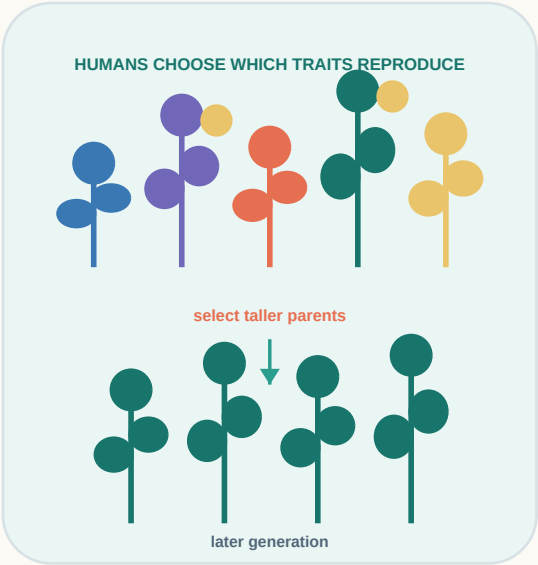
AP BIOLOGY | UNIT 7

# TOPIC 7.3

# Artificial Selection

Artificial selection occurs when humans choose which organisms reproduce, shifting heritable traits and alleles over generations.




## THE CORE CAUSAL CHAIN

**VARIATION**
traits already differ

→

**HUMAN CHOICE**
parents selected

→

**INHERITANCE**
offspring receive alleles

→

**FREQUENCY**
desired trait rises

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

1. Describe the repeated selective-breeding cycle.
2. Predict how human choice changes trait frequencies.
3. Explain possible effects on genetic diversity.

**CENTRAL IDEA**

Human preference replaces the environment as the main selection pressure, but selection still requires existing heritable variation.

# 1 Selective breeding repeats the same choice each generation

Breeders measure existing variation, choose parents with a desired heritable trait, and repeat the process with their offspring.

## THE BREEDING CYCLE

**1 DEFINE**
Choose a desired trait.

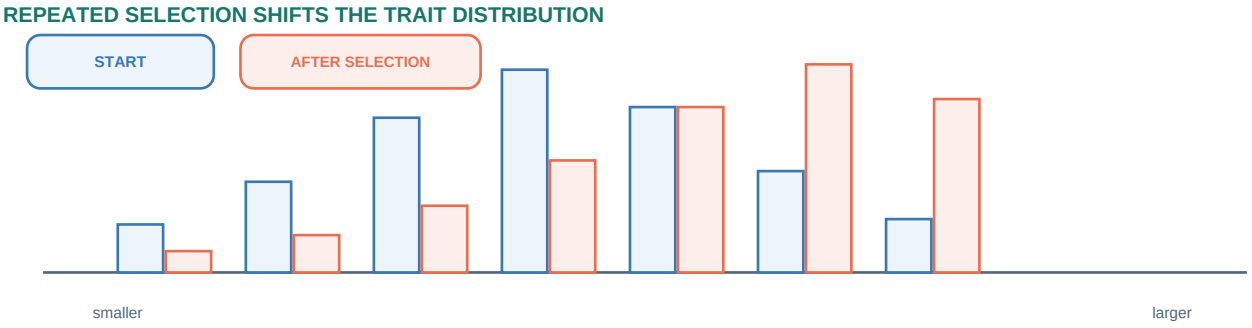
**2 MEASURE**
Find variation in the population.

**3 SELECT**
Choose breeding parents.

**4 BREED**
Produce and evaluate offspring.

**5 REPEAT**
Select again for generations.

## TRAIT FREQUENCY CHANGES




## ARTIFICIAL VS NATURAL SELECTION

### ARTIFICIAL SELECTION

| | |
|---|---|
| SELECTOR | humans |
| CRITERION | desired phenotype |
| OUTCOME | trait rises in breeding line |

### NATURAL SELECTION

| | |
|---|---|
| SELECTOR | environment |
| CRITERION | reproductive success |
| OUTCOME | adaptive traits may rise |

**SHARED LOGIC**

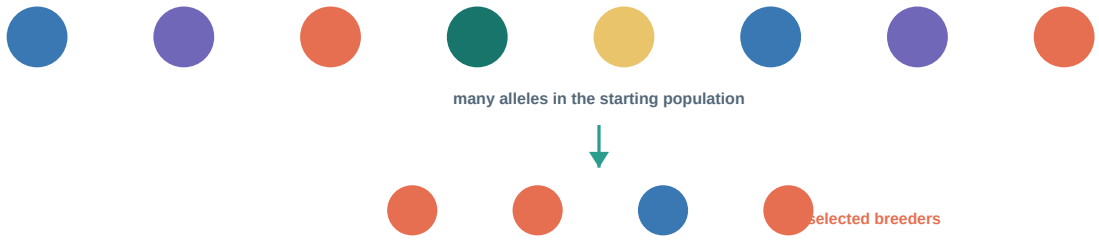
**Both processes change populations only when selected phenotypes have a heritable genetic basis and reproduction differs.**

# 2 Artificial selection can reshape genetic diversity

Selecting a small breeding group can rapidly increase a trait but may remove other alleles and expose unintended tradeoffs.

## A BREEDING BOTTLENECK

### USING FEW BREEDERS CAN NARROW THE GENE POOL




## POSSIBLE CONSEQUENCES

### LOWER WITHIN-LINE DIVERSITY

Alleles not carried by selected breeders may become rare or disappear.

### MORE HOMOZYGOSITY

Related breeders can increase expression of harmful recessive alleles.

### CORRELATED TRAITS

Genes inherited together or developmental links can produce unintended changes.

### DIVERGENT BREEDING LINES

Selecting different goals can increase differences among breeds or varieties.

### WHERE ARTIFICIAL SELECTION IS USED

| CROPS | LIVESTOCK | PETS | LAB LINES |
|---|---|---|---|
| yield, size, timing | growth, milk, behavior | appearance, temperament | specific research traits |

### FINAL MAP

**Existing heritable variation -> humans select breeders -> offspring inherit chosen alleles -> repeated selection changes traits and may narrow the gene pool.**