Johann Gregor Mendel (1822-1884) [1]

By: Andrei, Amanda

Johann Gregor Mendel studied plants and their patterns of inheritance in Austria during the nineteenth century. Mendel experimented with the pea plant, *Pisum* [2], and his publication, "*Versuche über Pflanzenhybriden*" ("Experiments on Plant Hybridization"), published in 1866, revolutionized theories of trait inheritance. Mendel's discoveries relating to factors, traits, and how they pass between generations of organisms enabled scientists in the twentieth century to build theories of genetics.

Born on 22 July 1822 in Heinzendorf, Austria, now Hynčice, Czech Republic, Mendel was the second child of Rosine and Anton Mendel. He had two sisters, Veronica and Theresia, with whom he spent his youth working on the 130-year-old family farm. This work fostered Mendel's interest in nature that later motivated his genetic experiments.

At the urging of the vicar and village schoolmaster, Mendel attended a secondary school and gymnasium. In 1840 Mendel entered the philosophy course at the Palackì University of Olmütz, now Olomouc, Czech Republic. During his three years in Olomouc, Mendel studied philosophy, physics and mathematics, and he was beset with financial worries. Due to fiscal pressures, Mendel entered the Augustian St. Thomas's Abbey in Brünn, now Brno, Czech Republic, in 1843, to continue his education. At this time Mendel, born Johann Mendel, adopted the name Gregor and began his scientific work, taking on many roles including priest, high-school teacher, botanist, and abbot.

Mendel pursued studies in theology, and upon the completion of his studies, he worked as a chaplain in a nearby parish serviced by the abbey. After a number of years he was relieved of his duties and in 1849, he was reassigned to Znaim, now Znojmo, Czech Republic, where he served as a substitute teacher in a local grammar school. Mendel's students welcomed and admired him, and he attempted to gain his teaching certificate. In the certification examination, Mendel performed well in all sections excepting geology and zoology, so he failed to receive his certificate. Shortly after, Andreas Baumgartner, professor of physics at the University of Vienna in Vienna, Austria, recommended that Mendel study at the university to complete his education. From 1851 to 1853, Mendel trained in mathematics, chemistry, and plant physiology at the University of Vienna. During this time, he joined the Zoologisch-Botanischer Verein Wien (Vienna Zoological-Botanical Society), where he began botanical experiments. In 1853 and 1854 he published his first two articles on the damage of plant cultures by insects [3]. In 1856, Mendel failed to obtain his teaching certificate for a second time. Following the failure, Mendel returned his focus to the abbey and returned to Brünn to take up pastoral duties and to teach physics and natural history [4] at the Brno Technical School, albeit part time.

Back at the abbey, Mendel was put in charge of the gardens by Abbot Franz Cyrill Napp, who was an avid agriculturist and a member of the Central Board of the Moravian Agricultural Society. Having been pushed into the gardens of the abbey, which had been dedicated to agricultural experiments, Mendel had ample time to note the plants in the garden. At the time, a common theory of inheritance was the idea of blending characteristics. One of the main advocates of this belief was Charles Darwin [5] in England, who formulated his theory of Pangenesis around the concept. Based on this notion, in which offspring displayed characteristics mixed from their parents, variety of characteristics was thought to decrease with each subsequent generation. Some argued that with blending inheritance, a homogenous pool of offspring would eventually result within every mating species.

According to Mendel's observations, the abbey's pea plants did not seem to follow those rules. Mendel spent the years from 1856 to 1863 cross-breeding almost 30,000 pea plants with different physical characteristics to see what would happen in the subsequent generations. After observing their physical traits, Mendel concluded that the blending theory of inheritance was flawed and that inheritance was actually controlled by unobserved things, which he called factors.

Mendel studied patterns of trait inheritance, or the physical appearances between parental generations and offspring, that led him to formulate laws concerning the generational passing of traits. The set of rules Mendel used to form a predictive principle, later termed The Law of Segregation, came from four kinds of observations. First, traits have multiple forms. For example, his garden variety pea plants (*Pisum sativum*) could either have wrinkled or round seeds or be tall or short. Second, the progeny, or offspring, obtains the character of the parent through a factor that it inherits. Third, one factor comes from each parent via the parents' sex cells (gametes). Last, the offspring physically expresses only one of the two factors inherited from the parents. Factors physically expressed were termed dominant, and factors not physically expressed were termed recessive. Though Mendel knew nothing of the particular mechanisms of inheritance, his rules reflected the patterns and characteristics of inheritance.

Mendel further noticed that when he examined two traits within a single plant species, for example a tall and green-seeded pea plant crossed with a short and yellow-seeded pea plant, all possible phenotypic combinations resulted in the progeny: tall and green-seeded, short and green-seeded, tall and yellow-seeded, and short and yellow-seeded. Mendel concluded that the factors for height and seed color were not paired or coupled in any way, but rather were passed onto the progeny independently of one

another. He concluded that there is no relationship between the height of the pea plant and the color of its seeds. This observation became known as Mendel's second law, or The Law of Independent Assortment.

Mendel summarized and presented these findings in 1865 at two meetings of the Natural History Society of Brünn. His paper, "Versuche über Pflanzenhybriden" ("Experiments in Plant Hybridization"), was published the year after in 1866 in the *Verhandlungen des naturforschenden Vereins Brünn* (Proceedings of the Natural History Society of Brünn), but his work remained largely unknown.

Mendel became abbot of St. Thomas's Abbey in 1868. His duties as abbot kept him away from experimental work, but he participated in many societies including the Central Board of the Agricultural Society, the Brno Horticultural Society, and the Society of Apiculturists. During his time on the Central Board, Mendel funded and promoted farming. For his work Mendel was offered the presidency of the Central Board of the Agricultural Society, but he declined it due to his poor and failing health. The remainder of his days he spent advocating on the abbey's behalf against new taxation laws. He died on 6 January 1884.

In 1899 the geneticist William Bateson [6] revived the papers and findings of Mendel through his own experiments on heredity in the UK. Furthermore, in 1900, three biologists in Europe, Hugo de Vries [7], Carl Correns, and Erich von Tschermak-Seysenegg, each performed their own experiments and independently arrived at the same conclusions as Mendel. Mendel's paper was republished in English, as well as many other languages, and became popularly circulated.

Sources

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Publisher

Arizona State University. School of Life Sciences. Center for Biology and Society. Embryo Project Encyclopedia.

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Last Modified

Wednesday, July 4, 2018 - 04:40

DC Date Accessioned

Saturday, July 27, 2013 - 00:09

DC Date Available
Saturday, July 27, 2013 - 00:09

DC Date Created
2013-07-27

DC Date Created Standard
Saturday, July 27, 2013 - 07:00

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