

Module 10: Meiosis and Sexual Reproduction

Keys to Success & Study Guide

Learning Objectives

By the end of this module, you should be able to: 1. **Contrast** the outcomes of Asexual and Sexual reproduction. 2. **Distinguish** between Homologous Chromosomes and Sister Chromatids. 3. **Diagram** the phases of Meiosis I and II. 4. **Explain** the three sources of genetic variation: Crossing Over, Independent Assortment, and Random Fertilization.

Key Terminology Checklist

Define these terms in your own words to ensure mastery. - [] **Allele:** Alternative forms of a gene (e.g., Blue eye gene vs. Brown eye gene). - [] **Karyotype:** A visual display of an individual's chromosomes arranged in pairs. - [] **Synapsis:** The fusing of homologous chromosomes during Prophase I. - [] **Tetrad:** The structure formed by two homologous chromosomes (4 chromatids). - [] **Euploidy:** The correct number of chromosomes. - [] **Aneuploidy:** An abnormal number of chromosomes (+1 or -1).

Concept Check

1. The Reductive Division

- **Question:** What separates during meiosis I? Meiosis II?
- **Deep Dive:** This is the most common exam mistake.
 - **Meiosis I:** Homologous Pairs separate from each other. (Diploid → Haploid).
 - **Meiosis II:** Sister Chromatids separate. (Haploid → Haploid).

2. The Variation Machine

- **Question:** Why is genetic variation so important?

- **Deep Dive:** Variation is the raw material for adaptation. If a population is identical (clones) and a new disease arrives, it kills everyone. If there is variation, some might survive.

3. Counting Chromosomes

- **Question:** How many chromosomes do humans have?
- **Deep Dive:** 46 total.
 - 22 Pairs of Autosomes (Instructions for body).
 - 1 Pair of Sex Chromosomes (XX or XY).
 - Gametes (Sperm/Egg) have 23 *total* chromosomes (no pairs).

4. Errors

- **Question:** What is a nondisjunction?
- **Deep Dive:** Failure to separate. It leads to gametes with $n+1$ or $n-1$ chromosomes.
 - $n+1$ sperm + n egg = $2n+1$ (Trisomy).
 - $n-1$ sperm + n egg = $2n-1$ (Monosomy).

Study Tips

- **Dance of the Chromosomes:**
 - Imagine two pairs of shoes (Dad's boots, Mom's heels).
 - **Replication:** Photocopy each shoe. Now you have two boots tied together (Sisters) and two heels tied together (Sisters).
 - **Metaphase I:** The Boots pair up with the Heels. (Homologous pair).
 - **Anaphase I:** Boots go left, Heels go right.
 - **Metaphase II:** The tie snaps. Single shoes separate.
- **Focus on Prophase I:** This is where the magic happens (Crossing Over). It's the longest phase.