11 - Evolution

Central Claim of Evolution

- Organisms descend with modification from their ancestors

Descent

- Formation of newer generations

Correlation

- Correlation of strata and faunal succession show that there have been organisms in the past that aren't alive today

Mechanism for Change

- We've known for tens of thousands of years that we can cause changes in a species

Artificial Selection

- Matching up individuals of a species with particular traits to accentuate that trait

Cultivation

- Example
  - Many vegetables were creating from inbreeding mustard plants
    - Broccoli, brussels sprouts, kale, cabbage, etc

Natural Selection

- Unlike artificial selection, there is no goal in mind
  - Organisms either live to reproduce or die and their traits are weeded out
- Assumes a population of species has natural variation
- Particular individuals have traits that enable them to survive and reproduce more commonly
- These traits spread as they are favored by each new generation

Source of Variation

- Mutations
- When DNA replicates, sometimes copying errors occur and new traits appear
- Mutation

    - Beneficial
    - Detrimental
    - Neutral
- All depends on the environment
- Evolution is the accumulation of these mutations

Importance of Variation

- The spectrum of traits seen in a species
- Variation results in a broad assortment of traits in the population
- It's more likely that, if the environment changes, at least some members of that group will have the needed traits to survive and reproduce

Survival of the Fittest

- Not necessarily big or strong
- Ex. sloths

Modern Genetics

- DNA is a complex molecule that stores genetic information
- It's where our traits come from
- DNA is made up of a handful of chemical letters
- Genes
    - Units of heredity
    - A few hundred to a few million nucleobases in a single gene
    - We have two copies of each gene, one from each parent
    - Different forms of a gene are called "alleles"
    - Chromosomes are made of two strands of DNA that are coiled tightly around a histone
    - 23 pairs of chromosomes in a human cell nucleus

Inheritance

- Half chromosome from each parent

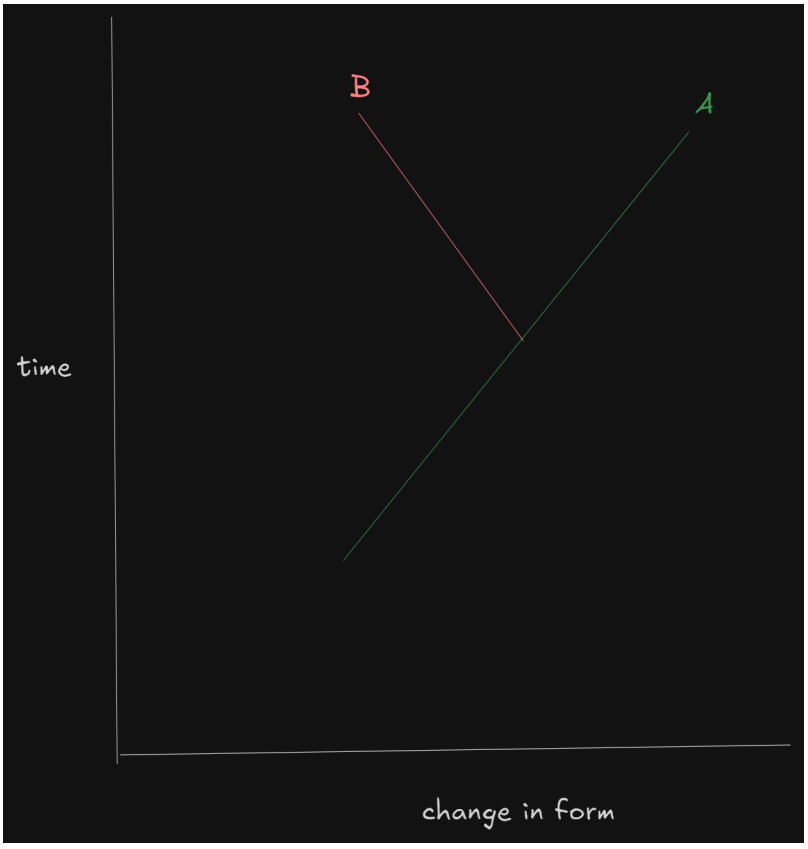
Mutations

- Sometimes when DNA copies during cell division, errors occurred
- Can be spontaneous, or caused by chemicals or radiation
- Leads to variation in a species, and to new traits

Patterns of Evolution

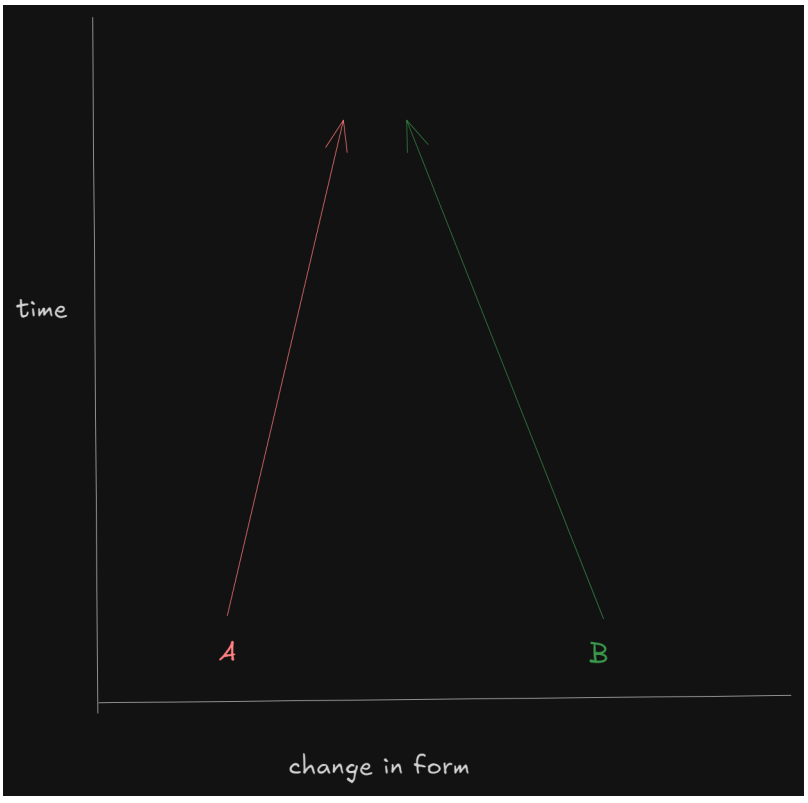
Divergent Evolution

- Ancestral species gives rise to many diverse species
- Descendants differ greatly from their ancestors and from each other in many cases



Convergent Evolution

- Development of similar characteristics in distantly-related organisms



Parallel Evolution

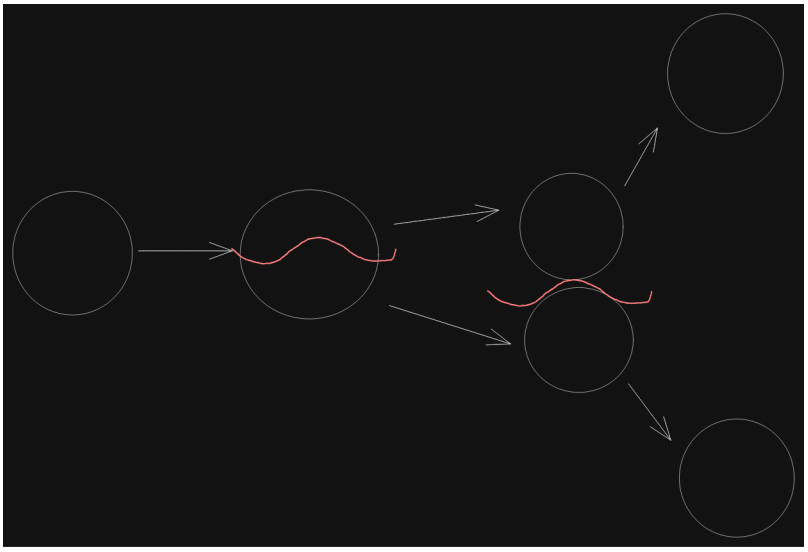
- A type of convergent evolution where closely-related organisms gain similar, but independently derived traits
- Placental and Marsupial mammals have a lot of "twins"; or "copycats"

Speciation

- When a new species arises from an ancestral species
- A species is a population of similar organisms that only breed among themselves
- Divergent form of evolution
- A new species is likely to form if a part of a species' population is isolated and forced to adapt to a new set of conditions. Small populations evolve faster

Allopatric Speciation

- A physical barrier causes a species to diverge into new species

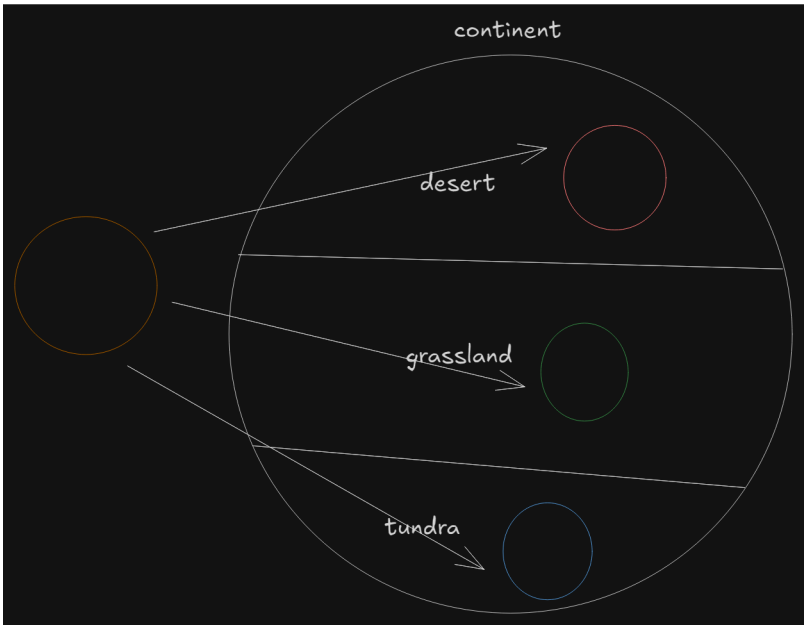


Peripatric Speciation

- Those on the **periphery** of a population form small subsets and evolve on their own

Parapatric Speciation

- When a species lives across a large area, and **fragments** into localized populations that stop mixing
- No physical isolation



Sympatric Speciation

- Overlapping

Adaptive Radiation

- When many new species arise from a common ancestor
- Ex. finches

Phyletic Gradualism

- Slow, continuous changes take place over long time periods

Punctuated Equilibrium

- A species remains unchanged during most of its existence and new species evolve rapidly, perhaps in a few thousand years

Evidence

How Did This All Begin?

- Darwin (former creationist) noted fossils slightly differed from modern day analogs

Homologous Structures

- Body features that are shared by a group of organism, that are inferred to be derived from a common ancestor

Vestigial Structures

- Body parts and/or traits that are no longer useful, or have been repurposed
- These are evolutionary remnants from ancient ancestors who used them

Embryology

- The embryos of all vertebrates are, at first, nearly identical, thus suggesting a common ancestor

Camouflage

- A bi-product of predator-prey relationships