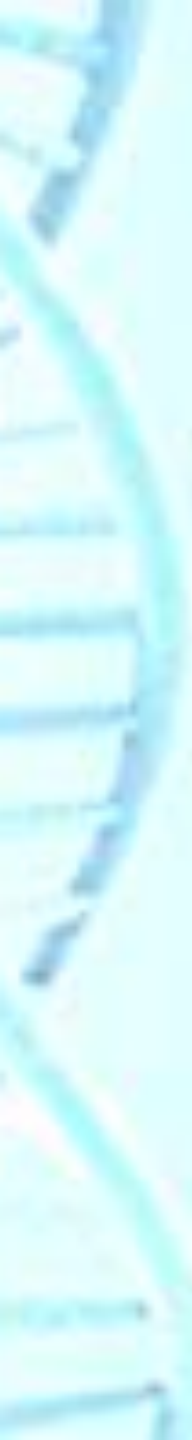





MCAS Review

Genetics

Mr. Lee
Room 320



In some pea plant experiments, Mendel studied the inheritance patterns of two characteristics at once, such as seed shape and seed color. He did this to determine which of the following?

- A. the process by which mutations occur
- B. where genes are located within chromosomes
-  C. whether characteristics are inherited together or separately
- D. the number of crosses necessary to cause physical changes in inheritance patterns

Earlobes may be free or attached, as shown in the illustrations below. The type of earlobe a person has is genetically determined. The allele for free earlobes (**E**) is dominant, while the allele for attached earlobes (**e**) is recessive.

Free earlobe
(dominant)



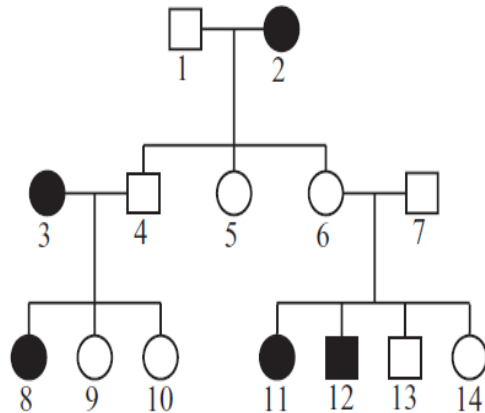
Attached earlobe
(recessive)



Which of the following encodes the genetic information for the earlobe trait?

- A. ATP
- B. DNA
- C. hormones
- D. carbohydrates

The inheritance of the earlobe trait can be traced over several generations using a family tree called a pedigree. A pedigree for the earlobe trait is shown below.



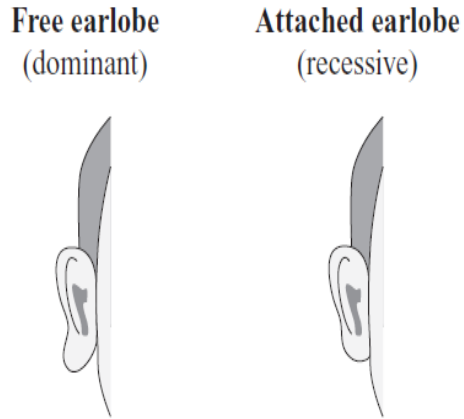
Key	
○	female with free earlobes
□	male with free earlobes
●	female with attached earlobes
■	male with attached earlobes



If female #3 and male #4 were to have another child, what would be the probability of that child having attached earlobes?

- A. $\frac{1}{4}$
- B. $\frac{1}{2}$
- C. $\frac{3}{4}$
- D. $\frac{1}{1}$

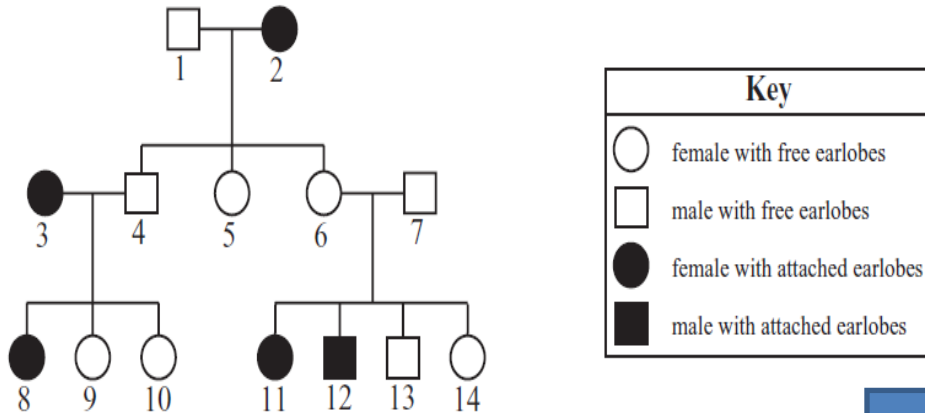
Earlobes may be free or attached, as shown in the illustrations below. The type of earlobe a person has is genetically determined. The allele for free earlobes (**E**) is dominant, while the allele for attached earlobes (**e**) is recessive.



If female #11 has a child with a male who has attached earlobes, which of the following genotypes is possible for the child?

- A. **ee** only
- B. **Ee** only
- C. **EE** or **Ee**
- D. **EE** or **ee**

The inheritance of the earlobe trait can be traced over several generations using a family tree called a pedigree. A pedigree for the earlobe trait is shown below.

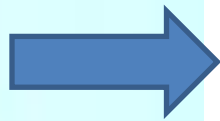


Female #10 is heterozygous for the earlobe trait. Suppose she has five children with a male who is also heterozygous for the earlobe trait.

Which of the following describes the **most likely** phenotypes of the five children?

- A. All of the children have free earlobes.
- B. All of the children have attached earlobes.
- C. Some of the children have free earlobes and some have attached earlobes.
- D. The female children all have free earlobes and the male children all have attached earlobes.

Which of the following describes DNA replication in eukaryotic cells?



- A. A copy of the DNA is made in the nucleus.
- B. A molecule of RNA is produced from the DNA.
- C. Each strand of DNA is combined with a strand of RNA.
- D. Each strand of DNA is separated into a new chromosome.

The box below contains a statement about mutations.

In many cases throughout geologic history, if mutations in the genetic material of existing species had not occurred, new species would not have appeared.

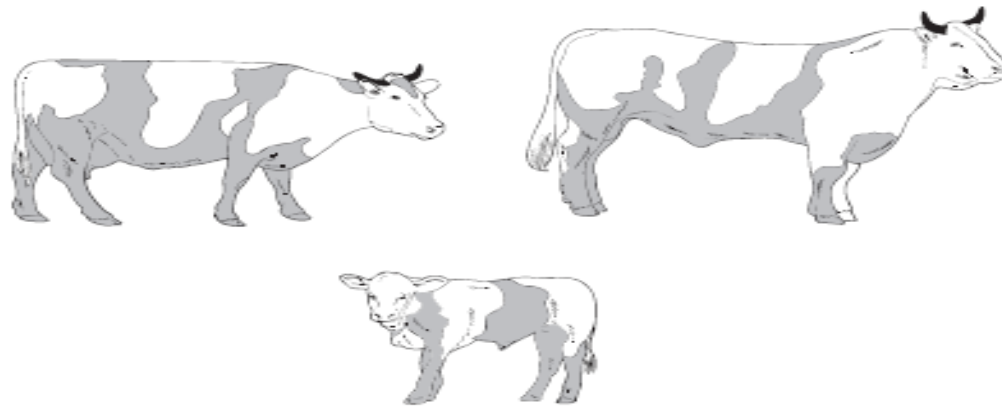
Which of the following conclusions about mutations in the DNA sequence of a gene is **most** consistent with the statement?

- A. Mutations are always rapidly occurring.
- B. Mutations are always beneficial.
- C. Mutations are the only way new species arise.
- D. Mutations are an important mechanism for the evolution of new species.



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The pictures below show a cow and a bull and their calf. All three animals have coats of the same colors.



This calf developed from a zygote. During the development of this zygote, a mutation occurred in a coat color gene.


Which of the following **best** explains why the calf's phenotype is the same as its parents'?

- A. The mutation is not present in the parent animals.
- B. The mutated gene is passed on during reproduction.
- C. The mutated allele is dominant over the parental allele.
- D. The mutation does not affect the expression of the color trait.



A gene in horses controls whether the horse has a white coat or a colored coat. A white female horse and a white male horse are the parents of a total of five female offspring. Three of these offspring have white coats. The other two offspring have colored coats.

The phenotypes of the horses suggest which of the following as the **most likely** pattern of inheritance for coat color?

- 
- A. The allele for a white coat is dominant.
 - B. The allele for a white coat is recessive.
 - C. The allele for a white coat is sex-linked.
 - D. The allele for a white coat is codominant.

DNA and RNA are similar because they both contain

A. deoxyribose.

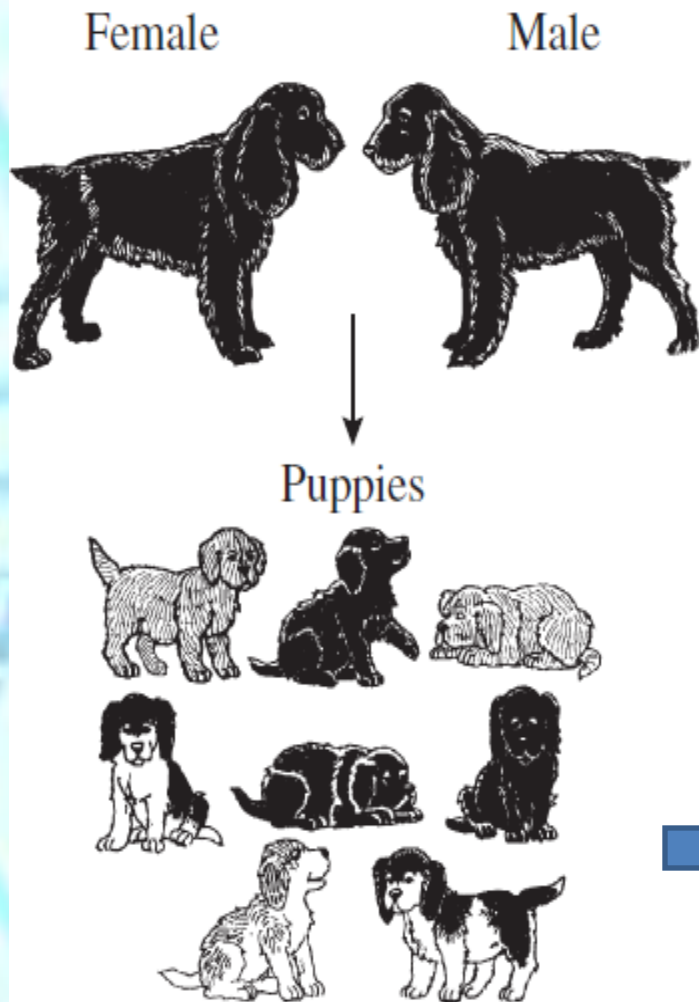


B. nucleotides.

C. thymine.

D. double helices.

The picture below shows two dogs and their puppies.



The parent dogs are each heterozygous for two traits: fur color and white spotting. Both parent dogs are solid black. Their puppies, however, have four different phenotypes as listed below.

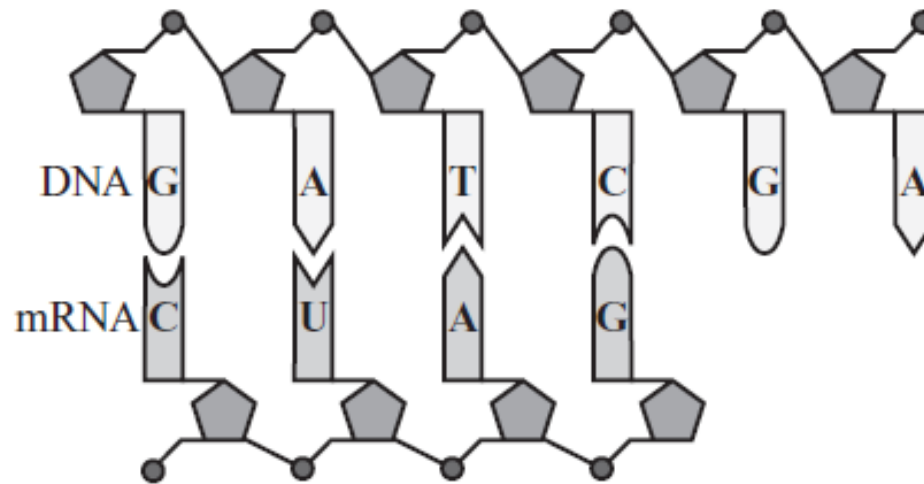
- solid black
- black with white spots
- solid red
- red with white spots

Which of the following explains how these parent dogs can produce puppies with these four phenotypes?

- A. The genes for these traits are sex-linked.
- B. The genes for these traits mutate frequently.
- C. The genes for these traits assort independently.
- D. The genes for these traits are on the same chromosome.

3

The diagram below shows a strand of DNA matched to a strand of messenger RNA.

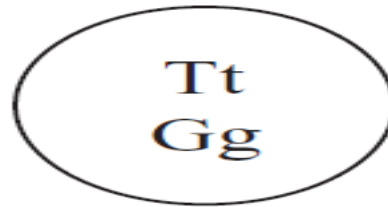


What process does this diagram represent?

- A. mutation
- B. respiration
- C. transcription
- D. translation

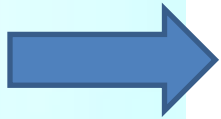


The diagram below represents a cell.
The letters in the diagram represent alleles for two different genetic traits.



According to Mendel's law of independent assortment, which of the following shows all of the allele combinations expected in gametes produced by this cell?

- A. TT tt GG gg
- B. TG TG tg tg
- C. TG tG Tg tg
- D. Tt Tt Gg Gg



Why is the particular sequence of bases in a segment of DNA important to cells?




- A. Some base sequences code for protein production.
- B. Some base sequences cause the release of lipids from the nucleus.
- C. Some base sequences contain the order of sugars in polysaccharides.
- D. Some base sequences produce electrical signals sent to the cytoplasm.


Within an individual mouse, four different mutations occurred in different genes, located on separate chromosomes and in different cells, as shown in the table below.

Cell Type	Chromosome	Trait	Normal Phenotype	Mutated Phenotype
skin	chromosome 4	fur color	black fur	white fur
gamete	chromosome 3	eye color	brown eyes	blue eyes
muscle	chromosome 2	fur thickness	thick fur	thin fur
nerve	chromosome 1	tail length	long tail	short tail

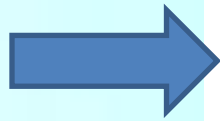
Which of these mutations could be passed on to the mouse's offspring?

- A. white fur
-  B. blue eyes
- C. thin fur
- D. short tail

A rare genetic condition causes dwarfism and immunodeficiencies. Which of the following is the **most likely** cause of this condition?

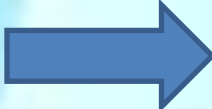
- A. a parasitic infection
-  B. a mutation in DNA
- C. a bacterial disease
- D. an excess of ATP

Which of the following genetic conditions results from a problem with segregation?




- A. **Trisomy 16:** a condition caused when a zygote receives three copies of chromosome 16
- B. **Huntington's disease:** a condition caused when a zygote receives a mutated dominant allele
- C. **Hemophilia:** a condition caused when a zygote receives an X chromosome with a particular recessive allele
- D. **Sickle cell anemia:** a condition caused when a zygote receives a recessive allele for hemoglobin from each parent

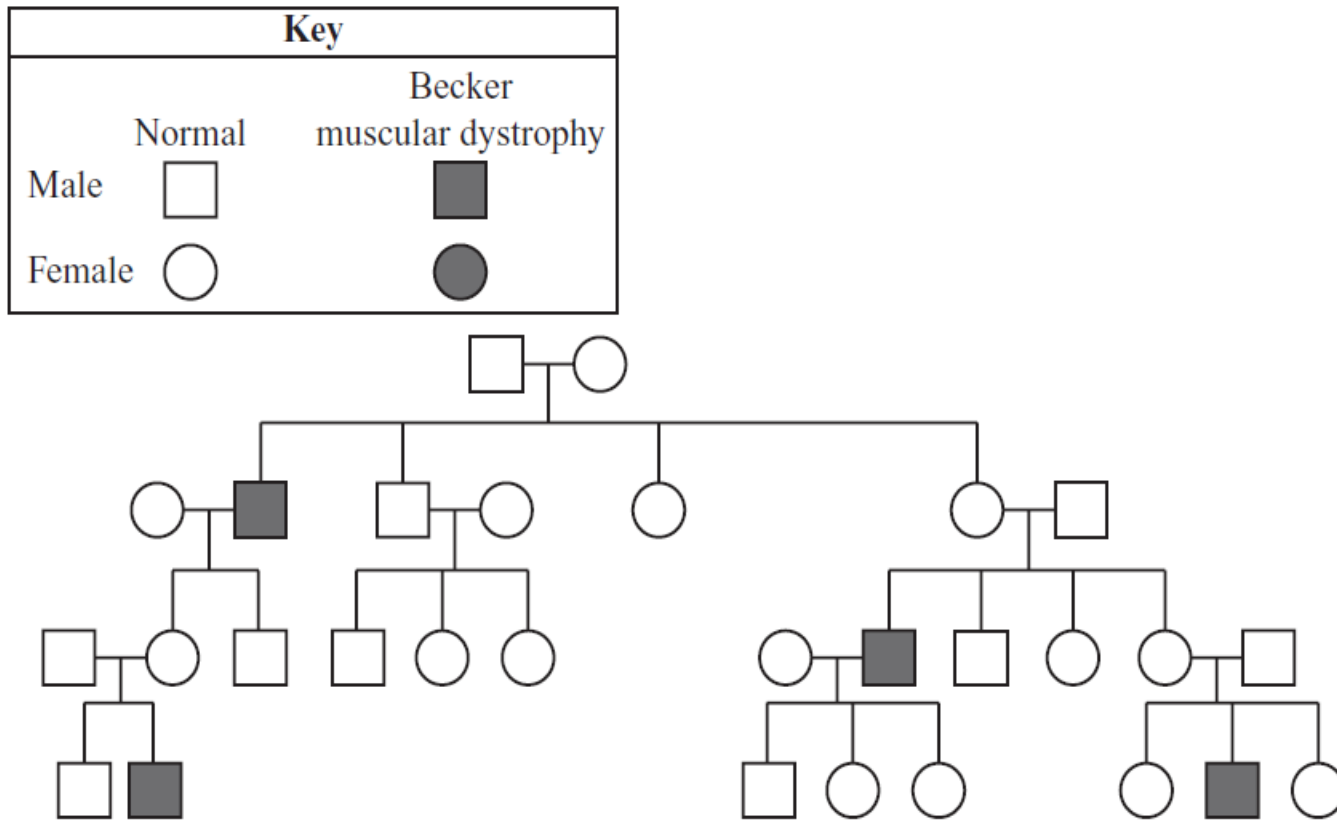
Two spotted leopards produce a litter of four cubs. Three of the cubs are spotted and one is solid black. The black coat is **probably** what type of trait?

- A. dominant
-  B. recessive
- C. polygenic
- D. sex-linked

Which of the following **best** describes the result of a mutation in an organism's DNA?

- A. The mutation may produce a zygote.
-  B. The mutation may cause phenotypic change.
- C. The mutation causes damage when it occurs.
- D. The mutation creates entirely new organisms.

The pedigree below shows the occurrence of Becker muscular dystrophy in a family. Becker muscular dystrophy causes muscle weakness.



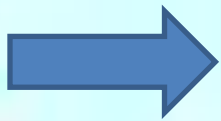
Based on this pedigree, it is **most** reasonable to conclude that Becker muscular dystrophy is which of the following?

- A. a polygenic trait
- B. a codominant trait
- C. a sex-linked recessive trait
- D. an autosomal dominant trait

The mold *Aspergillus flavus* grows on grain. *A. flavus* produces a toxin that binds to DNA in the bodies of animals that eat the grain.

The binding of the toxin to DNA blocks transcription, so it **directly** interferes with the ability of an animal cell to do which of the following?

- A. transport glucose across the cell membrane into the cytoplasm
- B. produce ATP using energy released from glucose and other nutrients
- C. transfer proteins from the endoplasmic reticulum to Golgi complexes
- D. send protein-building instructions from the nucleus to the cytoplasm and ribosomes



- 20 Human blood types are genetically determined. The table below shows the symbols used to represent two of the alleles for blood types and gives a description of each allele.

Two Alleles Controlling Human Blood Type

Symbol	Allele Description
I^A	produces antigen A on red blood cells
I^B	produces antigen B on red blood cells

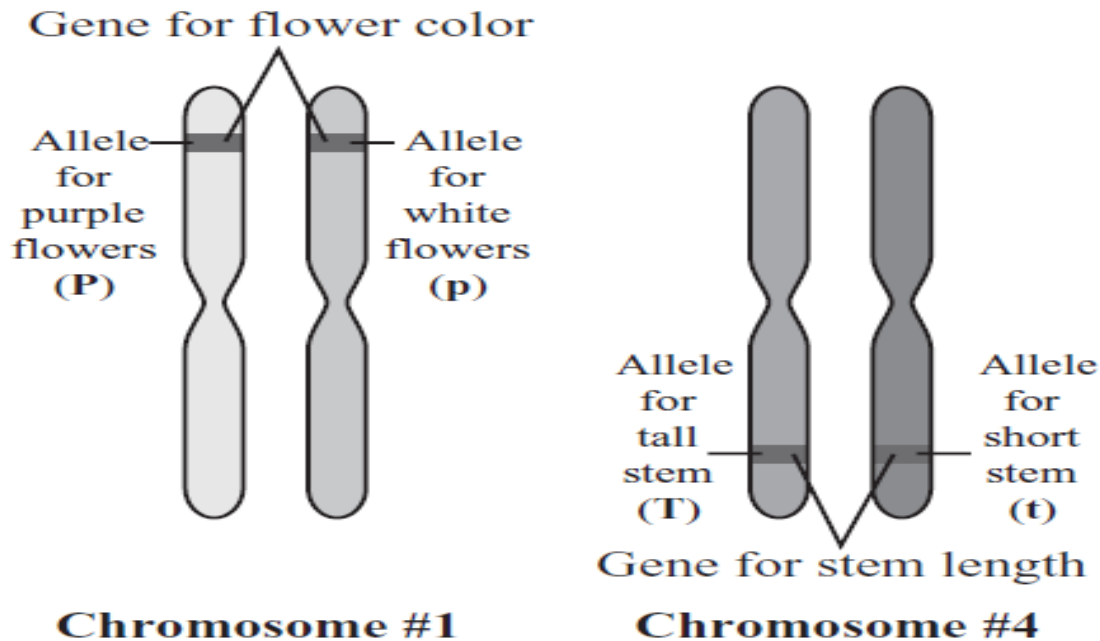
In homozygous individuals, two I^A alleles result in blood type A and two I^B alleles result in blood type B. The I^A and I^B alleles are codominant, resulting in blood type AB in individuals heterozygous for the two alleles.

A male and a female both have blood type AB. If they have a child, what is the probability that the child will also have blood type AB?

- A. $\frac{1}{4}$
- B. $\frac{1}{2}$
- C. $\frac{3}{4}$
- D. $\frac{1}{1}$

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The diagram below shows the positions of the genes for flower color and stem length in a pea plant. The chromosomes represented below will replicate before meiosis.



For these two genes, what is the maximum number of different allele combinations that can be formed normally in gametes produced from this cell?

- A. 2
- B. 4
- C. 6
- D. 8



Which of the following terms applies to traits, such as human eye color, that are controlled by more than one gene?

A. codominant

 B. polygenic

C. recessive

D. sex-linked

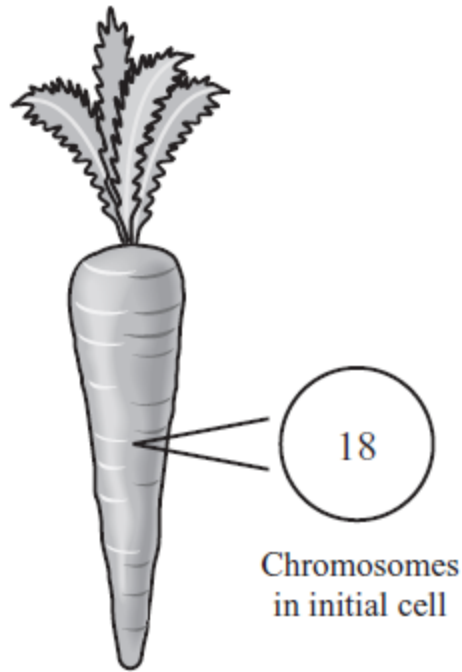
In pigeons, the allele **B** produces ash-red feathers. The allele **b** produces blue feathers. The **B** allele is dominant to the **b** allele.

A pigeon with genotype **Bb** is crossed with a pigeon with genotype **bb**. What percent of the offspring are expected to have ash-red feathers?

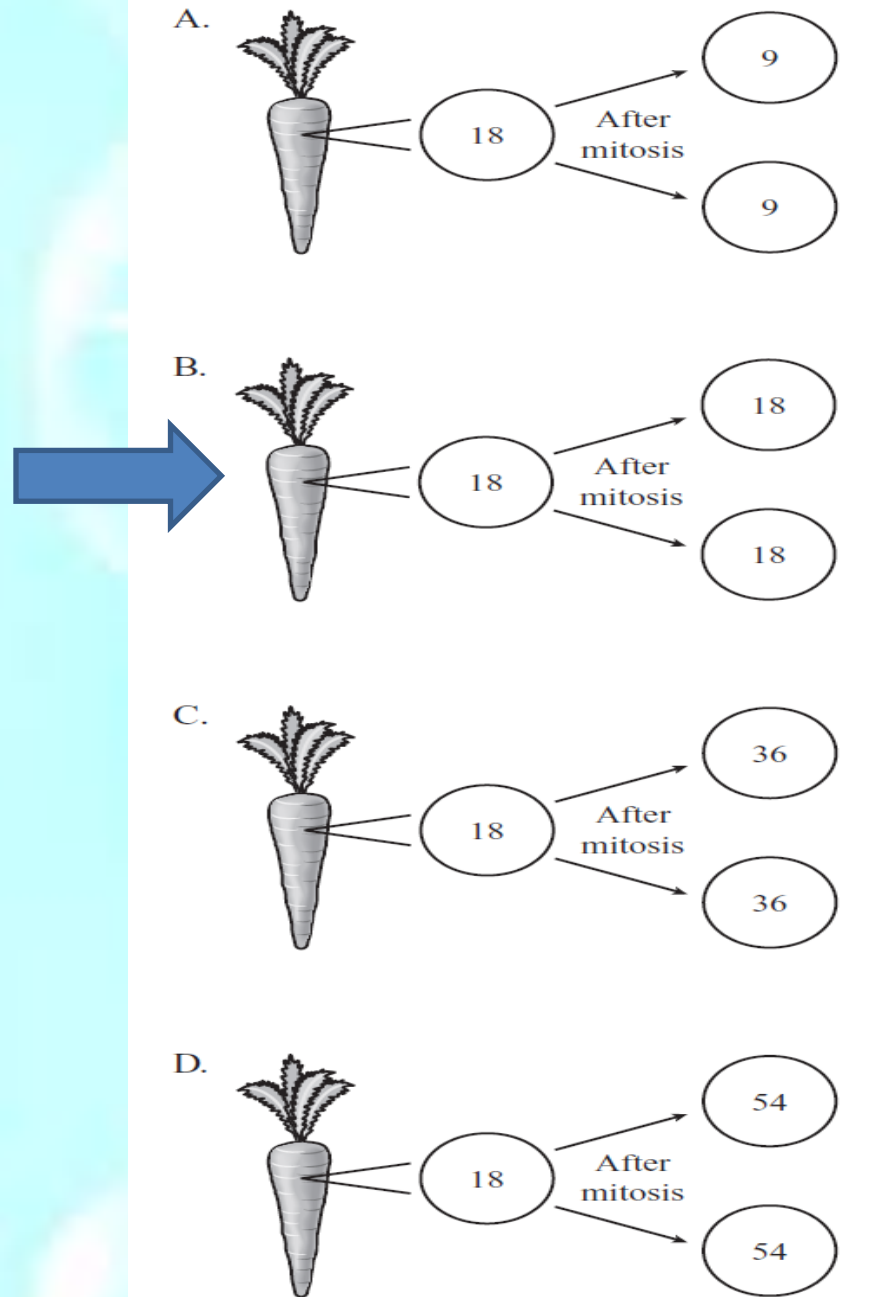
- A. 0%
- B. 25%
- C. 50%
- D. 100%



The diagram below provides information about a carrot cell.




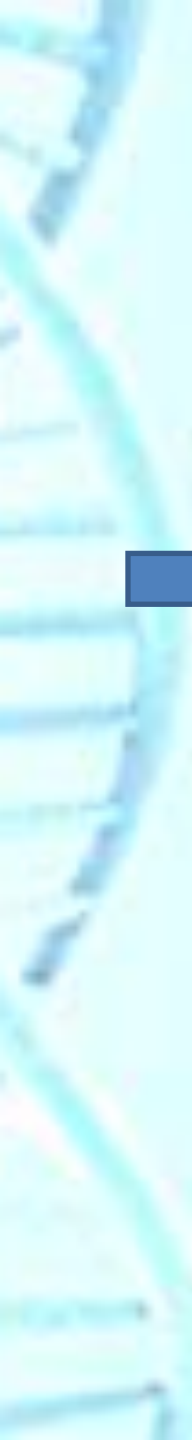
A carrot cell contains 18 chromosomes. Which of the following diagrams illustrates the correct number of chromosomes in new cells produced by mitosis?




In a certain variety of chicken, some offspring have a feather pattern that is black-and-white checkered. Chickens with this checkered feather pattern result from the cross of a black chicken with a white chicken.

Which of the following types of inheritance is **most likely** responsible for the checkered feather pattern?

- 
- A. codominant
 - B. dominant
 - C. polygenic
 - D. sex-linked



Which of the following statements **best** describes a DNA molecule?

- 
- A. It is a double helix.
 - B. It contains the sugar ribose.
 - C. It is composed of amino acids.
 - D. It contains the nitrogenous base uracil.

In fruit flies, a single gene controls wing phenotype. The diagram below shows the phenotypes for long wings and vestigial wings in fruit flies.

Long wings



Vestigial wings



Two fruit flies that have long wings are crossed. Of the 95 offspring produced, 73 have long wings. The other 22 have vestigial wings.

Which of the following conclusions about the inheritance of long wings and vestigial wings is **best** supported by the results of this experiment?

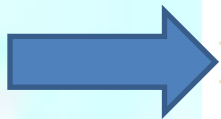
- A. The alleles for long wings and vestigial wings are sex-linked.
- B. The alleles for long wings and vestigial wings are codominant.
- C. The allele for long wings is dominant and the allele for vestigial wings is recessive.
- D. The allele for long wings is recessive and the allele for vestigial wings is dominant.



In sheep, the allele for white wool (**W**) is dominant, and the allele for black wool (**w**) is recessive. A farmer has mated two Suffolk sheep for a few years. These matings have resulted in six offspring, four with white wool and two with black wool. One parent has white wool and the other has black wool.

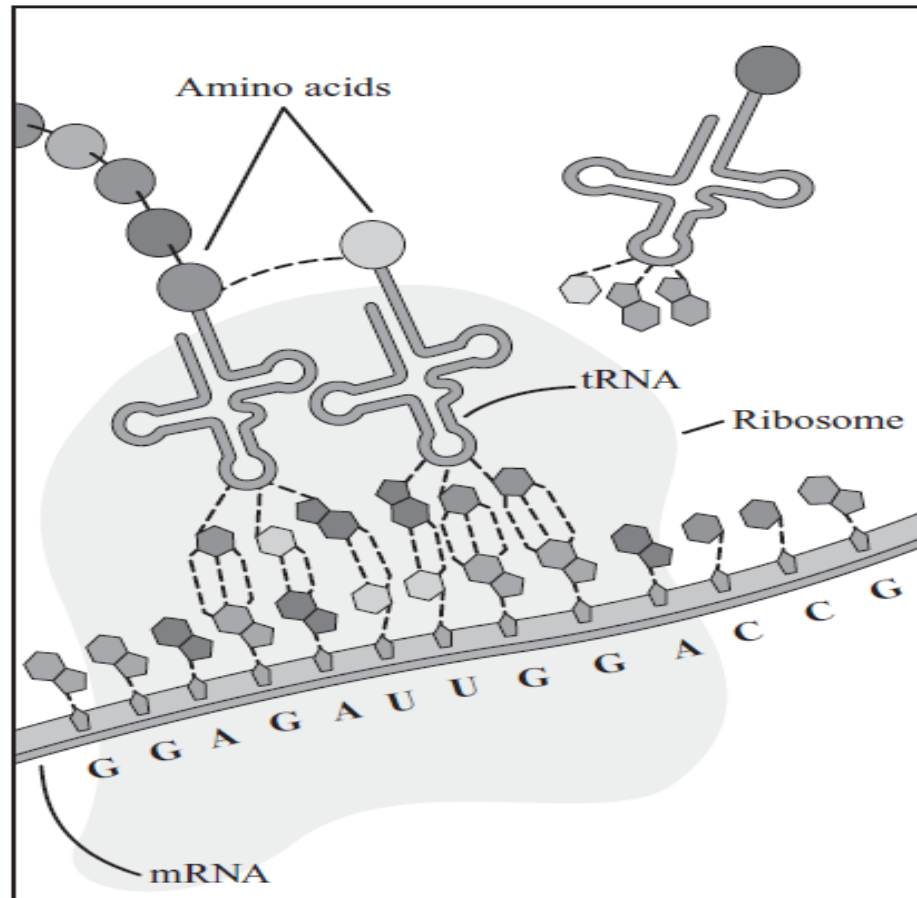
Which of the following could be the genotypes of the parent sheep?

- A. **WW** and **Ww**
- B. **WW** and **ww**
- C. **Ww** and **Ww**
- D. **Ww** and **ww**



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The diagram below represents part of a process that occurs in cells.



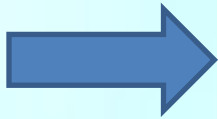
Which process is represented?

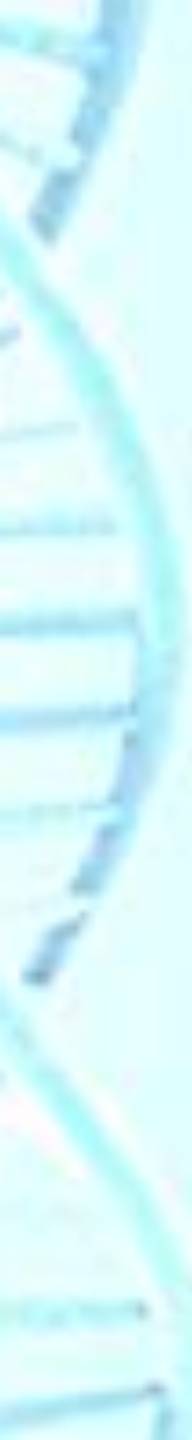
- A. meiosis
- B. osmosis
- C. replication
- D. translation



In mussels, brown (**B**) coloring is dominant, and blue (**b**) coloring is recessive. If a blue mussel has two brown parents, what percentage of the total offspring of these brown parents are expected to be blue?


- A. 100%
- B. 75%
- C. 50%
- D. 25%



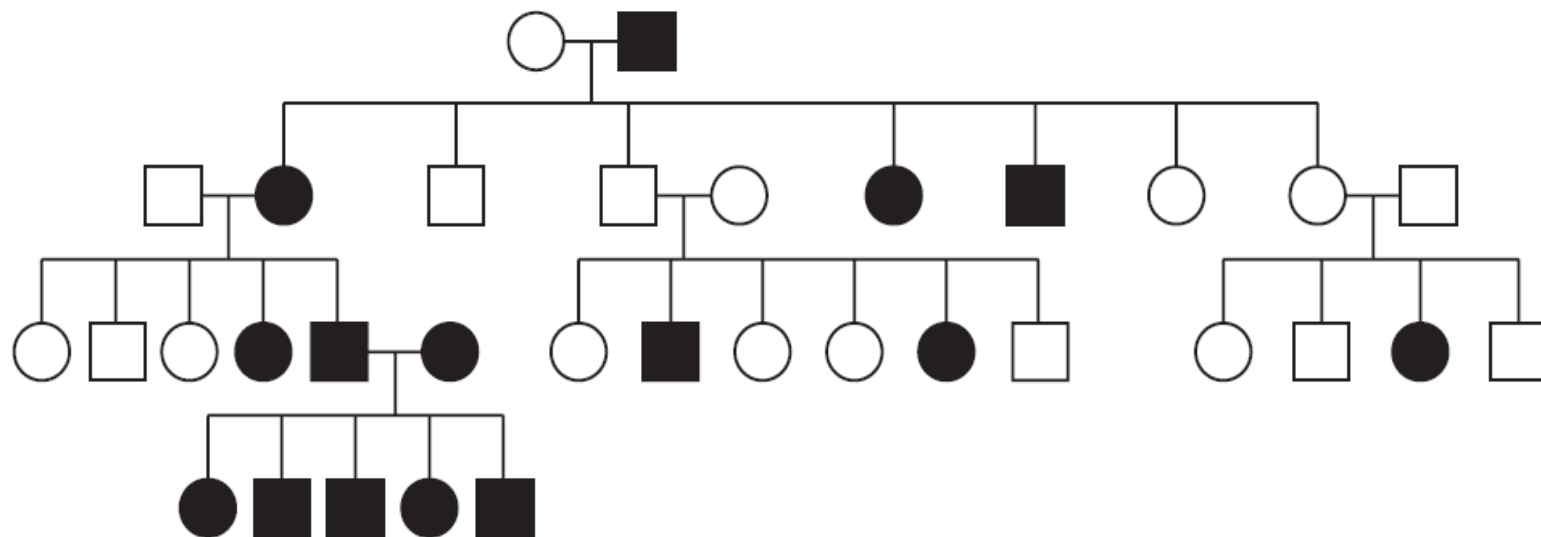


A mutation in an allele in an individual newt gave that newt faster reflexes. It is found that, after many generations, most of the newt population has the new allele.

Which of the following **most likely** caused this change?

- A. The newt gave its mutated allele to other adult newts.
- B. Other newts learned to copy the strategies of the mutated newt.
- C. The same mutation occurred in other newts as a result of environmental conditions.
-  D. Newts with the mutation are better able to survive and reproduce than newts without the mutation.

16 A pedigree showing the inheritance of a gold dorsal stripe pattern in ball pythons is shown below.



Key		
	Normal	Striped
Male		
Female		

According to the pedigree, what type of trait is this stripe pattern in ball pythons?

- A. codominant
- B. polygenic
- C. recessive
- D. sex-linked

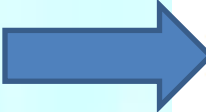


Which of the following units are repeatedly joined together to form a strand of DNA?

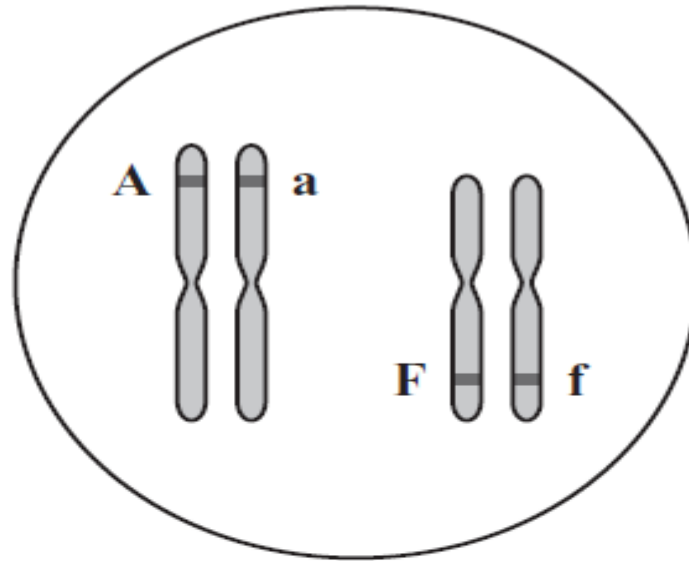
- A. amino acids
- B. fatty acids
- C. nucleotides
- D. polysaccharides



A hereditary muscular disease in horses causes abnormal opening and closing of the sodium ion channels in the muscle cells. Which of the following statements describes the **most likely** origin of this disease?

- A. A virus evolved specifically to attack the muscle cells of horses.
- B. Motor neurons near some of the muscle cells degenerated over time.
- C. High levels of sodium in the blood irreversibly damaged the ion channels.
-  D. A mutation occurred in the gene coding for the sodium ion channel protein.

Two chromosome pairs from a diploid organism are shown below.




Assuming meiosis and fertilization occur normally, which of the following pairs of alleles can an offspring receive from this parent?

- A. **A** and **A**
- B. **A** and **a**
- C. **A** and **f**
- D. **F** and **F**



In rabbits, a single gene controlling coat color has four alleles. The inheritance pattern for coat color in rabbits is therefore **best** described as which of the following?

- 
- A. multiple allele
 - B. polygenic
 - C. recessive
 - D. sex-linked

A mutation in which of the following types of cells could be passed on to an organism's offspring?

A. blood

 B. egg

C. muscle

D. nerve

In cats, the allele for short hair (**H**) is dominant to the allele for long hair (**h**). If a heterozygous short-hair cat is crossed with a long-hair cat, what percentage of the offspring is expected to be heterozygous for hair length?

- A. 0%
- B. 25%
- C. 50%
- D. 75%

