

AP BIOLOGY CHEAT SHEET

Unit 6: Gene Expression & Regulation

Quick Overview

- **Focus:** how genetic information flows from DNA → RNA → protein, and how cells regulate that process.
- **Exam lens:** transcription, translation, and gene regulation mechanisms (like operons and epigenetics).

Central Dogma of Biology

DNA → RNA → Protein

- **Transcription:** DNA → mRNA (in nucleus).
- **Translation:** mRNA → protein (in ribosome).

Mnemonic: "DNA is the cookbook, RNA is the recipe, protein is the dish."

Cell Cycle Basics

- **Double helix:** sugar-phosphate backbone + base pairs (A-T, C-G).
- **Antiparallel strands:** 5' → 3' and 3' → 5'.
- **Hydrogen bonds hold bases together.**

Enzymes in Replication:

- **Helicase:** unzips DNA.
- **DNA polymerase:** adds nucleotides (5'→3').
- **Ligase:** joins Okazaki fragments.

Mnemonic: "Helicase unzips, Polymerase builds, Ligase links."

Transcription (DNA → RNA)

1. **Initiation:** RNA polymerase binds promoter.
2. **Elongation:** mRNA strand built (U replaces T).
3. **Termination:** reaches stop signal.
4. **mRNA processing (in eukaryotes):**
 - Add 5' cap and poly-A tail.
 - Splicing: remove introns, join exons.

Pitfall: forgetting prokaryotes don't do RNA splicing!

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.

Translation (RNA → Protein)

- **Occurs in ribosomes (rRNA + proteins).**
- **tRNA brings amino acids using anticodons.**
- **Start codon:** AUG (Methionine).
- **Stop codons:** UAA, UAG, UGA.

Mnemonic: "AUG = Always the Start."

Gene Regulation

Prokaryotes:

- Operon model: group of genes controlled together.
- Lac operon (inducible): off until lactose present.
- Trp operon (repressible): on until tryptophan present.

Mnemonic: "Lac = Lazy until lactose, Trp = Tired when tryptophan."

Eukaryotes:

- Regulation via transcription factors, enhancers, and methylation/acetylation (epigenetic control).

Viruses & Gene Expression

- **Lytic cycle:** immediate replication → cell bursts.
- **Lysogenic cycle:** viral DNA integrates into host DNA.
- **Retroviruses:** use reverse transcriptase (RNA → DNA).

Mnemonic: "Lytic = Loud, Lysogenic = Latent."

Common exam pitfalls

- **Confusing transcription and replication enzymes.**
- **Forgetting mRNA processing happens only in eukaryotes.**
- **Mixing up lac vs trp operon control.**
- **Forgetting "reverse transcriptase" is unique to retroviruses.**

Integrated Tutor Tip

- **Don't memorize every enzyme — focus on the direction of information flow and where each process happens.**

On FRQs, explaining the why behind regulation (not just the steps) earns higher points.

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