

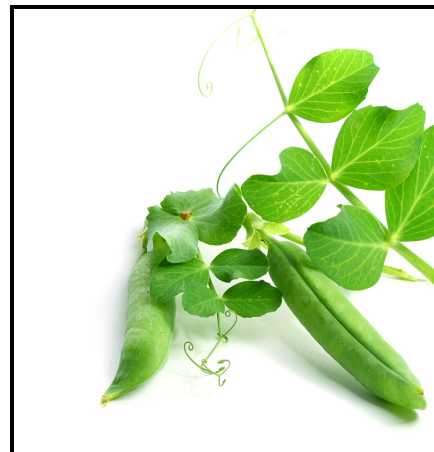


Name: _____ Date: _____ Group: _____

Gregor Mendel and Heredity

(Lexile 1010L)

- 1 Traits are the part of our genetic code that makes us who we are. You may have brown or blond hair, dark or light skin, or a blood type of A, B, AB, or O. These are all traits that are encoded on your DNA, your genetic material. Can one predict traits? Are certain traits more likely to be passed from one generation to the next? What exactly are the variations that we observe between organisms? How do they occur?
- 2 It was once hypothesized that the traits that arose from generation to generation must be blended in the same manner that different colors of paint are blended. According to this hypothesis, if a plant with red flowers reproduced with a plant with white flowers, then all of the flowers of the offspring should be pink. In other words, over time, all of the offspring of those plant parents should produce pink flowers. However, for many organisms this was not the observed result. Others, including Charles Darwin, thought that an organism's experiences caused them to produce chemicals in the blood. They thought these chemicals traveled to the animal's reproductive organs and then were passed to their offspring. Another hypothesis was later described as the "gene" hypothesis. This hypothesis speculated that traits were passed from generation to generation through specific packages known as heritable units. There were three scientific explanations proposed for heredity. It would take careful experimental testing to determine which was most accurate.
- 3 The process of trait transfer became the life's work of a monk and genetic pioneer named Gregor Mendel. He is now known as the Father of Modern Genetics. He was curious about the questions of trait transfer and spent his life studying heritability. Gregor Mendel grew up in Austria in the mid-1800s. As a young boy, he learned about agriculture and farming. As a young man, he studied at the University of Vienna. He learned about science, the experimental method, and the causes of variation in plants. Mendel also learned how to use statistics and probabilities to help analyze his data. Once his studies were completed, he moved to a monastery. This is where he began to investigate inheritance and the process of trait transfer, using garden peas as his subjects.
- 4 Mendel relied on all of the knowledge he had gained throughout his life. However, his study of statistics proved to be very useful in his final analysis. His choice of garden peas also helped with this process. Garden peas were a good choice for the scientific study of heredity as they came in many varieties. Furthermore, it was easy to control the pollination





process due to the structure of the pea flowers. They also produced a lot of offspring (large sample size) and were fast growing. Mendel was able to track the changes in traits from generation to generation, often within one growing season. Mendel was also very wise when he planned his study. He chose traits from the pea plants that were easy to distinguish. For example, he looked at flower color (purple or white), plant height (tall or short), or pea color (green or yellow). In this way, he was able to track the heritability of each specific trait as a heritable unit and could statistically track the results. One of Mendel's greatest gifts was the ability to see statistical patterns in the results of his breeding program.

- 5 So, how did he conduct these experiments, and what did he learn? Mendel began by crossing what he called "true-breeding" plants. When the true-breeding plants reproduced by self-pollination, the offspring would be identical to the parents. In other words, when plants with white flowers self-pollinated and created seeds, the offspring from those seeds would all produce white flowers. He used true-breeding parents and single traits for his study. His experimental procedures isolated variables and allowed him to decipher his results.
- 6 Mendel would follow his breeding plants for at least three generations. In order to test the gene hypotheses regarding inheritance, Mendel would cross two different types of true-breeding parents. The parents would only differ in one trait, such as flower color. The first generation, the true-breeding parents, was known as the P generation. This stood for parental generation. The hybrid offspring of the P generation were known as the F1 generation. This stood for first filial generation, since filial is derived from the Latin word for son. Then, Mendel would allow the hybrid F1 generation to reproduce, creating an F2 generation. The second filial generation can be thought of as grandchildren of the original parent generation.
- 7 If the blending hypothesis were true, then all of the F1 generation should have had light purple flowers, but this was not the case. All of the offspring had purple flowers. How could this be? When Mendel allowed the purple-flowered F1 generation to self-pollinate, some of the resulting plants produced white flowers like one of the plants in the P generation. Mendel realized that there must be specific traits that are dominant over other traits. As the white trait did not fully disappear, this must mean that the purple trait was dominant over the white trait. Mendel compared the numbers of plants with purple to the number with white flowers in the F2 generation. He saw that the flower colors consistently showed up in a ratio of three purple flowers to one white flower. Here is where Mendel used his mathematical knowledge to help him uncover the secret. Mendel found that traits occurred in predictable ratios from generation to generation. Therefore, he concluded that traits must be transferred in discrete units from parent to offspring. In Mendel's study of garden peas, the gene hypothesis was supported.



- 1** Following the sequence of Mendel's heritability study in Paragraph 6, which of the following is true?
- A** Mendel began by breeding two of the same true-breeding parents.
 - B** Mendel began by breeding two different types of true-breeding parents.
 - C** The offspring of the P generation were known as the first filial generation.
 - D** Both B and C
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- 2** Why were garden peas a good choice for a study of heredity?
- A** They come in many varieties.
 - B** They produce a large sample size, or many offspring.
 - C** The breeding, or pollination process, is easy to control.
 - D** All of the above
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- 3** The results of Mendel's study supported the gene hypothesis of heredity because the flower colors of the offspring –
- A** all blended.
 - B** appeared in distinct and predictable ratios.
 - C** always were either one color or the other.
 - D** never changed from generation to generation.



- 4** Gregor Mendel studied many things at the University of Vienna. According to the passage, which of the following topics of study was the most crucial to his final analysis?
- A** The study of statistics and probabilities
 - B** The study of plant varieties
 - C** The study of agriculture
 - D** His study of the experimental method
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- 5** Consider the following experiment: True-breeding tall pea plants are cut short before being pollinated to determine if there is an affect on the offspring. Which explanation for trait inheritance is this testing?
- A** Blended inheritance
 - B** Gene theory
 - C** An organism's experiences are passed to their offspring
 - D** None of the above



- 6** Which trait did Gregor Mendel examine from the pea plant when he planned his study?
- A** Plant height
 - B** Color of the plant flower
 - C** Traits that were easy to distinguish
 - D** All of the above