

Lesson 20

8th - NTI Day 2

Genetics

In the grand scheme of life, traits are passed down from parents to their offspring, a process known as **heredity**. Traits that make their way from parents to their children are referred to as **inherited traits**. The scientific study of how these traits are passed down is called **genetics**.

Gregor Mendel, often known as the *father of genetics*, began his exploration into this field by cultivating various types of pea plants. Some of these plants were towering, while others were quite short. Also, he found that some plants bore green peas, while others sprouted yellow ones. Plus, the plants either bloomed with purple or white flowers.

His initial experiment involved crossbreeding two pea plants with short stems through the process of pollination. After planting the seeds from these crossbred plants, he discovered that all the new plants were short-stemmed.

Then, Mendel decided to crossbreed two tall or long-stemmed pea plants. Surprisingly, these tall plants didn't consistently produce tall offspring; instead, they resulted in a majority of tall plants and a few short ones.

Taking his curiosity a step further, Mendel crossbred a tall-stemmed pea plant with a short-stemmed one. He found that the first generation of plants were all tall – not a single short one among them!

These experiments by Gregor Mendel laid the foundation for the fundamental rules of genetics, which state:

- Every organism inherits two genes for each trait, one from each parent.
- One of these genes can be dominant over the other. The characteristic of the **dominant gene** is the one that is visibly expressed, while the trait of the weaker or **recessive gene** remains hidden.
- An organism that inherits identical genes for a specific trait is classified as a **purebred**.
- An organism that inherits different genes for a trait is referred to as a **hybrid**.

Geneticists, or scientists specializing in genetics, use probability and a special chart called a **Punnett Square** to predict the genetic outcomes of a crossbreeding. The Punnett Square, named after the English geneticist Reginald C. Punnett who created it, shows all the potential gene combinations when two organisms are crossbred.

In a Punnett Square, a capital or uppercase letter represents the dominant gene, while a lowercase letter represents the recessive gene. The genes of the parents are placed outside the square.

When a hybrid tall plant (represented as Tt) is crossed with a purebred short plant (represented as tt), the Punnett Square predicts the traits of the resulting offspring. According to this chart, the offspring plants have equal chances of being hybrids (Tt) or purebreds (tt) since both combinations occur an equal number of times.

However, not all inherited traits adhere to Mendel's fundamental principles. For some traits, neither gene is dominant; both are equally strong. This type of inheritance is termed incomplete dominance.

Incomplete dominance happens when neither of the two traits completely overshadows the other. In these instances, the offspring exhibit a blend of both traits.

For instance, in some flowers, neither the red gene nor the white gene for the color of the flower is dominant. So, when these two genes coexist in the same plant, they blend. Can you guess the color of the offspring? If you guessed pink, you got it right!

Punnett Square Chart

		Hybrid Tall Plant	
		T	t
Purebred Short Plant	t	Tt	tt
	t	Tt	tt

Name: _____

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1. Who is known as the father of genetics?

- A. Reginald C. Punnett
- B. Charles Darwin
- C. Gregor Mendel
- D. Albert Einstein

2. What is the study of heredity called?

- A. Geology
- B. Genetics
- C. Botany
- D. Zoology

3. What did Mendel observe about the pea plants he was growing?

- A. Some were tall and others were short
- B. All of them produced yellow peas
- C. All of them were short-stemmed
- D. Some produced blue flowers and others red

4. How is the dominant gene described in Mendel's principles of genetics?

- A. It's the gene with weaker traits
- B. It's the gene with traits that show up
- C. It's a hidden gene
- D. It's a recessive gene

5. What is an organism with two identical genes for a trait called?

- A. Hybrid
- B. Dominant
- C. Recessive
- D. Purebred

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6. What does a lowercase letter represent in a Punnett Square?

- A. Dominant gene
- B. Recessive gene
- C. Purebred
- D. Hybrid

7. How is the term **hybrid** defined in Mendel's principles?

- A. An organism with two different genes for a trait
- B. An organism with two identical genes for a trait
- C. An organism with one dominant and one recessive gene
- D. An organism with both parents having the same traits

8. What is **incomplete dominance**?

- A. It occurs when one of the two forms of a trait completely masks the other
- B. It occurs when neither of the two forms of a trait completely masks the other
- C. It occurs when both traits are equally strong
- D. Both b and c

9. When the red gene and white gene are present in the same plant, what color does the offspring turn out to be?

- A. Red
- B. White
- C. Purple
- D. Pink

10. Who developed the Punnett Square chart?

- A. Charles Darwin
- B. Albert Einstein
- C. Reginald C. Punnett
- D. Gregor Mendel