Module 11: Mendelian Genetics

Keys to Success & Study Guide

Learning Objectives

By the end of this module, you should be able to: 1. **Predict** the outcomes of monohybrid and dihybrid crosses using Punnett Squares. 2. **Differentiate** between dominant, recessive, incomplete dominant, and codominant traits. 3. **Analyze** pedigrees to determine inheritance patterns (Autosomal vs Sex-linked). 4. **Explain** how multiple alleles and polygenic traits result in non-binary phenotypes.

Key Terminology Checklist

Define these terms in your own words to ensure mastery. - [ ] **Locus**: The specific physical location of a gene on a chromosome. - [ ] **True-Breeding**: An organism that always passes down certain phenotypic traits (Always Homozygous). - [ ] **F1 Generation**: The first filial generation (offspring of the parents). - [ ] **Carrier**: An individual who has a recessive allele for a disease but does not show symptoms (Heterozygote). - [ ] **Pleiotropy**: One gene affecting multiple seemingly unrelated traits (e.g., Marfan Syndrome).

Concept Check

1. The Ratios

- **Question**: What would be the resultant phenotype ratio for a monohybrid cross between two heterozygotes?
- **Deep Dive**: The Golden Ratio of Genetics is **3:1**.
    - AA (Dom)
    - Aa (Dom)
    - Aa (Dom)
    - aa (Rec)
    - 3 Dominant phenotypes : 1 Recessive phenotype.

2. Dihybrid Madness

- **Question**: What is the ratio for a dihybrid cross (AaBb x AaBb)?
- **Deep Dive**: **9:3:3:1**.
    - 9 Dom/Dom
    - 3 Dom/Rec
    - 3 Rec/Dom
    - 1 Rec/Rec.

3. Sex-Linked traits

- **Question**: Do males or females get sex-linked disease more?
- **Deep Dive**: Males. Why? Because males are **XY**. If they get a bad gene on their single X, they have no backup. Females are **XX**, so a healthy X can mask a bad one (making them a Carrier).

Study Tips

- **Letter Logic**: Always use the letter of the Dominant trait. If Tall is dominant, use T/t. Don't use S for short. It gets confusing.
- **The "And" Rule**: If you want the probability of This AND That happen (e.g., Tall AND Purple), multiply the individual probabilities.
    - Prob(Tall) = 3/4.
    - Prob(Purple) = 3/4.
    - Prob(Tall and Purple) = 3/4 * 3/4 = 9/16.