AP BIOLOGY | UNIT 7

TOPIC 7.8

Continuing Evolution

Evolution continues whenever heritable variation, selection, and reproduction change populations across generations.



THE CORE CAUSAL CHAIN

VARIATION
already present

→

PRESSURE
unequal survival

→

REPRODUCTION
traits inherited

→

CHANGE
frequencies shift

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

1. Recognize allele-frequency change in living populations.
2. Explain how treatment pressure selects resistant variants.
3. Distinguish population evolution from individual adjustment.

CENTRAL IDEA

Selection does not create useful variants on demand. It changes which existing heritable variants leave descendants, shifting the population over time.

1 Resistance is evolution in real time

A drug or chemical changes the environment. Resistant variants survive disproportionately and contribute more descendants to later generations.

THE POPULATION CHANGES ACROSS GENERATIONS

1 VARIATION EXISTS

A few individuals already carry a resistance allele.



2 PRESSURE ACTS

Treatment removes many susceptible individuals.



3 SURVIVORS REPRODUCE

Resistance becomes more common in descendants.



CAUSE AND EFFECT

The treatment is the selection pressure; it does not direct mutations. Heritable resistance present before or arising independently is what selection preserves.

THE SAME LOGIC APPEARS IN MANY SYSTEMS

ANTIBIOTIC RESISTANCE

PRESSURE	antibiotic exposure
SELECTED	bacteria with resistance mechanisms

PESTICIDE RESISTANCE

PRESSURE	pesticide exposure
SELECTED	insects that survive the pesticide

HERBICIDE RESISTANCE

PRESSURE	herbicide exposure
SELECTED	weeds with resistant variants

CHEMOTHERAPY RESISTANCE

PRESSURE	drug treatment
SELECTED	cancer-cell variants that survive

COMMON ERROR

An individual bacterium does not become resistant because it needs to survive. The frequency of resistant variants rises in the population.

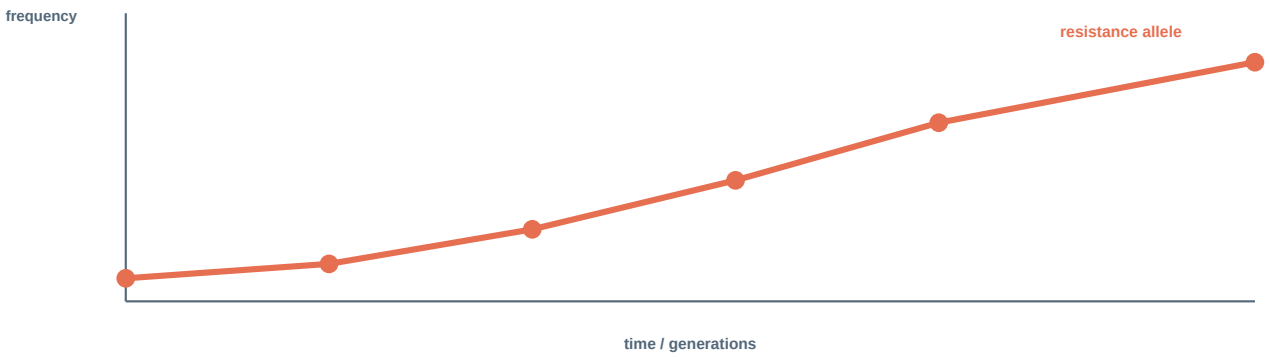
MEASURABLE OUTCOME

After selection, resistance alleles or resistant phenotypes make up a larger proportion of the surviving and reproducing population.

2 Genomes reveal evolution as it happens

Repeated sampling can show mutations, lineages, and frequency changes in pathogens or other populations across short time scales.

GENOMIC DATA TRACK CHANGE THROUGH TIME



WHY PATHOGENS CAN EVOLVE RAPIDLY

SHORT GENERATION TIMES

Many reproductive cycles create frequent opportunities for inherited change.

LARGE POPULATIONS

More individuals mean more genetic variants can be present.

MUTATION + RECOMBINATION

New combinations can generate phenotypes that selection acts on.

STRONG SELECTION PRESSURE

Immunity, drugs, and host environments can favor particular variants.

EMERGENT DISEASE

Evolution can contribute when pathogen variants expand host range, transmit differently, escape prior immunity, or resist treatment. Ecological conditions also matter.

EVIDENCE, NOT A SNAPSHOT

A sequence difference alone is variation. Evolution is demonstrated when the frequency of that variant changes through generations in the population.

FINAL MAP

Genomic change + selection pressure + differential reproduction + frequency shift = continuing evolution.