Ch.14 Mendel and the Gene Idea

1)Which of the following is not a reason that peas were well suited for Mendel's breeding experiments?

a) Peas show easily observed variations in a number of characters, such as pea shape and flower color.

b) It is possible to control matings between different pea plants.

c) It is possible to obtain large numbers of progeny from any given cross.

d) Peas have an unusually long generation time.

e) Many of the observable characters that vary in pea plants are controlled by single genes.

1)Which of the following is not a reason that peas were well suited for Mendel's breeding experiments?

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d) Peas have an unusually long generation time.

e) Many of the observable characters that vary in pea plants are controlled by single genes.

2)A pea plant is heterozygous at the independent loci for flower color (*Pp*) and seed color (*Yy*). What types of gametes can it produce?

a) two gamete types: *pp* and *PP*

b) two gamete types: *pY* and *Py*

c) four gamete types: *pY*, *py*, *PY*, and *Py*

d) four gamete types: *pP*, *Yy*, *pY*, and *Py*

e) one gamete type: *PpYy*

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3)A cross between homozygous purple-flowered and homozygous white-flowered pea plants results in offspring with purple flowers. This demonstrates

a) the blending model of genetics.

b) true breeding.

c) dominance.

d) a dihybrid cross.

e) the mistakes made by Mendel.

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4)A genetic counselor is working with a couple who have just had a child who has Tay-Sachs disease. Neither parent has Tay-Sachs, nor does anyone in their families. What should the counselor say to this couple?

a) “Because no one in either of your families has Tay-Sachs, you are not likely to have another baby with Tay-Sachs. You can safely have another child.”

b) “Because you have had one child with Tay-Sachs, you must each carry the allele. Any child you have has a 50% chance of having the disease.”

c) “Because you have had one child with Tay-Sachs, you must each carry the allele. Any child you have has a 25% chance of having the disease.”

d) “Because you have had one child with Tay-Sachs, you must both carry the allele. However, since the chance of having an affected child is 25%, you may safely have three more children without worrying about having another child with Tay-Sachs.”

e) “You must both be tested to see who is a carrier of the Tay-Sachs allele.”

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d) “Because you have had one child with Tay-Sachs, you must both carry the allele. However, since the chance of having an affected child is 25%, you may safely have three more children without worrying about having another child with Tay-Sachs.”

e) “You must both be tested to see who is a carrier of the Tay-Sachs allele.”

5)Imagine a locus with four different alleles for fur color in an animal, D^a, D^b, D^c, and D^d. If you crossed two heterozygotes, D^aD^b and D^cD^d, what genotype proportions would you expect in the offspring?

a) 25% D^aD^c, 25% D^aD^d, 25% D^bD^c, 25% D^bD^d

b) 50% D^aD^b, 50% D^cD^d

c) 25% D^aD^a, 25% D^bD^b, 25% D^cD^c, 25% D^dD^d

d) 50% D^aD^c, 50% D^bD^d

e) 25% D^aD^b, 25% D^cD^d, 25% D^cD^c, 25% D^dD^d

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d) 50% D^aD^c, 50% D^bD^d

e) 25% D^aD^b, 25% D^cD^d, 25% D^cD^c, 25% D^dD^d

6)John, age 47, has just been diagnosed with Huntington's disease, which is caused by a rare dominant allele. His daughter, age 25, has a 2-year-old son. No one else in the family has the disease. What is the probability that the daughter will develop the disease?

a) 0%

b) 25%

c) 50%

d) 75%

e) 100%

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7)John, age 47, has just been diagnosed with Huntington's disease, which is caused by a rare dominant allele. His daughter, age 25, has a 2-year-old son. No one else in the family has the disease. Without knowing anything about the 25-year-old daughter's genotype, what is the probability that the 2-year-old son will eventually develop the disease?

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8)An individual with the genotype *AaBbEeHH* is crossed with an individual who is *aaBbEehh*. What is the likelihood of having offspring with the genotype *AabbEEHh*?

a) 1/8

b) 1/16

c) 1/32

d) 1/64

e) That genotype would be impossible.

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9)ABO blood type in humans exhibits codominance and multiple alleles. What is the likelihood of a type A father and a type A mother having a type O child?

a) It is impossible.

b) 25% if both parents are heterozygous

c) 50% if both parent are heterozygous

d) 25% if only the father is heterozygous

e) 25% if only the mother is heterozygous

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10)Roan cattle result from incomplete dominance of red and white alleles at a single locus. If two roan cattle are allowed to breed, what ratio of phenotypes is expected in the offspring?

a) 1:1 red:white

b) all roan

c) 1:2:1 red:roan:white

d) 3:1 red:white

e) 1:1:1 red:roan:white

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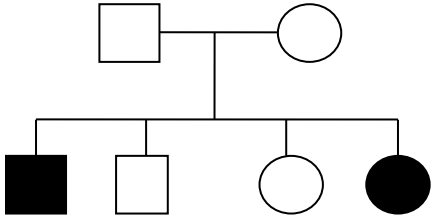
11)Examine this genetic pedigree. What mode of inheritance does this trait most likely follow?

a) autosomal dominant

b) autosomal recessive

c) sex-linked recessive

d) mitochondrial



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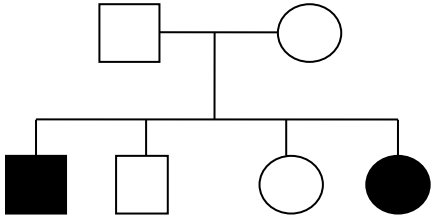

12)The following offspring were observed from many crossings of the same pea plants. What genotypes were the parents?

465 purple axial flowers	152 purple terminal flowers
140 white axial flowers	53 white terminal flowers

a) *PpAa* × *PpAA*

b) *PpAa* × *ppAA*

c) *PPAA* × *ppaa*

d) *PpAa* × *PpAa*

e) *PPaa* × *ppAA*

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13)A phenotypic trait that is dependent on several genes and environmental conditions is said to be

a) epistatic.

b) pleiotropic.

c) dominant.

d) multifactorial.

e) Mendelian.

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14)Suppose that Mendel's hypothesis that inheritance is "particulate" rather than due to blending were wrong. Which observation would he have *not* made?

a) There are two distinct flower colors in pea plants.

b) White-flowered plants are true-breeding.

c) Crossing true-breeding purple-flowered and white-flowered plants produced all purple-flowered plants.

d) Crossing two purple-flowered heterozygotes produced purple-flowered and white-flowered plants.

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15)The *agouti* gene in mice plays a role in determining coat color. At this locus, the genotype *AA* produces an “agouti coat,” and the heterozygote *Aa* produces a yellow coat. The *aa* homozygotes, however, die very early in development. What is the expected phenotypic ratio of *live* mice resulting from a cross of two *Aa* mice?

a) 3:1 agouti:yellow

b) 3:1 yellow:agouti

c) 2:1 agouti:yellow

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16)In peas, the allele for tall stems (*T*) is dominant to that for dwarf stems (*t*), and the allele for axial flowers (*A*) is dominant to that for terminal flowers (*a*). A plant of unknown genotype with tall stems and axial flowers is crossed with a plant with dwarf stems and terminal flowers. Among the offspring are 38 plants with tall stems and axial flowers, and 36 plants with tall stems and terminal flowers. What is the previously unknown genotype?

a) *TtAa*

b) *TTAa*

c) *TtAA*

d) *TTAA*

e) cannot be determined from these data

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17)Imagine a cross of two *triple* heterozygous pea plants with tall stems and axial purple flowers (genotype *TtAaPp*). If you were to create a Punnett square for this cross (this is not a recommended strategy!), what would be its dimensions? Recall that all three loci assort independently.

a) 3 × 3

b) 4 × 4

c) 6 × 6

d) 8 × 8

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18)Imagine the same cross of two *triple* heterozygous pea plants with tall stems and axial purple flowers (genotype *TtAaPp*). Using the rules of probability (and not a Punnett square), determine what proportion of offspring will have dwarf stems and axial purple flowers.

a) ¼ × ¼ × ¼ = 1/64

b) ¼ + ¾ + ¾ = 7/4

c) ¼ × ¾ × ¾ = 9/64

d) ½ × ½ × ½ = 1/8

e) ¾ × ¾ × ¾ = 27/64

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19)The Rh blood factor in humans is perhaps the most important after the ABO system. The + phenotype is dominant to the – phenotype and is encoded on a separate autosome from the ABO locus (i.e., the two loci assort independently). A child is born to a woman of blood type A+ and a man of blood type AB+. Which of the following blood types would *not* be possible for the child?

a) A+

b) B+

c) A–

d) O+

e) AB–

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20)Look around the classroom. Which of the following human phenotypes can likely be considered to be polygenic?

a) height

b) hair color

c) eye color

d) skin color

e) all of the above

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21)Consider the case of recessive epistasis in Labrador coat color. Suppose you were to cross a black lab (genotype *BbEe*) with a brown lab (genotype *bbEe*). What is the expected distribution of coat color among the offspring?

a) 9:3:4 black:brown:yellow

b) 3:3:2 black:brown:yellow

c) 1:1:1 black:brown:yellow

d) 3:1 black:brown

e) 1:2:1 black:brown:yellow

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Ch. 15 The Chromosomal Basis of Inheritance

1)How did the improvement of microscopy techniques in the late 1800s set the stage for the emergence of modern genetics?

a) It revealed new and unanticipated features of Mendel's pea plant varieties.

b) It allowed the study of meiosis and mitosis, revealing parallels between behaviors of the Mendelian concept of the gene and the movement/pairing of chromosomes.

c) It allowed scientists to see the nucleotide sequence of DNA.

d) It led to the discovery of mitochondria.

e) It showed genes functioning to direct the formation of enzymes.

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2)Morgan and his colleagues worked out a set of symbols to represent fly genotypes. Which of the following is representative?

a) *AaBb* × *AaBb*

b) 46 or 46*w*

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3)In some species of *Drosophila*, there are genes on the Y chromosome that are not on the X chromosome. Imagine that a new allele arises on the Y chromosome and reduces the size by half of individuals with the new allele. Which of the following statements is accurate with regard to this situation?

a) This allele is passed to all offspring of a male with the allele.

b) This allele is passed to all male but no female offspring of a male with the allele.

c) This allele is passed to all offspring of a female with the allele.

d) This allele is passed to all male but no female offspring of a female with the allele.

e) This allele is passed to all offspring of both males and females with the allele.

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4)In cats, an X-linked gene affects coat color. The *O* allele produces an enzyme that converts eumelanin, a black or brown pigment, into phaeomelanin, an orange pigment. The *o* allele is recessive to *O* and produces a defective enzyme, one that does not convert eumelanin into phaeomelanin. Which of the following statements is accurate?4)

a) The phenotype of *o-Y* males is black/brown because the nonfunctional allele *o* does not convert eumelanin into phaeomelanin.

b) The phenotype of *OO* and *Oo* males is orange because the functional allele *O* converts eumelanin into phaeomelanin.

c) The phenotype of *Oo* males is mixed orange and black/brown because the functional allele *O* converts eumelanin into phaeomelanin in some cell groups (orange) and because in other cell groups the nonfunctional allele *o* does not convert eumelanin into phaeomelanin.

d) The phenotype of *O-Y* males is orange because the nonfunctional allele *O* does not convert eumelanin into phaeomelanin, while the phenotype of *o-Y* males is black/brown because the functional allele *o* converts eumelanin into phaeomelanin.

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5)Imagine a species with three loci thought to be on the same chromosome. The recombination rate between locus A and locus B is 35%, and the recombination rate between locus B and locus C is 33%. Predict the recombination rate between A and C.

a) The recombination rate between locus A and locus C is either 2% or 68%.

b) The recombination rate between locus A and locus C is probably 2%.

c) The recombination rate between locus A and locus C is either 2% or 50%.

d) The recombination rate between locus A and locus C is either 2% or 39%.

e) The recombination rate between locus A and locus C cannot be predicted.

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6)Which of the following is a type of chromosomal alteration that differs from all of the others?

a) aneuploidy

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c) triploidy

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e) octaploidy

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7)In *Drosophila*, white eyes are due to an X-linked recessive allele (X^w). Which of the following crosses could *not* result in a white-eyed *Drosophila* male?

a) homozygous red-eyed females with white-eyed males

b) homozygous white-eyed females with red-eyed males

c) heterozygous red-eyed females with white-eyed males

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8)What is the relationship between recombination frequency and the physical distance between genes on chromosomes?

a) The closer two genes are, the lower the recombination frequency.

b) The farther apart two genes are, the lower the recombination frequency.

c) There is no relationship. All genes have the same, fixed recombination frequencies.

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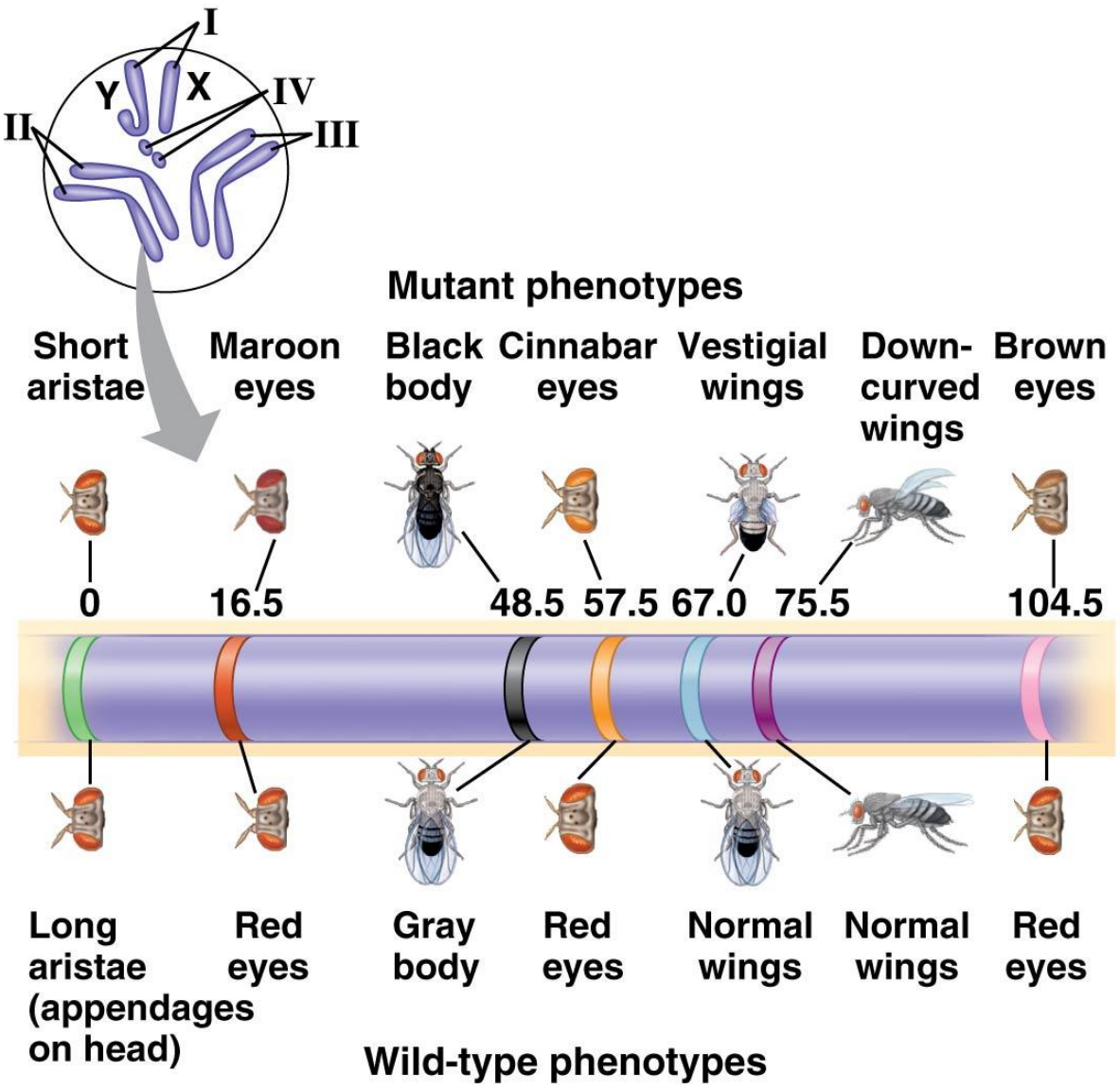
9)What is the expected recombination frequency for a testcross between the cinnabar and vestigial loci?

a) 67%
b) 57.5%
c) 50%
d) 9.5%
e) 0%



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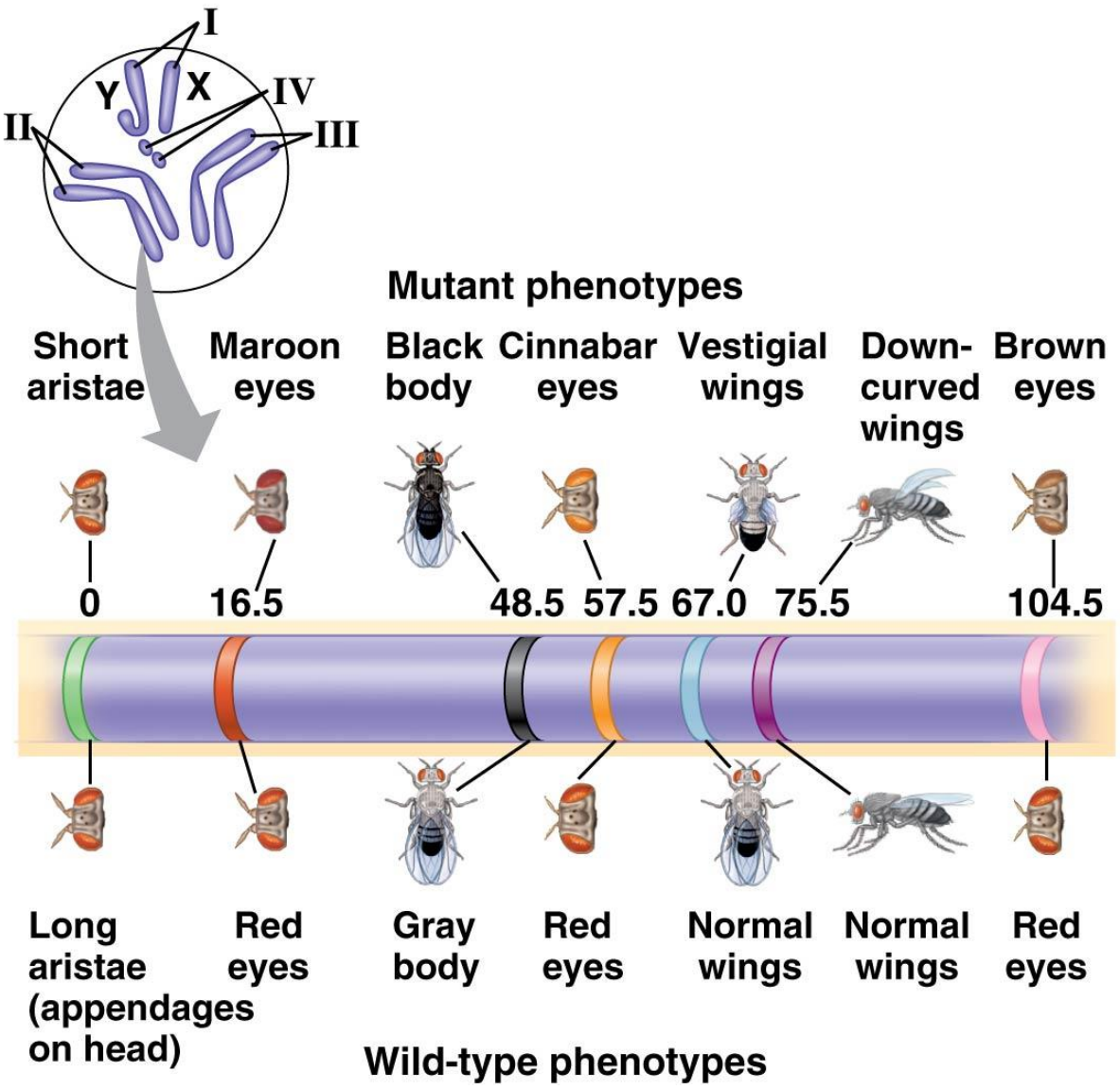

10)What is the expected recombination frequency for a testcross between the short aristae and vestigial loci?

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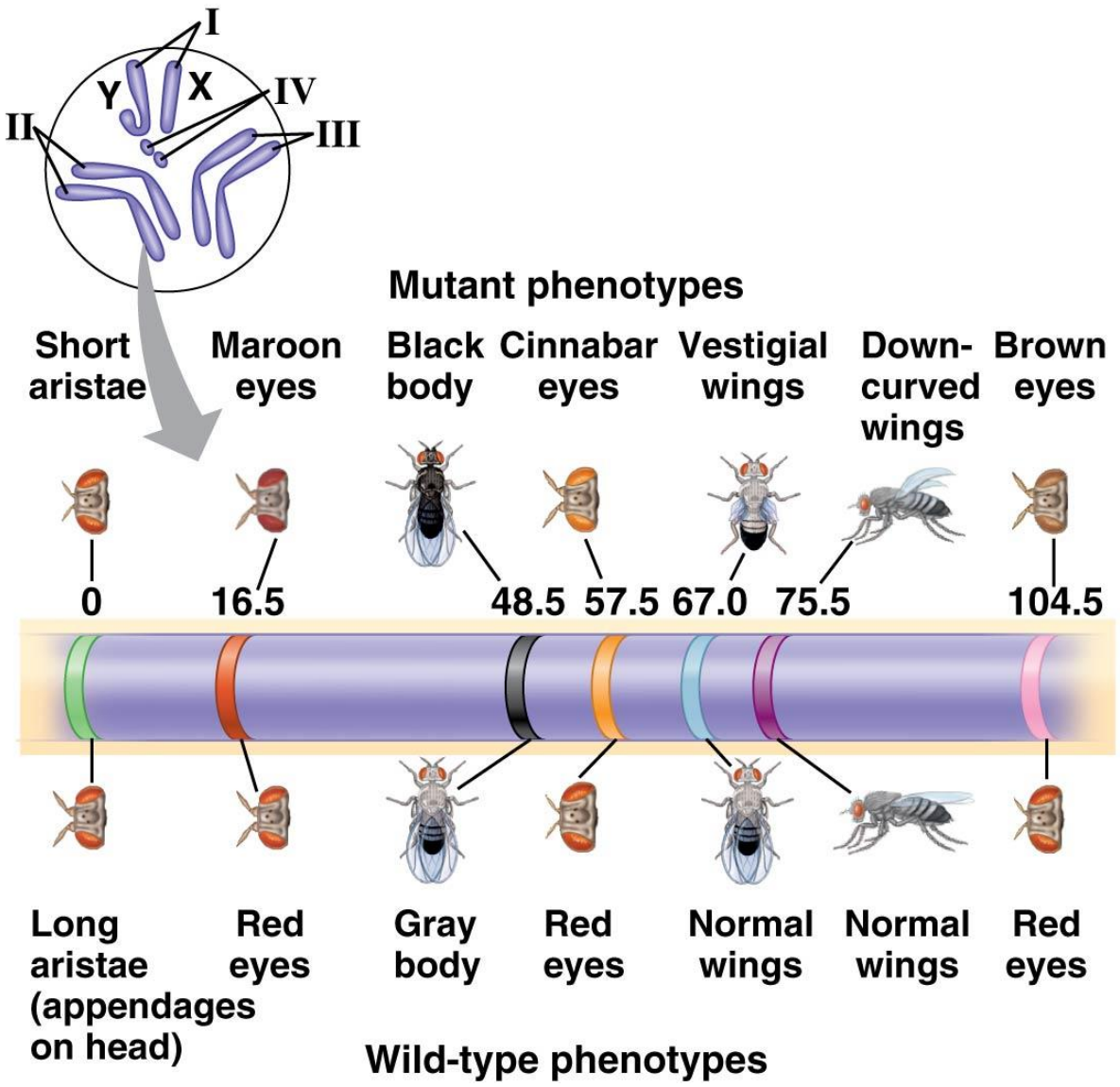

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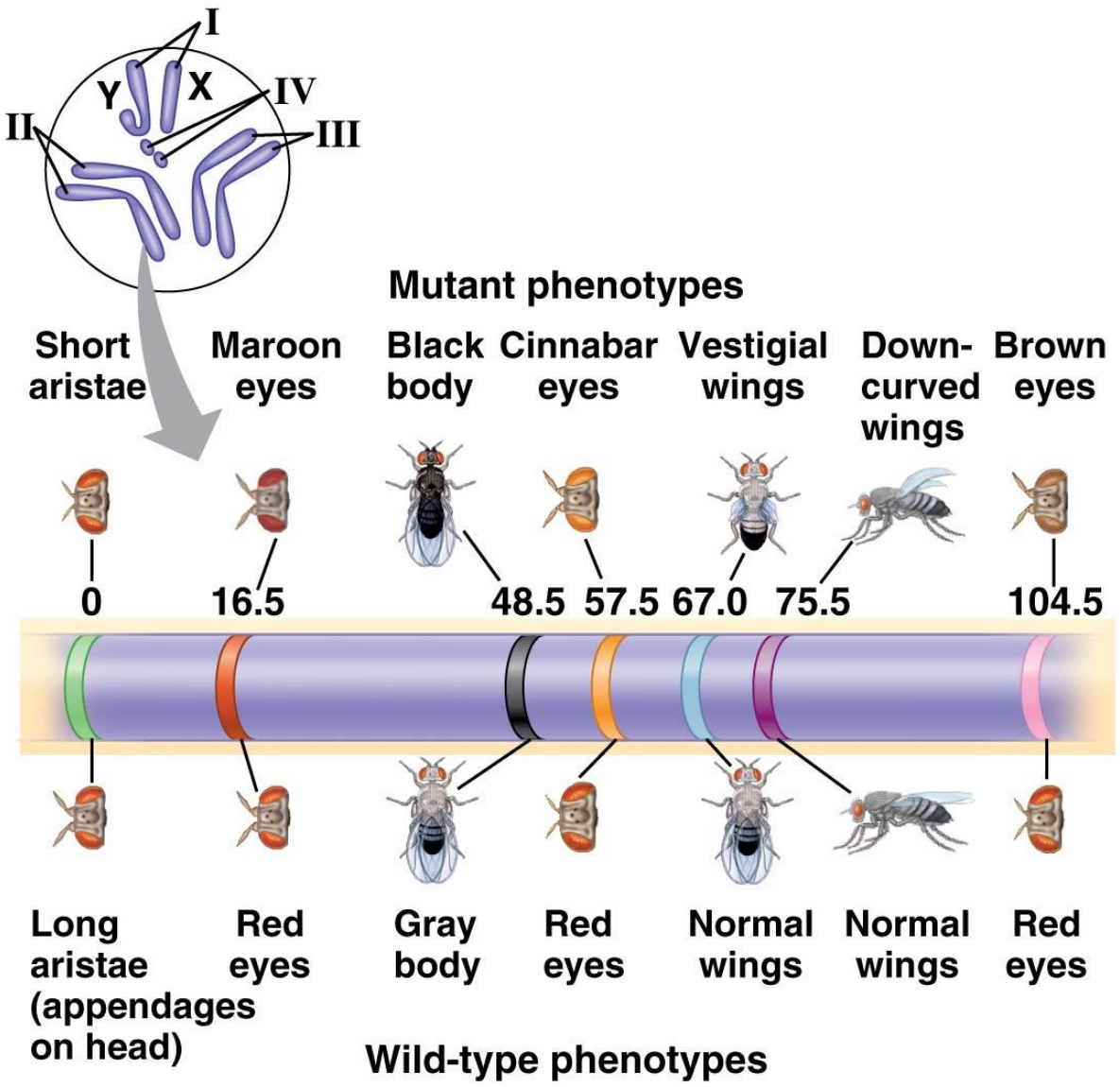


11)In tomatoes, a heterozygous plant with normal fruit and purple stems is crossed with a recessive plant having fasciated fruit and green stems. The following distribution of offspring is observed:

normal fruit, purple stems	38.5%
fasciated fruit, green stems	38.5%
normal fruit, green stems	11.5%
fasciated fruit, purple stems	11.5%

What conclusion can be made regarding the loci for fruit shape and stem color?

a) The loci may be on the same chromosome more than 50 map units apart, or they may be on separate chromosomes.

b) The loci are on the same chromosome 23 map units apart.

c) The loci are on separate chromosomes.

d) The loci are on the same chromosome at an unknown distance from each other.

11)In tomatoes, a heterozygous plant with normal fruit and purple stems is crossed with a recessive plant having fasciated fruit and green stems. The following distribution of offspring is observed:

normal fruit, purple stems	38.5%
fasciated fruit, green stems	38.5%
normal fruit, green stems	11.5%
fasciated fruit, purple stems	11.5%

What conclusion can be made regarding the loci for fruit shape and stem color?

a) The loci may be on the same chromosome more than 50 map units apart, or they may be on separate chromosomes.

b) The loci are on the same chromosome 23 map units apart.

c) The loci are on separate chromosomes.

d) The loci are on the same chromosome at an unknown distance from each other.

12)In tomatoes, a heterozygous plant with green leaves and red fruit is crossed with a recessive plant having mottled leaves and yellow fruit. The following distribution of offspring is observed:

green leaves, red fruit	25%
green leaves, yellow fruit	25%
mottled leaves, red fruit	25%
mottled leaves, yellow fruit	25%

What conclusion can be made regarding the loci for leaf color and fruit color?

a) The loci are on the same chromosome at an unknown distance from each other.

b) The loci may be on the same chromosome more than 50 map units apart, or they may be on separate chromosomes.

c) The loci are on separate chromosomes.

d) The loci are on the same chromosome 25 map units apart.

12)In tomatoes, a heterozygous plant with green leaves and red fruit is crossed with a recessive plant having mottled leaves and yellow fruit. The following distribution of offspring is observed:

green leaves, red fruit	25%
green leaves, yellow fruit	25%
mottled leaves, red fruit	25%
mottled leaves, yellow fruit	25%

What conclusion can be made regarding the loci for leaf color and fruit color?

a) The loci are on the same chromosome at an unknown distance from each other.

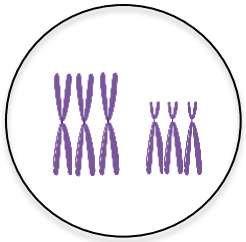
b) The loci may be on the same chromosome more than 50 map units apart, or they may be on separate chromosomes.

c) The loci are on separate chromosomes.

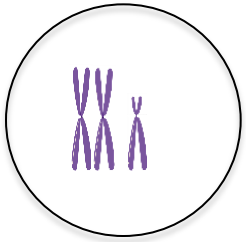
d) The loci are on the same chromosome 25 map units apart.

13)Which of the following diagrams best depicts the karyotype of a monosomy?

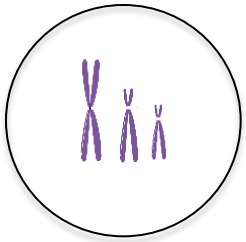
a)



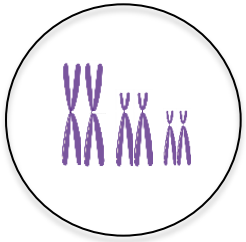
b)



c)

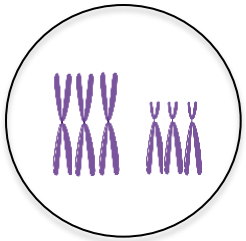


d)

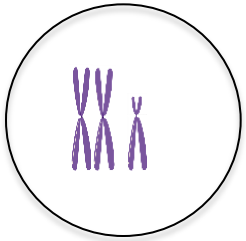


13)Which of the following diagrams best depicts the karyotype of a monosomy?

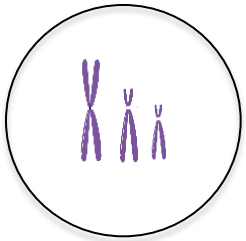
a)



b)



c)



d)

14)Nondisjunction can happen in either meiosis I or meiosis II. Consider *n* + 1 and *n* – 1 gametes involving chromosome 21 that are formed from nondisjunction in meiosis I and meiosis II. Select the best comparative statement.

a) *n* + 1 and *n* – 1 gametes are the same whether they result from nondisjunction in meiosis I or meiosis II.

b) *n* + 1 and *n* – 1 gametes are necessarily different whether they result from nondisjunction in meiosis I or meiosis II.

c) A *n* – 1 gamete can be different depending on whether nondisjunction happened in meiosis I or meiosis II.

d) A *n* + 1 gamete can be different depending on whether nondisjunction happened in meiosis I or meiosis II.

14)Nondisjunction can happen in either meiosis I or meiosis II. Consider *n* + 1 and *n* – 1 gametes involving chromosome 21 that are formed from nondisjunction in meiosis I and meiosis II. Select the best comparative statement.

a) *n* + 1 and *n* – 1 gametes are the same whether they result from nondisjunction in meiosis I or meiosis II.

b) *n* + 1 and *n* – 1 gametes are necessarily different whether they result from nondisjunction in meiosis I or meiosis II.

c) A *n* – 1 gamete can be different depending on whether nondisjunction happened in meiosis I or meiosis II.

d) A *n* + 1 gamete can be different depending on whether nondisjunction happened in meiosis I or meiosis II.