

Name: _____

Date: _____ Period: _____

Gene Expression



How can the environment affect gene expression?

Temperature and Light

Directions: Read the article below and answer the questions that follow.

Every cell in an organism's body contains the exact same DNA as every other cell in the organism's body. Different traits develop depending on which part of an organism's genes are expressed. Sometimes the external environment has an effect on these expressed genes. In addition to drugs and chemicals, temperature and light are external environmental factors that may influence gene expression in certain organisms. For example, Himalayan rabbits carry the C gene, which is required for the development of pigments in the fur, skin, and eyes, and whose expression is regulated by temperature. Specifically, the C gene is inactive (does not work) above 35°C, and it is maximally active from 15°C to 25°C. This temperature regulation of gene expression produces rabbits with a distinctive coat coloring. In the warm, central parts of the rabbit's body, the gene is inactive because the temperature is above 35°C, and no pigments are produced, causing the fur color to be white (see image above). Meanwhile, in the rabbit's extremities (i.e., the ears, tip of the nose, and feet), where the temperature is much lower than 35°C, the C gene actively produces pigment, making these parts of the animal black.

Light can also influence gene expression, as in the case of butterfly wing development and growth. For example, in 1917, biologist Thomas Hunt Morgan conducted studies in which he placed *Vanessa urtica* and *Vanessa io* caterpillars under red, green, or blue light, while other caterpillars were kept in the dark. When the caterpillars developed into butterflies, their wings showed dramatic differences. Exposure to red light resulted in intensely colored wings, while exposure to green light resulted in dusky wings. Blue light and darkness led to paler colored wings. In addition, the *V. urtica* butterflies reared under blue light and *V. io* butterflies reared in the dark were larger than the other butterflies.

Questions:

1. How does DNA compare in every cell in the entire body of an organism?
2. If there is the same copy of DNA in every cell, why are different traits possible?
3. What two environmental factors can affect gene expression in an organism?
4. **Explain** how temperature affects the coloring in rabbits.
5. How did the red light affect butterfly wings?
6. How did blue light or no light affect the size of butterflies?