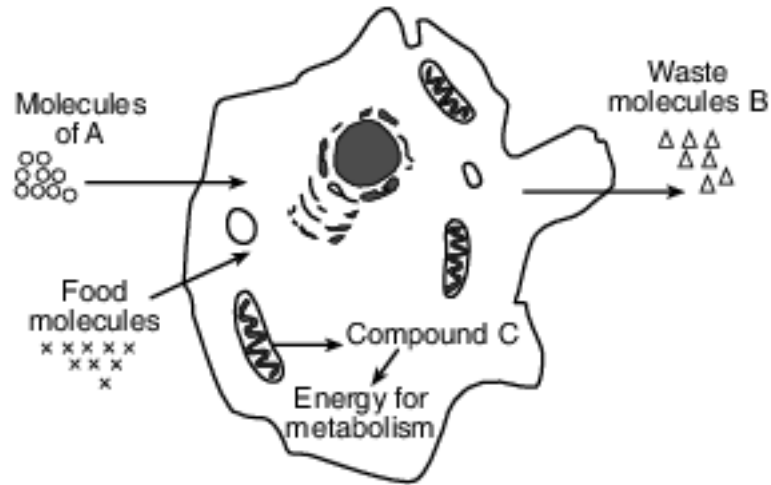


Heredity Affected Due To Changes In Dna

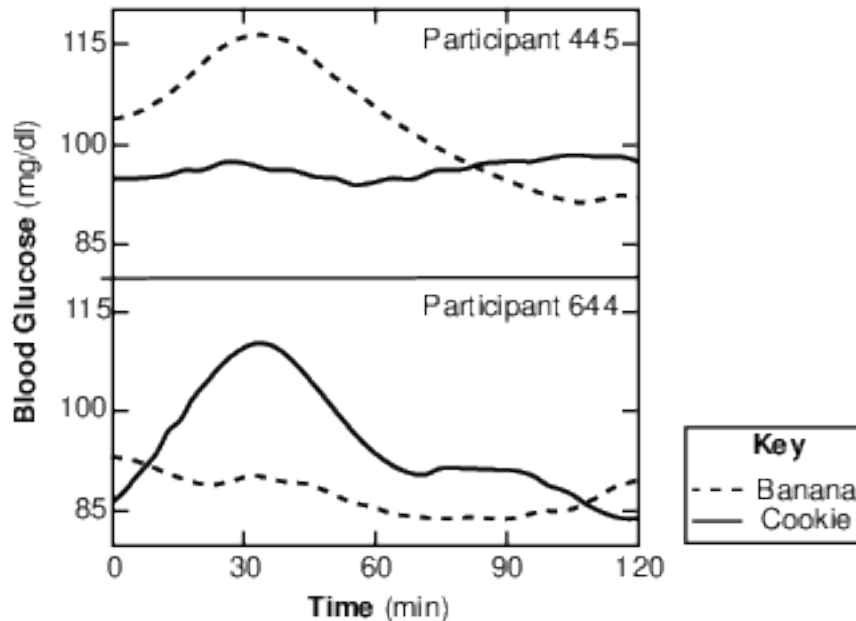
1 The activity of a single-celled organism is represented in the diagram below.



Which concept is best illustrated by this diagram?

- (1) The life functions performed by single-celled organisms are different from the life functions performed by complex organisms.
- (2) Single-celled organisms carry out life functions that are essential for survival.
- (3) Since single-celled organisms lack organs, they can survive only in moist environments.
- (4) Single-celled organisms contain one organelle that performs all the life functions.

2 The chart below shows a comparison of the blood sugar levels for two individuals who took part in a scientific study.



Source: Science Daily 11/19/15

Scientists have observed that blood sugar levels rose by different amounts in the two individuals even though they were given identical portions of bananas and cookies. These results were obtained because

- (1) glucose is too large a molecule to be absorbed into the blood, so the researchers were only measuring the amount of glucose already present
- (2) participant 445 didn't like bananas, and his body absorbed more of the food that he likes
- (3) individuals have genetic differences that alter their responses to environmental factors
- (4) two different foods were used; the scientists should have had only one experimental variable

3 Plants are green because they contain the protein chlorophyll. A bucket was left on the lawn for one week. When the bucket was removed, the grass under the bucket had turned from green to a yellowish white color. This change is due to the interaction between the grass and

- (1) decomposer organisms in the soil, an abiotic factor
- (2) the amount of sunlight, an abiotic factor
- (3) increased moisture under the bucket, a biotic factor
- (4) the metal composition of the bucket, a biotic factor

4 In the summer, the arctic fox appears brown because its cells produce a dark pigment. However, in the winter, the arctic fox appears white because the dark pigment is not produced. The color change is most likely due to the effect of

- (1) different genes produced in the different seasons
- (2) increased pollution on genetic mutations
- (3) environmental conditions on gene expression
- (4) poor nutrition on cell growth and development

5 Researchers recently discovered that when hammerhead sharks were moved to shallower water, resulting in exposure to increased light intensity, their backs turned a deep brownish black. Which statement best supports this observation?

- (1) Genes are inherited, but their expression can be modified by interactions with the environment.
- (2) The cells of hammerhead sharks contain many thousands of different genes in their nuclei.
- (3) An inherited trait of an individual can be determined by one or by many genes.
- (4) Asexually produced offspring are normally genetically identical to the parent.

6 A hydrangea plant has blue flowers when grown in acidic soil, but has pink flowers when grown in basic soil. A clone of the pink-flowered plant is grown in acidic soil and produces blue flowers. This change in flower color is most likely due to

- (1) sexual reproduction in the plants, resulting in variation
- (2) asexual reproduction in the plants, resulting in variation
- (3) genes being expressed in different ways due to environmental conditions
- (4) a gene mutation that occurred after the clone was produced

7 The photographs below are of two Siamese cats.

Cat Kept Indoors



Source: <http://aboutmyrecovery.com/2008/12/13/my-very-own-siamese-pet-kitten/>

Cat Kept Outdoors



Source: <http://www.superstock.com/stock-photos-images/662-220>

The Siamese breed has a gene that controls fur color. The cat in the first photograph was kept indoors while the cat in the second photograph was kept outdoors. Which statement best explains the differences in fur color between these two cats?

- (1) The cat kept indoors is older than the cat kept outdoors.
- (2) The environment influenced the expression of fur color genes.
- (3) The environment influenced the production of all the proteins in the cat kept outdoors.
- (4) The cat kept outdoors has a gene mutation that prevents it from producing light-colored fur.

8 A photograph of a Siamese cat is shown below.



Source: www.pinterest.com/explorer/siamese/cats

Siamese cats have dark fur on areas of the body that are cooler and light fur on parts of the body that are warmer. The color differences in this Siamese cat are most likely due to

- (1) a decrease in glucose produced in areas with light fur
 - (2) more DNA molecules being produced in areas with light fur
 - (3) gene expression being influenced by the environment
 - (4) mutations in the genes for eye color
- 9 Identical twins were separated at birth and raised by two different families. Years later, one twin was a physically fit member of the cross-country team, and the other twin was overweight with slightly higher-than-normal blood pressure. The differences in these twins could be explained by the fact that
- (1) the genes in the two individuals are completely different
 - (2) in twins, each individual inherits genes from only one parent
 - (3) the DNA bases in twins combine differently
 - (4) the environment can influence the expression of genes

10 The diagram below represents genetic material.



The expression of the section labeled X may be modified by

- (1) temperature, only
 - (2) asexual reproduction
 - (3) the environment
 - (4) pH, only
- 11 Chlorophyll gives plants their green color. Chlorophyll is produced only when plants are exposed to light, so plants kept in darkness have no chlorophyll and appear white. The best explanation for this is that
- (1) chlorophyll is not needed by green plants at night
 - (2) darkness mutates the chlorophyll genes, causing them to produce a white color
 - (3) light is required for chlorophyll genes to be expressed
 - (4) genetic information in cells is not influenced by the outside environment

12 Several goldfish were kept in a small aquarium for several years. The fish grew to be approximately 6 centimeters long in the first year, and after that, growth in length stopped. These fish were later transferred to a large pond. In the pond, the goldfish grew much larger, reaching lengths of around 25 centimeters. Which statement provides the best explanation for the increased growth of the fish in the pond?

- (1) Chemicals present in the pond increased the amount of DNA in the fish, causing the growth increase.
- (2) The expression of genetic information in the fish was influenced by their surroundings.
- (3) The fish expressed and passed on only those characteristics that enabled them to survive in the new environment.
- (4) The size of the fish depended only on their food supply and not on their DNA.

13 In the early 1900s, experiments were conducted on two caterpillar species. The members of the two species were each divided into two groups. One group of each species was placed under red light, while the other group of each species was kept in the dark. When the caterpillars developed into butterflies, their wings showed extreme color differences. Exposure to red light resulted in intensely colored wings, while those kept in the dark had paler wing colors. The color differences were most likely due to

- (1) mutations in the color-producing genes
- (2) the caterpillars in the red light producing more DNA
- (3) gene expression being affected by the environment
- (4) the caterpillars in the dark evolving less than those in the light

Base your answers to questions 14 on the passage below and on your knowledge of biology. Biologists have been studying the genes present in newborn twins.

Twins Don't Share Everything

...Chemicals called epigenetic markers can be attached to those [inherited] genes, like flags or balloons hanging off the sides of the DNA ladder. These don't just change the look of the genes. Like pieces of tape stuck over a light switch, these markers can force a gene to remain turned on or off. The type of marker scientists studied in the twins generally sticks the switch in the off position so that some proteins don't get made. And that means the proteins' jobs won't get done.

Every time a cell divides, new epigenetic markers may form. Foods, pollutants, and stress may all contribute to the development of new markers. So throughout our lives we tend to accumulate more and more. But a few are there from the day we're born.

...His [Jeffrey Craig's] team found that newborn twins have markers attached to different genes from the very start. It's true in identical twins, which come from the same fertilized egg. It's also true in fraternal twins, which come from different fertilized eggs. However, fraternal twins had more such differences than identical twins did.

Source: Science News for Students; July 31, 2012

14 Identify two environmental factors that can lead to an increase in the number of epigenetic markers that modify gene expression. [1]

15-18 Discuss the process used by scientists to insert a gene from one organism into the DNA of another. In your answer, be sure to:

- identify the scientific technique used to insert a gene from one organism into another [1]
- describe the function of a gene [1]
- identify the type of molecule used to cut the gene from the DNA of an organism [1]
- state one benefit of this technique to humans [1]

Answer Keys

1 2

2 3

3 2

4 3

5 1

6 3

7 2

8 3

9 4

10 3

11 3

12 2

13 3

14 Allow 1 credit for two environmental factors. Acceptable responses include, but are not limited to:

- — stress
- — pollutants
- — food
- — smoke/pesticides/alcohol/drugs
- — temperature

15-18 The student's response to the bulleted items in the question need not appear in the following order.

- 15. Allow 1 credit for identifying the scientific technique used to insert a gene from one organism into another. Acceptable responses include, but are not limited to:
 - — genetic engineering
 - — genetic recombination
 - — genetic manipulation
 - — gene splicing
- Note: Do not allow credit for biotechnology. It is a field of science, not a technique.
- 16. Allow 1 credit for describing the function of a gene. Acceptable responses include, but are not limited to:
 - — a segment of DNA that codes for a protein
 - — Genes control traits.
 - — Genes carry genetic information from one generation to the next.
- 17. Allow 1 credit for identifying the type of molecule used to cut the gene from the DNA of an organism. Acceptable responses include, but are not limited to:
 - — enzyme
 - — restriction enzyme
 - — biological catalyst
- 18. Allow 1 credit for stating one benefit of this technique to humans. Acceptable responses include, but are not limited to:
 - — make medicines for humans
 - — increase the yield of crops
 - — use plants to produce vaccines
 - — produce needed hormones (chemicals) for humans
 - — introduce new traits/characteristics into an organism