9.1

Natural Selection is the mechanism of evolution

Anki Vocab

- **Evolution** — The gradual genetic change in populations of organisms over generations.
- **Species** — A group of organisms that can interbreed and produce fertile offspring.
- **Variation** — Differences between individuals in a population.
- **Inherited trait** — A characteristic passed from parents to offspring.
- **Adaptation** — A trait that increases survival and reproduction.
- **Fitness** — An organism's ability to survive and reproduce.
- **Environment** — The conditions in which an organism lives.

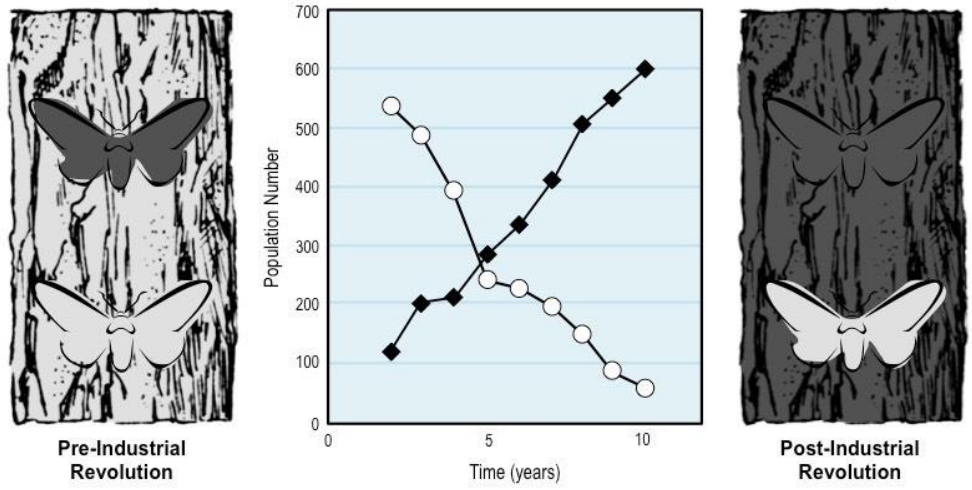
What Is Natural Selection?

A process by which organisms with favourable traits are more likely to survive and reproduce.

What happens as a result?

Over time, the favourable traits become more common in the population.

Example 1. Peppered Moth



Queries

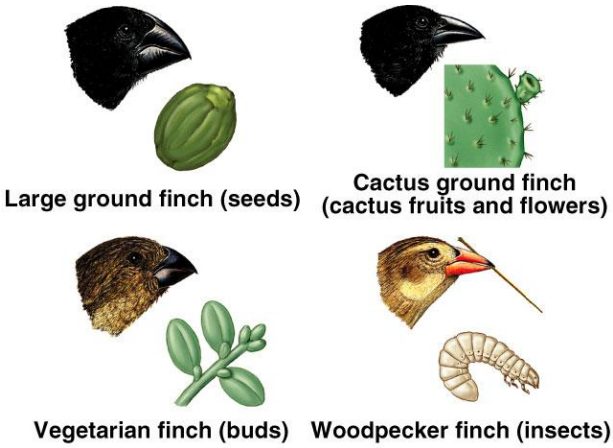
1. What conclusion regarding natural selection could you draw from **Example 1** ?
2. After a population has undergone natural selection for a period of time, and as a result its newer individuals have more favourable traits, we can say that this population has _____ .

Ingredients for natural selection

If we want to make natural selection happen within a population, we need:

1. Genetic variation in the population
2. The ability for genetic variations to be inherited (passed down)
3. Individuals to produce more offspring than can survive (more individuals than resources).

Example 2. Genetic variations in beaks for different species of Finch



Queries

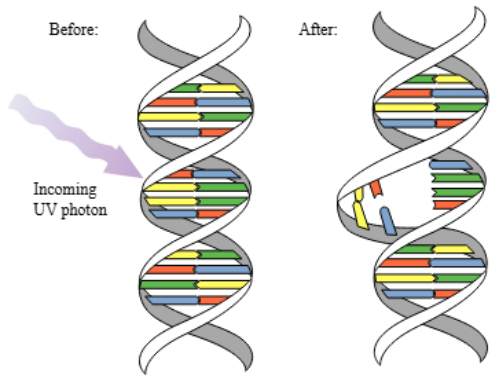
1. Can you define genetic variation?
2. What role do each of the three ingredients play in causing natural selection ?
3. What is the result of having these three ingredients in a population ? (recall the definition of natural selection)

How do we get genetic variation?

Genetic variation in a population can come from two main sources:

1. Sexual reproduction – offspring inherits a shuffled/random mix of genes from both parents, resulting in a different genetic makeup
2. Mutations – permanent change in an organism's DNA (e.g. high UV damaging skin cell DNA and causing skin cancer) resulting in a different genetic makeup

Example 3. UV light damaging DNA



Query

1. Only *inherited genetic variations* can be acted on by natural selection. Of the two sources of genetic variations (sexual reproduction and mutations), which is *inherited,* and why can natural selection only act on this type of variation?

Step-by-step natural selection

1. Variation exists in a population.
2. Environmental pressures select for certain traits.
3. Individuals with advantageous traits reproduce more.
4. Over generations, the genetic makeup of the population changes.

Queries

1. What might 'environmental pressures' be referring to, and could you provide an example of an environmental pressure and how it 'select[s] for certain traits' ?
2. Why do 'individuals with advantageous traits reproduce more'?

Common Misconceptions

Incorrect	Correct
Organisms choose to adapt	Adaptations (advantageous traits) are inherited and selected
Evolution happens in individuals	Evolution occurs in populations
The ‘strongest’ organisms survive	The best-adapted organisms reproduce

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MCQ

Question 1

What is evolution?

A. A sudden change in a single organism
B. The gradual genetic change in populations over generations
C. The development of new organs during an organism’s lifetime
D. The extinction of a species

Question 2

Which definition best describes a species?

A. Any group of similar-looking organisms
B. Organisms living in the same environment
C. A group of organisms that can interbreed and produce fertile offspring
D. A population with high genetic variation

Question 3

Variation refers to differences between individuals in a population.

A. True
B. False

Question 4

Which of the following is an inherited trait?

A. A scar from an injury
B. Muscles gained from exercise
C. Eye colour passed from parents to offspring
D. A tan from sun exposure

Question 5

An adaptation is best described as:

A. Any trait an organism develops during its lifetime
B. A trait that increases survival and reproduction in a specific environment
C. A random change with no effect on survival

Question 6

In evolutionary biology, fitness refers to an organism's

A. Physical strength
B. Ability to escape predators
C. Ability to survive and reproduce
D. Size compared to other organisms

Question 7

Which of the following is NOT an ingredient required for natural selection?

A. Genetic variation in a population
B. Inheritance of traits
C. Unlimited resources for all offspring
D. More offspring produced than can survive

Question 8

Which process is a major source of genetic variation in populations?

A. Natural selection
B. Sexual reproduction and mutations
C. Adaptation
D. Environmental change

Question 9

Mutations are permanent changes in DNA that can create genetic variation in a population.

A. True
B. False

Question 10

Which sequence best describes the step-by-step process of natural selection?

A. Environmental change → mutation → extinction → adaptation
B. Variation → environmental pressure → differential reproduction → population changes
C. Mutation → inheritance → species formation → extinction
D. Fitness → reproduction → variation → environment