

# Lecture 11: 11 Oct 2018

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## 1. Evolution's Engine: Population Genetics

### (a) Departures from H-W

- i. Fitness: allows us to translate genetic variation into evolution
  - A. Mutations: deleterious, advantageous, neutral (selection doesn't care about neutral)
  - B. Negative selection reduces freq of deleterious mutations
  - C. Positive selection increases freq of advantageous ones
- ii. Fitness is relative - zebra example
- iii. Darwinian Paradox: Taurus example - random change will mess up the car. Imagine within an organism, therefore mutations mess things up. Lots of checks to make sure mutations aren't introduced. There are about 60 new, random mutations in each person that weren't present in parents
- iv. Stabilizing selection: middle, trimming the ends
- v. Natural Selection: purifying selection - eliminates mutations that disrupt function. Mutations can accrue, if neutral muts, but if deleterious will be weeded out.
- vi. Pieces of DNA may be under strong purifying selection whereas most other chunks can be very different (e.g. mouse vs human)
  - A. Fruitfly and mouse eye gene - deep homology
  - B. Nat selection - keeping things the same

### (b) Positive Mutation: (highly unusual) when a mutation makes things better. beneficial mutations

- i. Peppered Moth is example of positive selection
- ii. Negative: new mutation that is deleterious is eliminated
- iii. Positive: replace deleterious allele with a positively selected allele

### (c) Balancing Selection: maintained

- i. Sickle-cell anemia

### (d) Genetic Drift: the drunkard's walk

- i. at each point in time there's a random process. All populations are finite in size. Deviations will be smaller with larger populations sizes. The extent of drift depends on population size.

ii. Extreme case: population crashes and only a few survivors. Ex: Founder event - finches from Ecuador to Galapagos. Random event - allele that was rare all of sudden becomes more prevalent just given drift or stochasticity. **Genetic Drift is population dependent.**

(e) Non-random Mating: inbreeding

i. **Inbreeding depression:** Increase in homozygosity. Deleterious recessive alleles - if heterozygote then it doesn't matter but as a homozygote it matters

(f) Migration:

i. Prevents populations from genetically diverging. Homogenizing the two populations by exchanging material