SCIENCE FOUNDATIONS

Natural selection

Difficulty level: Intermediate

Science Foundations

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Overview of the concept

This is how you explain why peppered moths turned dark during the smoky industrial age, and why bacteria keep evolving to survive new antibiotics. When soot darkened the trees, the dark moths were harder for birds to spot, so they survived and passed on their colour. When an antibiotic kills most bacteria, the few that survive it are the ones that carry resistance, and their offspring inherit it. Knowing natural selection tells you why populations change over time, and why the same medicine can stop working if it is overused.



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Rule

Natural selection: for natural selection to work there must be variation in a population, the traits must be inherited, and some traits must help their owners survive and reproduce better than others.

Over generations, the helpful traits become more common and the population changes. Individuals do not evolve, populations do.

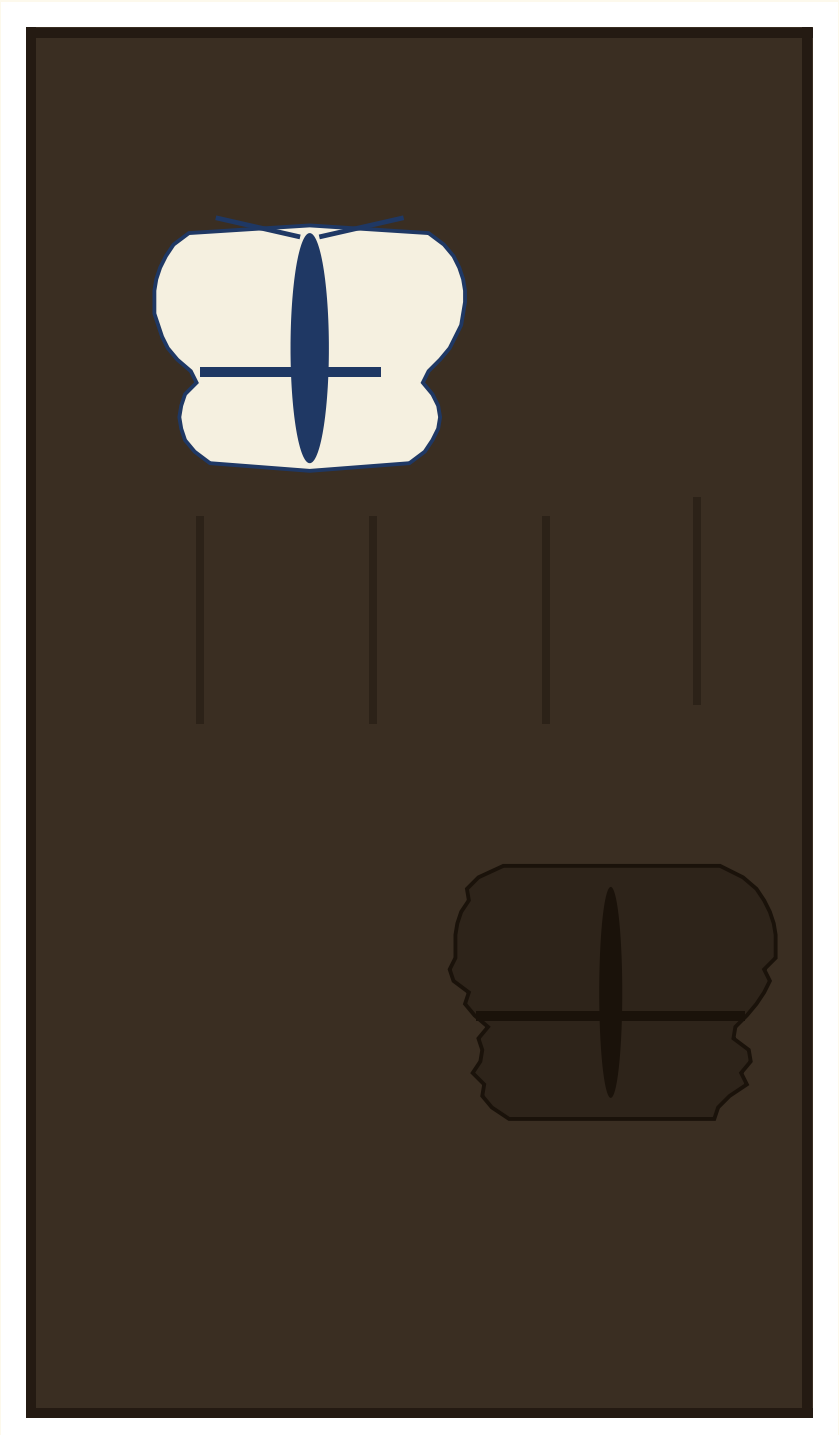
The different versions of a gene are called alleles.

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Worked examples

EXAMPLE 1

Q Peppered moths: dark moths survived better on sooty trees. What happens over time?



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SOLUTION

Start with variation: light and dark moths both exist.

Apply selection: dark moths hide better and survive more.

Over generations, dark moths become more common.

The result is dark moths increase in the population.

EXAMPLE 2

Q What is needed for natural selection to work?

SOLUTION

List the ingredients: variation, inheritance, selection, time.

Check each: traits must vary, pass on, and affect survival.

Conclude: all four are needed.

The result is variation, inheritance, selection, and time.

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Practice questions

1 **In a cold habitat, mice with thicker fur survive winter better than mice with thin fur. Explain what happens to the mouse population over generations.**

- **A** Thin fur becomes more common
- **B** Thick fur becomes more common
- **C** All mice grow thick fur in one winter
- **D** Fur thickness stops varying

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2 A mouse grows thicker fur during a cold winter. Will its babies have thicker fur?

- **A** Yes, the fur it grew is passed on
- **B** No, changes during a lifetime are not inherited
- **C** Yes, all mice grow thick fur
- **D** No, mice cannot grow thick fur

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3 Variation, inheritance, and selection are all present, but no generations have passed. Which ingredient of natural selection is still missing?

- **A** Variation
- **B** Inheritance
- **C** Selection
- **D** Time

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4 A population has variation and inheritance, but no trait affects survival. Can natural selection work?

- **A** Yes, variation alone is enough
- **B** Yes, inheritance alone is enough
- **C** No, without selection by survival no trait spreads
- **D** No, because variation is missing

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5 Do individuals evolve, or do populations evolve?

- **A** Individuals evolve.
- **B** Populations evolve.
- **C** Both evolve in the same way.
- **D** Neither evolves.

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6 Does natural selection create variation?

- A Yes, it creates new variation.
- B Yes, it creates new genes.
- C No, variation never changes.
- D No, variation already exists in the population.

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7 Are best-fitting traits chosen on purpose?

- A Yes, nature picks the best traits
- B No, they spread because their carriers survive and reproduce more
- C Yes, animals choose the best traits
- D No, best-fitting traits never spread

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8

Over what timescale does natural selection act?

A In one lifetime

B Over generations

C In one day

D In one season

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9

What spreads through a population: traits or individuals?

A Individuals

B Whole species at once

C Traits (alleles)

D Single cells

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10

A new antibiotic kills most bacteria. The survivors were already resistant before the drug was used. What does this show?

A The drug created the resistance

B The resistance already existed in the population

C All bacteria become resistant at once

D The drug stops working in one day

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ANSWER KEY

1. Thick fur becomes more common
2. No, changes during a lifetime are not inherited
3. Time
4. No, without selection by survival no trait spreads
5. Populations evolve.
6. No, variation already exists in the population.
7. No, they spread because their carriers survive and reproduce more
8. Over generations
9. Traits (alleles)
10. The resistance already existed in the population

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