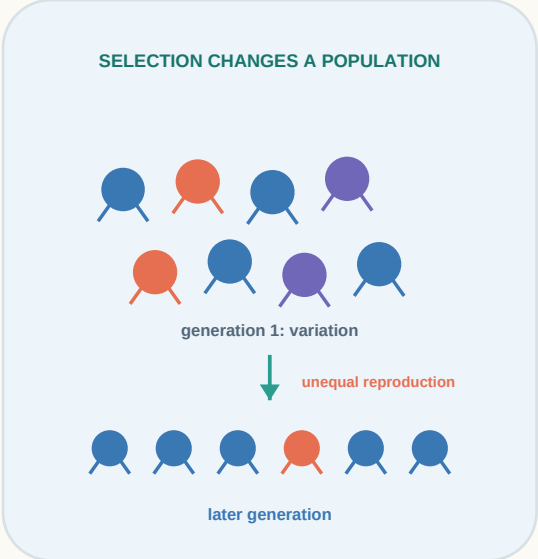
AP BIOLOGY | UNIT 7

TOPIC 7.1

Introduction to Natural Selection

Natural selection occurs when heritable trait differences lead to unequal reproductive success in a particular environment.



THE CORE CAUSAL CHAIN

VARIATION → phenotypes differ

HERITABILITY → traits pass on

FITNESS → offspring differ

EVOLUTION → frequencies shift

BY THE END, YOU SHOULD BE ABLE TO...

1. Identify the conditions required for natural selection.
2. Explain fitness as reproductive success in an environment.
3. Describe why populations, not individuals, evolve.

CENTRAL IDEA

Selection acts on existing phenotypes, but evolution is the resulting change in heritable trait or allele frequencies across generations.

1 Natural selection requires a complete causal chain

Variation alone is not enough: trait differences must be heritable and linked to unequal reproductive success.

FOUR CONDITIONS

1 VARIATION

Individuals in a population differ in phenotype.

2 HERITABILITY

At least some trait differences can pass to offspring.

3 LIMITED RESOURCES

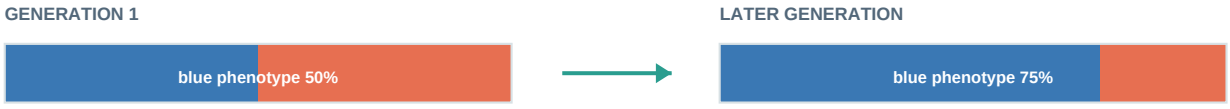
Not every individual can obtain all resources or reproduce equally.

4 DIFFERENTIAL FITNESS

Some phenotypes lead to more surviving, reproducing offspring.

THE POPULATION CHANGES ACROSS GENERATIONS

DIFFERENTIAL REPRODUCTION CHANGES FREQUENCIES



Individuals with the favored heritable phenotype leave more offspring; its frequency rises.

FITNESS = REPRODUCTIVE SUCCESS

Fitness is measured by contribution to the next generation. Living longer matters only if it helps an organism leave more viable, fertile offspring.

SCALE CHECK

An individual can survive, reproduce, or acclimate. A population evolves when heritable frequencies change over generations.

2 The environment determines which phenotypes succeed

Selection pressures can be living or nonliving, and a phenotype's fitness effect can reverse when conditions change.

SELECTION PRESSURES

BIOTIC FACTORS

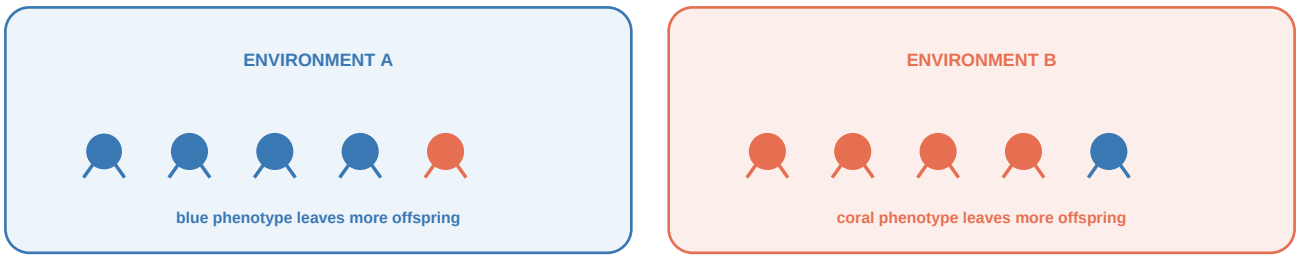
Predators, pathogens, competitors, mates, and food organisms.

ABIOTIC FACTORS

Temperature, water, light, salinity, pH, and physical disturbance.

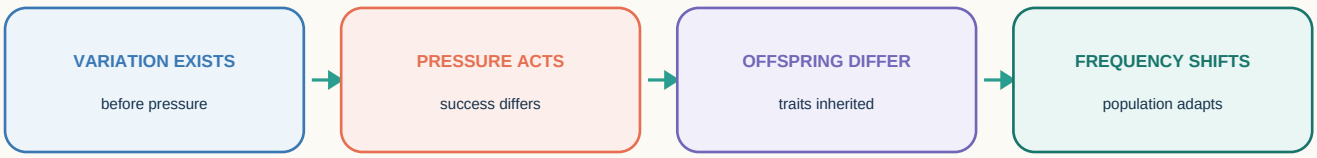
FITNESS DEPENDS ON CONTEXT

THE SAME HERITABLE TRAIT CAN HAVE DIFFERENT EFFECTS



Fitness is context-dependent, not a permanent property of a trait.

SELECTION SORTS EXISTING VARIATION



DO NOT CONFUSE

The environment does not create a needed trait, and organisms do not evolve because they try. Existing heritable variants differ in reproductive success.

FINAL MAP

Heritable variation + selection pressure -> unequal reproductive success -> changing frequencies -> population-level adaptation.