

1 | Evolution

The unifying theory of all biology involving any change in the heritable traits in a population over a long period of time.

Causes of evolution - different reproduction rates - Environmental pressures - non-random mate choices - Migration

Evidence for evolution - Lab evidence of short-lifespan bacteria - Fossils and DNA evidence

1.1 | Begin by defining evolution

=> Descend with modification

Micro-evolution: changes in allel frequency within a population from one generation to the next

Macro-evolution: descend of different species from a common ancestry over much longer timescales

*Remember: evolution happens over **deep time** — much longer than your monkey brain could feasibly preserved*

The size of civilization to now is about 10,000 years, which is 0.002 seconds if all history is 1 minute.

1.1.1 | DNA Evidence for evolution

Comparing DNA between species could show an idea of common ancestry.

Evolution Experiment

- Take bacteria
- Introduce a filter/challenge (antibiotic)
- Result: resistant bacterial is left, and they prosper

1.1.2 | Fossil Example

- Analyzing fossils over time

1.2 | Origin of Life

(Before there was evolution)

- RNA world Hypothesis => RNA started self replicating and kabamm
- Metabolism Evolution

The Miller-Urey experiment: fundamental earth molecule + heats and pressure => kabamm amino acids and DNA and other organic molecules.

1.3 | Common Ancestry

All life on earth is related by descent from a universal ancestor.

There is a certain ancestor LUCA — which is the Last Universal Common Ancestor.

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1.4 | Mechanisms of evolution

- Natural Selection
- Genetic drift
- Gene flow
- Variations/Mutations

1.4.1 | Natural Selection

- Variation => for a certain trait, there are differences between individuals
- Heritability => differences that could be passed through generations
- Reproductive advantage => ability to increase rate of reproduction/competition

Natural selection could change allele frequencies in a particular population over time.

After a longer time, eventually, natural selection will make new species.

Sexual selection: a special case *The process of natural selection acting on an organism's ability to access mates/fertilization.*

Direct Benefits - Care, food, territory, etc.

Indirect Benefits - Choosing of the most competent male - "Good genes" of ornamentation (looking pretty is costly)

This could also produce harmful results (looking good also attracts predators.)

1.4.2 | Genetic Drift + Gene Flow

Mechanisms of evolution without adaptation

Genetic Drift

- Traits are not selected because they are beneficial against environmental pressures
- Allele frequencies change based on random chance or events

Random bottlenecks (like, colonization, a typhoon) cause the next generation to randomly have a large allele that's not at all competitive.

Gene Flow Movement/migration of one individual with a dominant gene over takes the others/change genetic makeup.

- **Genetic Drift:** one-way movement from larger population to unestablished population causes (even recessive) genes to multiply
- **Gene Flow:** potential for two-way movement in well-established communities affecting population alleles (mostly dominant) by making babies

1.4.3 | Mutations

KBhBIO101Mutations

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1.4.4 | Artificial Selection

A chihuahua + saint-bernard mix.

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1.5 | Speciation

When do many many mutations build up into one new species?

1. Establishing a barrier to gene flow (like, a large ocean)
2. Genetic divergence accumulation until reproductive separation

Variation => Natural Selection => Evolution => Speciation

Fitness: "how many offsprings can this organism reproduce and pass its DNA to?" Evolution can take place when natural selection has occurred.

You could also create traits that's non beneficial and gets weeded out.