

Review Sheet Mendel and Gene Idea

Lester BIOL 150

General things to do to prepare for the exam:

- study the PowerPoints
- write out the answers to the learning objectives found with each PowerPoint
- listen to my lecture recordings
- see exercises 10 and 12 in the lab manual more info and genetics problems

Chapter 14

Define: hybridization, P, F1, and F2 generations.

Describe the four concepts that explain the 3:1 inheritance pattern of F2 offspring.

Define: dominant, recessive, allele, heterozygous, homozygous, genotype, and phenotype.

What does a testcross tell us and how?

What is a monohybrid? A dihybrid?

Describe Mendel's law of independent assortment.

Explain how to calculate a probability.

How are the multiplication (product) and addition (sum) rules different with regard to the outcomes and their probability?

Compare and contrast complete dominance, incomplete dominance, and codominance. Give examples.

Explain pleiotropy and give examples (explain why they are examples).

Explain epistasis and give examples (explain why they are examples).

Define polygenic inheritance and quantitative characters/characteristics. Give examples.

Define the norm of reaction and explain the example of blue and pink hydrangea flowers.

Why are humans not good test subjects for genetic research?

What is a pedigree? Use a pedigree to determine if a trait is dominant or recessive.

Explain what a "carrier" is?

What are consanguineous matings? Why are they bad (genetically speaking!)?

How does sickle cell disease work to protect populations? Protect them from what?

What is the genotype for someone with achondroplasia? Make a Punnett square for a cross between two of these individuals? What is the percentage of dwarf, normal height, and dead offspring?

Sample Test Questions

Which of the following statements is correct in describing the terms *monohybrid cross* and *dihybrid cross*?

- A) A monohybrid cross involves a single parent, whereas a dihybrid cross involves two parents.
- B) A dihybrid cross involves organisms that are heterozygous for two characters that are being studied, and a monohybrid cross involves organisms that are heterozygous for only one character being studied.
- C) A monohybrid cross is performed for one generation, whereas a dihybrid cross is performed for two generations.
- D) A monohybrid cross results in a 9:3:3:1 ratio, whereas a dihybrid cross gives a 3:1 ratio.

How many unique gametes could be produced through independent assortment by an individual with the genotype *AaBbCCDdEE*?

- A) 4
- B) 8
- C) 16
- D) 64

A sexually reproducing animal has two unlinked genes, one for head shape (*H*) and one for tail length (*T*). Its genotype is *HhTt*. Which of the following genotypes is possible in a gamete from this organism?

- A) *Hh*
- B) *HhTt*
- C) *T*
- D) *HT*

Mendel's observation of the segregation of alleles in gamete formation has its basis in which of the following phases of cell division?

- A) prophase I of meiosis
- B) anaphase II of meiosis
- C) metaphase II of meiosis
- D) anaphase I of meiosis

Mendel's law of independent assortment has its basis in which of the following events of meiosis I?

- A) synapsis of homologous chromosomes
- B) crossing over of homologous pairs of chromosomes
- C) alignment of pairs of homologous chromosomes along the middle of the cell
- D) the division of cells at telophase

Skin color in a certain species of fish is inherited by a single gene with four different alleles. How many different types of gametes would be possible in this organism?

- A) 2
- B) 4
- C) 8
- D) 16

Albinism is a recessive trait. A man and woman who both have normal pigmentation have one child out of three who has albinism (without melanin pigmentation). What are the genotypes of this child's parents?

- A) One parent must be homozygous for the recessive allele; the other parent can be homozygous dominant, homozygous recessive, or heterozygous.
- B) One parent must be heterozygous; the other parent can be homozygous dominant, homozygous recessive, or heterozygous.
- C) Both parents must be heterozygous.
- D) One parent must be homozygous dominant; the other parent must be heterozygous.

Gray seed color in peas is dominant to white. Assume that Mendel conducted a series of experiments where plants with gray seeds were crossed among themselves, and the following progeny were produced: 302 gray and 98 white. What is the most probable genotype of each parent?

- A) $GG \times gg$
- B) $Gg \times Gg$
- C) $GG \times Gg$
- D) $gg \times Gg$

In pea plants, the tall phenotype is dominant to the dwarf phenotype. If a heterozygous pea plant is crossed with a homozygous tall pea plant, what is the probability that the offspring will be dwarf in size?

- A) 1
- B) $\frac{1}{2}$
- C) $\frac{1}{4}$
- D) 0

In cattle, roan coat color (mixed red and white hairs) occurs in the heterozygous ($CRCW$) offspring of red ($CRCR$) and white ($CWCW$) homozygotes. Which of the following crosses would produce offspring in the ratio of 1 red:2 roan:1 white?

- A) red \times white B) roan \times roan C) white \times roan D) red \times roan

Which of the following inheritance patterns describes the ability of a single allele to have multiple phenotypic effects?

- A) incomplete dominance B) multiple alleles C) pleiotropy D) epistasis

Which of the following phenotypes is an example of polygenic inheritance?

- A) pink flowers in snapdragons B) the ABO blood group in humans
C) white and purple flower color in peas D) skin pigmentation in humans

Hydrangea plants of the same genotype are planted in a large flower garden. Some of the plants produce blue flowers and others pink flowers. This can be best explained by which of the following?

- A) the knowledge that multiple alleles are involved
B) the allele for blue hydrangea is completely dominant over the allele for pink hydrangea
C) the alleles are codominant
D) environmental factors such as soil pH affect the phenotype

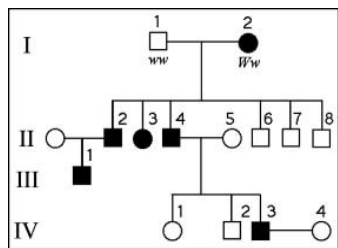
In human blood types, Rh positive is a trait that shows simple dominance over Rh negative. A woman who has blood type A positive has a daughter who is type O positive and a son who is type B negative. Which of the following phenotypes is possible for the father?

- A) A negative B) O negative C) B positive D) AB negative

In some parts of Africa, the frequency of heterozygosity for the sickle-cell anemia allele is unusually high, presumably because this reduces the frequency of malaria. Such a relationship is related to which of the following?

- A) Mendel's law of independent assortment B) Mendel's law of segregation
C) Darwin's explanation of natural selection D) the malarial parasite changing the allele

The following question refers to the pedigree chart in the figure for a family, some of whose members exhibit the dominant trait, W . Affected individuals are indicated by a dark square or circle.



What is the genotype of individual II-5?

- A) WW B) Ww C) ww D) ww or Ww