Mendelian Link Practice Test (Sample)

Study Guide

BY EXAMZIFY

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Questions

1. **In Drosophila genetics, which trait is dominant: red eyes or white eyes?**
   - A. Red eyes
   - B. White eyes
   - C. Neither trait is dominant
   - D. Both traits are equally dominant

2. **What fails to separate during non-disjunction in anaphase 1 of meiosis?**
   - A. Sister chromatids
   - B. Gametes
   - C. Homologues
   - D. Centromeres

3. **How many phenotypic classes are expected when two homozygous dominant and two heterozygous parents are crossed for two traits?**
   - A. Three
   - B. Four
   - C. Two
   - D. Five

4. **In genetics, what are autosomes?**
   - A. Chromosomes that determine the sex of an individual
   - B. Non-sex chromosomes
   - C. Chromosomes that only carry lethal alleles
   - D. Chromosomes that always express dominant traits

5. **What type of genetic cross involves parents that differ in only one trait?**
   - A. Test Cross
   - B. Dihybrid Cross
   - C. Reciprocal Cross
   - D. Mono-hybrid Cross

6. Which phenotype reappears in the F2 generation after a cross of two heterozygous plants (Tt)?

A. Tall

B. Short

C. Intermediate

D. All of the above

7. How does partial dominance affect allele expression?

A. Both alleles are expressed equally

B. One allele is fully expressed while the other is not

C. One allele partially masks the other

D. Neither allele influences the phenotype

8. What is the expected outcome for the daughters in a cross between a normal male and a carrier female for a sex-linked trait?

A. All will be normal

B. All will be carriers

C. Half will be carriers and half will be normal

D. None will be affected

9. How does the Bombay phenotype illustrate the concept of epistasis?

A. A second gene entirely determines the phenotype

B. It shows complete dominance of one trait over another

C. Only the dominant traits are expressed

D. There is no interaction between different genes

10. When a white-eyed female fruit fly is crossed with a red-eyed male, what are the expected phenotypes of the offspring?

A. All red-eyed females and white-eyed males

B. All white-eyed females and red-eyed males

C. All red-eyed offspring

D. All white-eyed offspring

Answers

1. A
2. C
3. B
4. B
5. D
6. D
7. C
8. C
9. A
10. A

Explanations

1. In Drosophila genetics, which trait is dominant: red eyes or white eyes?

A. Red eyes

B. White eyes

C. Neither trait is dominant

D. Both traits are equally dominant

In Drosophila, or fruit flies, the trait for red eyes is dominant over the trait for white eyes. This is a classic example of Mendelian inheritance where one allele can mask the presence of another. In these flies, the gene responsible for eye color has two alleles: one allele for red eyes, which is dominant, and another allele for white eyes, which is recessive. When both alleles are present in an individual (heterozygous condition), the dominant red allele expresses itself, resulting in red-eyed flies. In contrast, the flies will only exhibit white eyes if they are homozygous for the white allele, meaning they possess two copies of the recessive allele. This demonstrates the fundamental principle of dominance in genetics where the dominant allele's trait is observable in the phenotype, while the recessive allele's trait is masked when paired with the dominant allele. Understanding the dominance relationship between these traits is crucial for predicting the phenotypic outcomes in Drosophila and applying this knowledge to more complex genetic crosses.

2. What fails to separate during non-disjunction in anaphase 1 of meiosis?

A. Sister chromatids

B. Gametes

C. Homologues

D. Centromeres

During anaphase 1 of meiosis, the key event is the separation of homologous chromosomes, which are pairs of chromosomes, one inherited from each parent. Non-disjunction occurs when these homologous chromosomes fail to separate properly. As a result, one daughter cell receives both copies of a particular chromosome, while the other daughter cell receives none. This can lead to gametes with an abnormal number of chromosomes, which can result in various genetic disorders upon fertilization. Sister chromatids, which are identical copies formed after DNA replication, are still held together by centromeres during anaphase 1 and only separate during anaphase 2 of meiosis. Therefore, it is the failure of homologous chromosomes to separate during anaphase 1 that characterizes non-disjunction in this phase, not the other processes or structures involved in meiosis.

3. How many phenotypic classes are expected when two homozygous dominant and two heterozygous parents are crossed for two traits?

A. Three

B. Four

C. Two

D. Five

To determine the number of phenotypic classes expected when crossing two homozygous dominant parents with two heterozygous parents for two traits, it's essential to understand the concepts of genotype, phenotype, and how traits assort during a dihybrid cross. When two traits are involved, each trait can exhibit dominance or recessiveness. In this scenario, the homozygous dominant parents can only contribute one type of allele for each trait, while the heterozygous parents contribute two types of alleles. This combination leads to a variety of genotypes. For two traits, you can use a Punnett square or the principles of independent assortment to visualize the possible combinations. Each trait can yield different combinations of dominant and recessive phenotypes. If the homozygous dominant parents are homozygous for both traits (let's say AA and BB for Trait 1 and Trait 2), and the heterozygous parents are heterozygous (AaBb), the crosses might yield: 1. Homozygous dominant for both traits (AABB) 2. Homozygous dominant for one trait and heterozygous for the other (AABb, AaBB) 3. Heterozygous for both traits (AaBb

4. In genetics, what are autosomes?

A. Chromosomes that determine the sex of an individual

B. Non-sex chromosomes

C. Chromosomes that only carry lethal alleles

D. Chromosomes that always express dominant traits

Autosomes refer to non-sex chromosomes, which means they are the chromosomes that do not play a role in determining an individual's sex. In humans, there are 22 pairs of autosomes and one pair of sex chromosomes (XX or XY). The significance of identifying autosomes as non-sex chromosomes lies in their function; they carry the bulk of genetic information that influences various traits such as physical characteristics, susceptibility to diseases, and other hereditary factors. Unlike sex chromosomes, which are directly involved in sex determination and can impact traits linked to gender, autosomes contain genes that determine a wide range of heritable characteristics regardless of the organism's sex. Therefore, understanding what constitutes autosomes is crucial in the study of inheritance patterns, genetic mapping, and various applications in medical and biological research. This clear distinction helps researchers and students alike to grasp the complexities of genetic inheritance beyond just sex-linked traits.

5. What type of genetic cross involves parents that differ in only one trait?

A. Test Cross

B. Dihybrid Cross

C. Reciprocal Cross

D. Mono-hybrid Cross

A genetic cross that involves parents differing in only one trait is referred to as a monohybrid cross. This type of cross is fundamental in Mendelian genetics, as it allows researchers to observe how a single characteristic is inherited through generations. In a monohybrid cross, one parent may exhibit a dominant trait while the other displays a recessive trait for that particular characteristic. For example, if one parent is homozygous for purple flower color (a dominant trait) and the other is homozygous for white flower color (a recessive trait), the resulting offspring will uniformly express the dominant trait if only one trait is considered. This method is crucial in studying Mendel's laws of inheritance, particularly the law of segregation, which states that the alleles for a trait separate during gamete formation. The simplicity of a monohybrid cross provides clear insights into dominant and recessive allele interactions, making it a foundational concept in genetics. In contrast, the other types of crosses involve either multiple traits or different approaches to genetic analysis, which diverge from the simplicity of a monohybrid cross, focused solely on one trait.

6. Which phenotype reappears in the F2 generation after a cross of two heterozygous plants (Tt)?

A. Tall

B. Short

C. Intermediate

D. All of the above

The phenotype that reappears in the F2 generation after a cross of two heterozygous plants, both represented as Tt, demonstrates classic Mendelian inheritance patterns. In this case, T represents the dominant allele for tallness, and t represents the recessive allele for shortness. When two heterozygous plants (Tt) are crossed, the expected genotypic ratio in the F2 generation is as follows: - 1 TT (homozygous dominant) - 2 Tt (heterozygous) - 1 tt (homozygous recessive) This combination results in three genotypes producing the tall phenotype (TT and Tt) and one genotype producing the short phenotype (tt). Therefore, both tall and short plants will be present in the F2 generation. Additionally, when considering incomplete dominance, where phenotypes blend or show intermediate traits, there could be instances where an intermediate phenotype appears, especially if other traits were considered. However, in the classical dominance scenario described here, tall and short phenotypes are the focus. Since tall (TT and Tt) and short (tt) plants are present distinctly, and under certain crossing conditions, an intermediate phenotype could be observed,

7. How does partial dominance affect allele expression?

A. Both alleles are expressed equally

B. One allele is fully expressed while the other is not

C. One allele partially masks the other

D. Neither allele influences the phenotype

Partial dominance describes a situation where one allele does not completely mask the expression of another allele. Instead, one allele exerts a partial influence over the phenotype while the other contributes to the overall trait expression as well. This results in a phenotype that is intermediate between the two homozygous forms. For example, consider a plant that has one allele for red flowers and another for white flowers. In a case of partial dominance, the resulting flower color in the heterozygous plant might be pink, illustrating how one allele partially masks the effect of the other rather than wholly dominating it or being entirely unexpressed. This concept helps to illustrate the complexity of genetic traits, showing that the interaction of alleles can lead to a spectrum of phenotypic outcomes rather than simple Mendelian traits where one allele completely governs the phenotype.

8. What is the expected outcome for the daughters in a cross between a normal male and a carrier female for a sex-linked trait?

A. All will be normal

B. All will be carriers

C. Half will be carriers and half will be normal

D. None will be affected

In a cross between a normal male and a carrier female for a sex-linked trait, particularly one located on the X chromosome, we can analyze the expected outcomes for their daughters. A carrier female has one normal X chromosome and one affected X chromosome (X^NX^n), while the normal male has one normal X chromosome and one Y chromosome (X^NY). The daughters receive one X chromosome from each parent. Thus, from the father, every daughter will inherit the normal X chromosome (X^N), and from the mother, they can inherit either the normal X chromosome (X^N) or the affected X chromosome (X^n). The possible combinations for the daughters are as follows: 1. Inheriting the normal X from the father and the normal X from the mother (X^N/X^N), resulting in daughters who are normal. 2. Inheriting the normal X from the father and the affected X from the mother (X^N/X^n), resulting in daughters who are carriers. In this scenario, there are two equally likely outcomes: half of the daughters will be normal (X^N/X^N) and half will be carriers (X^N/X^n). This leads us to

9. How does the Bombay phenotype illustrate the concept of epistasis?

A. A second gene entirely determines the phenotype

B. It shows complete dominance of one trait over another

C. Only the dominant traits are expressed

D. There is no interaction between different genes

The Bombay phenotype serves as a classic example of epistasis, where the expression of one gene is affected by the presence of one or more other genes. In the case of the Bombay phenotype, individuals with this phenotype have a mutation in the H gene, which encodes for a protein necessary for the formation of the H antigen, an essential precursor for the A and B antigens on red blood cells. Because the H antigen is required for the expression of the ABO blood group, those who have the Bombay phenotype will appear as type O blood regardless of the ABO gene they possess. This illustrates epistasis because the effects of the H gene overshadow the contributions of the ABO genes, demonstrating that the second gene (the H gene) greatly determines the phenotype (the blood type) and masks the expected expression caused by the ABO alleles. This example highlights the complex interactions between genes, where one gene can influence the phenotypic expression of another, solidifying our understanding of how epistasis occurs in genetic traits.

10. When a white-eyed female fruit fly is crossed with a red-eyed male, what are the expected phenotypes of the offspring?

A. All red-eyed females and white-eyed males

B. All white-eyed females and red-eyed males

C. All red-eyed offspring

D. All white-eyed offspring

To understand the expected phenotypes of the offspring from crossing a white-eyed female fruit fly with a red-eyed male, it is important to consider the genetics behind eye color in Drosophila melanogaster. The gene for eye color is located on the X chromosome, making it an example of a sex-linked trait. In this scenario, we have: - The white-eyed female, which is likely homozygous for the white eye allele (let's designate it as "X^w X^w"). - The red-eyed male, who carries the dominant red eye allele (designated "X^R Y"). When these two flies are crossed, the possible combinations of alleles in their offspring can be determined through a Punnett square. The female can contribute X^w (white eye) alleles, and the male can contribute either X^R (red eye) alleles or the Y chromosome. The results from this cross yield the following combinations for the offspring: 1. X^R X^w (female with red eyes) 2. X^w Y (male with white eyes) Thus, the offspring will consist of all females with red eyes and all males with white eyes. This supports the correct choice, wherein all females