 6 red:4 black
  - 3 red:7 black
  - 7 red:3 black
Population Bottlenecking

- Population crash
- Reduces genetic variability
Founder’s Effect

- After a Population Bottleneck
- Reduced genetic variability affects the remaining population
  - Color blindness on Pingelap
  - Prophyria in the British Royal Family & South Africans
  - Ellis van-Creveld syndrome among the Amish
Evolution is the change in the genetic composition of a population over time

- Natural selection acts on phenotypes (genotypes affected)

- Next generation has different traits (and genes) that are common

- **When allele frequencies change from one generation to the next, evolution is occurring**

- Equilibrium = no change
Population Genetics allows us to track the changes in allele frequencies in a population

• Understand how traits in a population can change over time = Evolution

• Demonstrate how alleles stay hidden in the genome & available for natural selection to act upon
Questions??

• List some of the forces that redistribute variation
• Tell me about a population bottleneck
• How does this influence a founders effect?
• Is population genetics important? Why?
Sickle Cell

- https://www.youtube.com/watch?v=1fN7rOwDyMQ
Let’s follow a Mendelian trait…

- Sickle-cell anemia
- Two alleles
  - A = normal hemoglobin
  - S = sickling hemoglobin
- Three genotypes
  - AA normal blood cells
  - SS sickled blood cells
  - AS defense against malaria
Selection for AS genotype (and S allele)

- AS people have an advantage
- S allele favored as part of the heterozygotes despite SS disease & death (before reproduction)
Natural selection is not guaranteed to produce “perfect” adaptations

- NS can only act on existing traits

- Natural selection does not have “foresight”

- Traits arise via mutation, chance
NS limited by Pleiotropy

- In Darwin’s finches, beak traits are correlated
  - Deeper & wider
  - Shallow & narrow
- one gene affects multiple traits = correlated traits
NS limited by Disequilibrium

• If environment changes, population is not perfectly suited

In Humans!!

• Some nutrients (fat, salt, sugar) rare in the past
• Selection favored strong preferences
• No longer rare, but still delicious!
NS limited by the Laws of Physics & Chemistry

- Some designs may be physically impossible
- Why can’t elephants fly?
- Why can’t male mammals lactate?