Module 13: Regulation of Gene Expression

Comprehension & Critical Thinking Questions

Part 1: Core Concepts

1. **Prokaryotic Regulation**
    - Define operon.
    - Compare inducible operons (lac) vs. repressible operons (trp).
2. **Eukaryotic Regulation**
    - Gene expression is controlled at multiple levels. Briefly explain:
        - Chromatin remodeling (histone modification)
        - Transcriptional control (transcription factors)
        - Post-translational control (protein modification/degradation)
3. **Mutations**
    - Define point mutation vs. frameshift mutation.
    - Why are frameshift mutations typically more damaging?

Part 2: Application

1. **The Lac Operon**
    - **Scenario**: E. coli are growing in glucose-only medium.
    - Is the lac operon on or off? Is the repressor bound?
    - What happens when lactose is added?
2. **X-Inactivation**
    - Explain dosage compensation and Barr body formation.
    - How does X-inactivation explain calico cat coat patterns?

Part 3: Analysis & Evaluation

1. **Cancer and Gene Regulation**
    - Cancer results from dysregulated gene expression.
    - Analyze how mutations in tumor suppressor genes or proto-oncogenes lead to uncontrolled cell division.
2. **Epigenetics**
    - Environmental factors (diet, stress) can modify DNA methylation without changing the sequence.
    - Can these modifications be inherited? Discuss evidence.