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Medicine in Stamps

Gregor Mendel (1822-1884): man of God and science

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Gregor Johannes Mendel is an interesting figure: an Augustinian monk who is considered the father of genetics. He was ahead of his time in his application of mathematics to biology, and he overcame obstacles of poverty and failure to become one of the most respected men of science.

Priesthood: Mendel was born on July 22, 1822, the only son of a peasant farmer in Heizendorf, Austria (currently the Czech Republic). His family chose to put him in school, although this meant additional hardship with their only son away from the farm. Mendel was able to make extra money by tutoring other students, especially in the physical sciences and philosophy; but this was short-lived, as his father became injured and was soon unable to work. Dropping out, young Mendel, then 20 years old, opted to join the St Thomas Monastery. The monastery at the time was a hotbed of learning, as priests cultivated religious, social and scientific ideas, and the resources at hand included an incredible library of manuscripts, some dating back to the 16th century, mineral collections, and an experimental garden. He completed his studies at Brunn Theological College and in 1847, was ordained an Augustinian monk, taking the name Gregor.

Failure: Mendel was required to teach as part of his priestly duties. Initially assigned to a secondary school in the city of Znaim in 1849, he was however unable to scale the required examination for teacher certification. From 1851 to 1853, he took diploma courses at the University of Vienna, hoping to increase his chances of passing the examination. A shy student, he did not complete the diploma course, with his teachers observing that *"he lacks insight and the clarity of knowledge."* He returned to the monastery in 1853, an apparent failure; worst yet, two years after his return, he took and again failed the teaching certification exam.

Not all was in vain at the University of Vienna, where he was exposed to influential teachers such as Franz Unger, a plant physiologist, and Christian Doppler, an experimental physicist. Together, they provided the foundation that would allow Mendel to carry out his botanical experiments that delved into genetics and inheritance. Paradoxically, Mendel's failure as a teacher allowed him more time for research, which he began soon after his return from Vienna. His interest in theories of descent and evolution such as the one proposed by Charles Darwin drew him to his early experiments. His work centred on *Pisum*, a common type of garden pea ideal for hybridisation experiments, as he could grow a large number of plants within the confines of the monastery garden. The species also had the ability to both self- and cross-fertilise, and the different pea lines displayed easily identifiable phenotypic variations such as colour and pod appearance.

Over the course of eight years, Mendel used 34 types of pure strains and extensively planned and documented the cross-pollination of thousands of plants. He cultivated nearly 30,000 pea plants,

focusing on and comparing seven pairs of seeds that determined shape, colour, plant height, and other characteristics. For example, he crossed tall and short plants, and obtained hybrids that were either tall or short, rather than of intermediate height. The first to apply mathematics to biology, Mendel discovered that the appearance of plant offspring traits was statistically predictable and they did not necessarily blend to form transitional species. He observed that the pattern of inheritance depended on paired hereditary units, now known as genes, which exerted their influence in a dominant (expressed phenotype) or recessive (hidden phenotype) manner. The Augustinian monk was clearly an astute scientist, and he had stumbled upon the fundamental laws of Mendelian genetics, which would eventually help to describe the laws of segregation and independent assortment.

In 1865, Mendel presented his findings to the Society for the Study of Natural Sciences, and published them a year later. He sent his paper to over one hundred scientists, but it was largely ignored. Mendel did conduct additional experiments to produce hybrid offsprings. He worked on the hawkweed *Hieracium*, but the inconclusive results failed to confirm his earlier pea findings. Unbeknown to him, the hawkweed was an unwise choice because of its breeding nature, asexual reproduction, restricted inheritance to only one, i.e., the maternal, component. Mendel also experimented with bees, and was able to produce a strain that produced excellent honey. Unfortunately, the species was extremely vicious, which prevented further experimentation.

Mendel's results and conclusions met with opposition, partly because of his religious affiliation. The extreme goodness-of-fit of his data raised doubts regarding possible fabrication, while others felt that the logic of his interpretation was unwarranted. In his defense, Mendel's supporters pointed to the meticulousness of his methods and record keeping, and the extreme precautions he took in covering plants to eliminate cross-contamination. He also excluded aberrant plants, which he thought might have been contaminated, from his calculations. However, with the loss of his own writings after his death, many of these questions will sadly remain unanswered.

The Loss of Science and Life: On March 30, 1868, Gregor Mendel was chosen as successor to lead the St Thomas Monastery. This signalled the beginning of the end of the scientific work that brought him so much joy. At the beginning of his tenure, he was able to remain an active member of the legislature and multiple societies, but over time, his religious, civic and administrative duties left him little time for much else. His tenure saw him battling tax increases passed by the government in 1874. He became more solitary, even within the monastery, as a result of greatly increased workload, but there may have been other factors. Ambivalent towards his scientific discoveries, Mendel's religious peers took turns respecting and shunning him. The Church itself took nearly another century before openly discussing evolution and Darwinism, issues inextricably intertwined with genetics and inheritance.

Gregor Mendel died on January 6, 1884 at the age of 62 years of Bright's Disease (glomerulonephritis). Even as Czech composer Leos Janacek played the organ at the Augustinian monk's funeral, his own monastery deemed his work tantamount to heresy, and set fire to virtually all of his scientific papers. As with many other luminaries, Mendel did not receive the recognition he deserved during his life. Dormant for some 35 years, his work had to wait until the early 1900s before three European scientists, including the influential Dutch botanist Hugo de Vries, independently verified its importance. At long last, his ideas had gained the approval of the scientific community at large and this cemented his place in history as the Father of Genetics. In a way, Mendel had predicted the outcome when he wrote: "*I have experienced many a bitter hour in my life. Nevertheless, I admit gratefully that the beautiful, good hours far outnumbered the others. My scientific work brought me such satisfaction, and I am convinced the entire world will recognize the results of these studies*."

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