

# Lecture 14: 23 Oct 2018

## Andrew

1. Morphospace: butterfly example, where individuals cluster within species. Speciation is the underpinning of descent with modification.
2. What is a species?
  - (a) Species is the keystone of evolution.
  - (b) Species change, they aren't static, yet discrete.
  - (c) Species are groups that are reproductively isolated from other such groups. Biological Species Concept. Ernst Mayr 1942. Gene pool is the sum total of genetic variation in a species.
  - (d) Species are essentially closed gene pools
  - (e) Wallace essentially stated the same definition in 1864. "when in contact, do not intermix... incapable of producing fertile offspring"
3. Limitations of Biological Species Concept
  - (a) Fossils: can't test if they can reproduce. Forced to rely on morphological differences
  - (b) Asexual: even microbes can sometimes reproduce sexually.
  - (c) Reproductive Isolation
    - i. Not always watertight
      - A. Hybridization among close relatives
      - B. They can co-occur. Spatial heterogeneity.
4. Barriers to Reproduction
  - (a) Pre-zygotic: ecologically separated in space, temporally, sexually, mechanically, gametic incompatibility
  - (b) Incipient Species: a natural population that is more or less interfertile with another related population but is inhibited from interbreeding in nature by some specific barrier
  - (c) Post-zygotic: infertile organisms, embryos don't reach maturity, etc
  - (d) Speciation is a biproductive of divergence. Physical isolation then will inevitably diverge because mutations accumulate in populations. Geography is a key consideration in models of speciation
  - (e) Vicariance: population split by an extrinsic event (e.g Isthmus of Panama)

- (f) Dispersal: Some species disperse to a new location (e.g birds migrate to another island)
- (g) Darwin's Finches: Allopatry - vicariance or dispersal mediated isolation
  - i. First island appeared about 4.5 mya. And very few islands to start until 1.5 mya. Finches arose around 3 mya. Not many finch species until after many islands formed. Facilitates isolation
- (h) Sympatric Isolation: with gene flow still occurring
  - i. Chromosomal speciation - almost instantly. Chromosomal Rearrangement
  - ii. Chromosome configurations: Humans (diploid number is 46, haploid number is 23). Peaks on even numbers in plants - overrepresented. Some process of genome doubling. Plants have the ability to self-reproduce.
  - iii. Speciation with Gene flow: something must counteract homogenizing influence
    - A. Disruptive Selection: finches example of bill size and seed size availability
    - B. Ecological Niche: Principle of Competitive Exclusion - can coexist if not competing for the same resources