# AP BIOLOGY CHEAT SHEET

*Unit 7: Natural Selection*

## Quick Overview

- **Focus:** how populations evolve over time through natural selection, genetic drift, gene flow, and mutation.
- **Exam lens:** connect evidence of evolution to population-level genetic change.

## Natural Selection Basics

- **Definition:** process where individuals with favorable traits survive and reproduce more.
- **Requirements:**
  a. Variation in traits
  b. Heritability
  c. Differential survival/reproduction
- **Outcome:** population becomes better adapted to environment.

**Mnemonic:** "VHS → Variation, Heritability, Selection."

## Evidence for Evolution

1. **Fossil record** — transitional species show gradual change.
2. **Comparative anatomy** — homologous vs analogous structures.
3. **Molecular biology** — DNA/protein similarities.
4. **Biogeography** — species distribution supports common ancestry.
5. **Embryology** — shared developmental patterns.

## Types of Selection

1. **Directional:** favors one extreme (e.g., antibiotic resistance).
2. **Stabilizing:** favors average (e.g., human birth weight).
3. **Disruptive:** favors both extremes (e.g., dark & light mice).

**Mnemonic:** "D-S-D — Directional, Stabilizing, Disruptive."

### Mini formula box

- **Independent assortment combinations: $2^n$ (n = haploid number).**
- **Monohybrid cross ratio: 1:2:1 genotype, 3:1 phenotype.**
- **Chi-square: use to test expected Mendelian ratios.**

## Integrated Tutor Tip

**On FRQs, always mention allele frequency change over generations when defining evolution, this earns definition points and shows depth.**

## Translation (RNA → Protein)

- **Gene pool:** total alleles in a population.
- **Allele frequency:** proportion of a given allele.
- **Hardy-Weinberg Equilibrium:** predicts no evolution if conditions are met.

**Formula:**

- $p^2 + 2pq + q^2 = 1$
- $(p + q = 1)$

**Conditions:**

- No mutation
- No migration
- Random mating
- Large population
- No selection

**Mnemonic: "M-M-R-L-S → My Mom Raises Large Snacks."**

## Mechanisms of Evolution

- **Natural selection** — adaptive change.
- **Genetic drift** — random change (bottleneck, founder effect).
- **Gene flow** — movement of alleles between populations.
- **Mutation** — introduces variation.
- **Sexual selection** — mate choice influences traits.

## Speciation

- **Allopatric:** physical barrier divides populations.
- **Sympatric:** occurs without a barrier (e.g., polyploidy in plants).
- **Reproductive isolation:** prevents interbreeding.

**Mnemonic:** "Allo = Apart, Sym = Same."

## Evidence in Action

- **Peppered moths:** industrial melanism (directional selection).
- **Antibiotic resistance:** rapid evolution in bacteria.
- **Darwin's finches:** beak size variation during droughts.

## Common exam pitfalls

- **Forgetting Hardy-Weinberg assumes no evolution.**
- **Confusing homologous (same origin) and analogous (same function).**
- **Mixing up gene flow vs genetic drift.**
- **Believing individuals evolve — only populations do.**