What is Mendelian Genetics?

Worksheet

Mendelian genetics states that each parent contributes one of two alleles for a trait (law of segregation), and alleles for different genes on different chromosomes are inherited independently of each other (law of independent assortment), producing predictable Punnett-square ratios like 3:1 and 9:3:3:1.

Questions

1. Which law explains why alleles separate into different gametes?

A) Law of independent assortment
B) Law of segregation
C) Law of dominance
D) Law of linkage

2. In Aa Aa, what fraction of offspring is expected to show the recessive phenotype?

A) 1/2
B) 1/4
C) 3/4
D) 1

3. For a dihybrid cross AaBb AaBb, what fraction of offspring is aabb?

A) 1/16
B) 3/16
C) 9/16
D) 1/4

4. Why is a testcross (Aa aa) useful?

A) It doubles the mutation rate
B) It reveals whether a dominant-phenotype individual is homozygous or heterozygous
C) It only works with recessive traits
D) It changes the genotype of the parent

5. A monohybrid cross: Aa Aa. What genotype and phenotype ratios appear in the offspring?

6. A testcross: Aa aa. Predict the offspring ratio.

7. A dihybrid cross: AaBb AaBb, with A and B on different chromosomes. Find the phenotype ratio for A_B_ (both dominant).

8. Define: Law of segregation?

9. Define: Law of independent assortment?

10. Define: What is a Punnett square?

Answer Key

1. B) Law of segregation - The law of segregation states the two alleles for a gene separate during meiosis.

2. B) 1/4 - Genotype ratio is 1 AA : 2 Aa : 1 aa, so 1/4 are aa (recessive).

3. A) 1/16 - P(aa) = 1/4 and P(bb) = 1/4; by independent assortment P(aabb) = 1/4 1/4 = 1/16.

4. B) It reveals whether a dominant-phenotype individual is homozygous or heterozygous - Crossing with a homozygous recessive individual exposes the unknown parent's alleles in the offspring ratio.

5. Each parent produces gametes A and a with equal probability (law of segregation) Punnett square: AA, Aa, Aa, aa genotype ratio 1 AA : 2 Aa : 1 aa If A is dominant, phenotype ratio is 3 dominant : 1 recessive

6. The heterozygote makes gametes A and a (1/2 each); the homozygous recessive parent makes only a Punnett square: Aa, Aa, aa, aa genotype ratio 1 Aa : 1 aa Phenotype ratio is 1 dominant : 1 recessive - testcrosses reveal an unknown genotype this way

7. By independent assortment, P(A_) = 3/4 and P(B_) = 3/4 P(A_ and B_) = P(A_) P(B_) = 3/4 3/4 = 9/16 The full dihybrid ratio is 9 A_B_ : 3 A_bb : 3 aaB_ : 1 aabb

8. The two alleles for a trait separate during gamete formation, so each gamete carries only one allele.

9. Alleles of genes on different chromosomes are distributed to gametes independently of each other.

10. A grid used to predict the genotype and phenotype ratios of offspring from a genetic cross.