

Source: [\[\[KBBIologyMasterIndex\]\]](#)

# 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

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## 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.

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### 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  $\Rightarrow$  for a certain trait, there are differences between individuals
- Heritability  $\Rightarrow$  differences that could be passed through generations
- Reproductive advantage  $\Rightarrow$  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) 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.

#### 1.4.3 | Mutations

[[KBhBI0101Mutations]]

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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
2. Genetic divergence accumulation until reproductive separation

Variation  $\Rightarrow$  Natural Selection  $\Rightarrow$  Evolution  $\Rightarrow$  Speciation

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**Fitness:** “how many offsprings can this organism reproduce and pass its DNA to?”

Evolution can take place when natural selection has occurred.