

## History of Evolutionary Thought

- pre-darwin: transmutation of species occurred, but no hypothesis of mechanism
  - ↳ Oswald Avery, Crick + Watson: 1940s discovery of DNA

## Natural Selection:

1. individuals vary in phenotypes
2. phenotypic variation transmitted to offspring
3. competition for scarce resources

Consequence: offspring w/ favorable traits have more offspring,  
⇒ adaptation by natural selection

## Darwin and Natural Selection

- 5-year voyage on Beagle as naturalist
- Galapagos islands:
  - founder effect: evolution depends on small group of species who happened to arrive. first arrivals = little competition ⇒ more
  - adaptive radiation: diversification
    - ↳ Symba Covington unto locations, John Gould realized all collected beach finch had a different beak to specialize in food types

## Effects of Weather:

- during drought, food is scarce and only food is hard seeds
- finches begin to adapt to have larger beaks
  - ↳ those that already have big beaks more successful
- decrease in variation in size

★ Evolution is not progress. Success is local and temporary;

environments are constantly changing.

- bush structure: current adaptations built off of historical traits, but are not always getting "better"

This also applies to cultural evolution: culture is a response to the present environment, and must build off past cultures

## Sexual Selection / Kin Selection

2 problems:

→ Peacock Problem: how did evolution lead to peacock tails?

- makes them more vulnerable to predators

- solution: sexual selection - competition to reproduce, need to compete within a species

  - can lead to lower survivability, higher reproductivity

- handicap principle: expensive traits that demonstrate fitness

  - example: peacock feathers, deer antlers, widowbird tails (longer = better)

  - only the smartest, most fit individuals can survive predators w/ handicap

  - typically honest indicators (no way to cheat), eg barn swallows who have lower parasite load have longer tails

- sexual selection has same goal as natural selection (increase offspring), but different process

  - intrasexual: compete against same sex

  - intersexual: attract opposite sex

→ Honeybee Problem: why is there only one queen bee that can reproduce?

William D Hamilton: 1964: evolution works at individual level

- individual is vehicle for genes

- inclusive fitness: count of genes in relatives as well as self

Hamilton's Rule:  $rB > C$

- $r$  = relatedness b/tw two individuals

- $B$  = benefit to recipient

- $C$  = cost to actor

↳ altruism makes sense when  $rB > C$ , since it increases inclusive fitness

· example: nepotism

- honeybees maximize inclusive fitness by helping queen reproduce, create sister workers (more closely related)