Gregor Mendel: "The Father of Modern Genetics"

The mechanisms concerning inheritance of traits was unknown to science before Gregor Mendel's pea experiments. This article explores how Mendel's ground breaking work shed light on modern genetics and inheritance.

PRACTICAL SCIENCE WITH PHIL FREDA

Why do we look like our parents?
Why are some disorders and traits passed down to our children?
These questions stumped scientists over 150 years ago. Thanks to his numerous experiments with pea plants, Gregor Mendel began to decode the mechanisms that underlie inheritance and earned himself the title, "The Father of Modern Genetics."

Who is Gregor Mendel?
Bibliographical information was compiled from Villanova University and Zephyrus Online.
Gregor Johann Mendel was born in Hyncice, Moravia on July, 22 1822 in what is now the Czech Republic.
Mendel was born into a poor farming family and showed interest in the sciences. Since a good education was expensive, Mendel entered the Augustinian Order of monks at St. Thomas Monastery in Brunn in 1843 and was ordained a priest in 1847.
Mendel's love for the natural sciences blossomed at St. Thomas, for it was a center for scientific inquiry and research.
Mendel began to teach in 1849, where he was well received by his students. However, when he took a qualification exam for the state, he failed.
Mendel was then sent to the University of Vienna for two years to improve his scientific knowledge and research skills, and soon after, he began to teach again. When it came time for his next examination, he became ill and withdrew.
Mendel never took the examination again, but did teach part-time.
While studying in Vienna, Mendel became interested in the work of a biologist named Franz Unger, who was working on how living things came to inherit the traits of our ancestors.
This inspired Mendel, and he began to conduct experiments with pea plants at St. Thomas.
After cultivating thousands or pea plants and looking at over 28,000 peas between 1856 and 1863, Mendel discovered some interesting results.
Mendel found that offspring usually resemble one parent. In other words if he crossed a tall plant with a short one, the offspring was tall. This led Mendel to come to the conclusion that traits can be dominant or recessive. Dominant traits are expressed in the offspring and recessive ones are masked or hidden.
Mendel also concluded that traits are passed to offspring through units or factors, which are now called genes.
In 1866, Mendel published his work in the *Journal of the Brno Natural History Society* and received no attention.
Later Mendel successfully hybridized a species of bee that made delicious honey but were so vicious, they stung everyone who came near them.
The bees were destroyed.
It seems Mendel had the worst luck ever.
Mendel died in 1884 at the age of 62 and it wasn't until 1900 that Mendel's work was recognized and spawned a revolution of genetic research. Mendel's work even helped solidify the Theory of Evolution.

How inheritance works
Our parents give us half of their genetic material to us. We are roughly half our mother and half our father.
But as Mendel discovered, it isn't that simple.
Let's use the pea plant, as Mendel did, as our example.

The peas, which we eat, are usually smooth and green. Sometimes in nature, mutations can arise in which we see wrinkled peas.
Now, lets take two parent plants, one with wrinkled peas and one with smooth peas.
These parent plants are **true breeding**, meaning that they produce their respective pea types each generation, and cross them, what would you expect to see?
All of the offspring, which are called the **F1 generation**, have smooth peas, but why?
Remember we stated that parents give half of their genetic material to their offspring, but our offspring here are only expressing the genes of the smooth pea parent.
This happens as a result of dominance.
Each offspring received 2 copies of a gene that governs pea shape, one from the smooth pea parent and one from the wrinkled pea parent.
We will call the smooth pea gene ***A***, and the wrinkled pea gene ***a***. So every offspring has the genotype ***Aa***.
Since *A* is dominant, the *a* allele (version of a gene), is masked and not expressed, but it is still there.
Mendel went further and crossed the *Aa* offspring and found that the generation, called the **F2**, was composed of 75 percent smooth pea plants and 25 percent wrinkled pea plants
Here things get a bit complicated and have uploaded pictures above to help understand it.
Remember, each parent (which are now all *Aa*) gives half of their material to the offspring, but which half, the *A* allele or the *a* allele?
It actually all comes down to chance, but roughly half of the time, each offspring will receive the same complement as their parents of *Aa*, one quarter will get two *A*'s (*AA*) and one quarter will get two *a*'s (*aa*).
Remember since dominance is in play, the *AA* offspring and *Aa* offspring will look identical and have smooth peas.
This will result in ¾, or 75 percent, having smooth peas.
The remaining ¼, or 25 percent, will have wrinkled peas.
Since the wrinkled pea trait is seen in the F2 and not the F1, we see how traits can skip a generation.

Is it really that simple?
Without Mendel's groundbreaking work, our understanding of genetics would not be possible.
Unfortunately for Mendel, he never got to see the fruit of his labor. We use his work still to this day to understand inheritance.
What is interesting, and a bit annoying, is that most traits in living things are not inherited as simply as Mendel's pea plants. He was fortunate that he picked traits, and a species, that follows simple inheritance patterns.
In reality, most traits are a product of multiple genes and each gene contributes different percentages to the trait as a whole.
Also some species should display a trait because they have the gene(s) responsible, but it doesn't show up at all. This means some traits have less than 100 percent penetrance, or the ability to be observed.
Traits that are a product of multiple genes are called polygenic traits and are usually observed as a continuum. This means that instead of black and white results, as in Mendel's peas, the results aren't green and yellow, but also, all of the shades in between.
A good example is human skin tone. There is no such thing as a black human and a white human, but a continuum of various shades of from light to dark is seen.
Another, important example of a polygenic traits are cancers.
Cancer, depending on the type, is a result of many genes, their interactions among one another, and the gene interaction with the environment (i.e. smoking, radiation, pollution). A person may have a genetic predisposition for cancer and never get it. On the other hand, a person with no genetic risks may get the disease.
There still is so much we do not know, but it is important to thank Mendel for his work as the "Father of Modern Genetics" because he outlined the groundwork that was necessary to establish our current understanding of genetics and inheritance. Think about it.

Have you thought about it, yet? Tell us in the comments.