



58 GREGOR MENDEL

1822 - 1884

Gregor Mendel is famous today as the man who discovered the basic principles of heredity. During his lifetime, however, he was an obscure Austrian monk and amateur scientist, whose brilliant research was ignored by the scientific world.

Mendel was born in 1822, in the town of Heinzendorf, at that time within the Austrian Empire, but now part of Czechoslovakia. In 1843, he entered an Augustinian monastery in Brunn, Austria (now Brno, Czechoslovakia). He was ordained a priest in 1847. In 1850, he took an examination for teacher certification. He failed, receiving his lowest marks in biology and geology! Nevertheless, the abbot in charge of his monastery sent Mendel to the University of Vienna, where, from 1851 to 1853, he studied mathematics and science. Mendel never did get a re-

gular teacher's license, but from 1854 to 1868, he was a substitute teacher of natural science at the Brünn Modern School.

Meanwhile, starting in 1856, he performed his famous experiments in plant breeding. By 1865, he had derived his famous laws of heredity and presented them in a paper given before the Brünn Natural History Society. In 1866, his results were published in the *Transactions* of that society, in an article entitled "Experiments with Plant Hybrids." A second article was published in the same journal three years later. Although the *Transactions* of the Brünn Natural History Society was not a prestigious journal, it was carried by major libraries. In addition, Mendel sent a copy of his paper to Karl Nägeli, a leading authority on heredity. Nägeli read the paper and replied to Mendel, but failed to comprehend the paper's enormous importance. Thereafter, Mendel's articles were generally ignored and, indeed, almost forgotten for over thirty years.

In 1868, Mendel was appointed abbot of his chapter, and from then on his administrative duties left him little time to continue his plant experiments. When he died, in 1884, at the age of sixty-one, his brilliant research had been nearly forgotten, and he had received no recognition for it.

Mendel's work was not rediscovered until the year 1900, when three different scientists (a Dutchman, Hugo de Vries; a German, Carl Correns; and an Austrian, Erich von Tschermak), working independently, came across Mendel's article. Each of the three men had performed his own botanical experiments; each had independently discovered Mendel's Laws; each, before publishing his results, had researched the literature and come across Mendel's original article; and each carefully cited Mendel's paper and stated that his own work confirmed Mendel's conclusions. An astounding triple coincidence! Moreover, in that same year, William Bateson, an English scientist, came across Mendel's original article and promptly drew it to the attention of other scientists. By the end of the year, Mendel was receiving the acclaim that he had so richly deserved during his lifetime.

What were the facts about heredity that Mendel discovered?

In the first place, Mendel learned that in all living organisms there were basic units, today called genes, by which inherited characteristics were transmitted from parent to offspring. In the plants that Mendel studied, each individual characteristic, such as seed color or leaf shape, was determined by a pair of genes. An individual plant inherited one gene of each pair from each parent. Mendel found that if the two genes inherited for a given trait were different (for example, one gene for green seeds and another gene for yellow seeds) then, normally, only the effect of the dominant gene (in this case for yellow seeds) would manifest itself in that individual. Nevertheless, the recessive gene was not destroyed and might be transmitted to the plant's descendants. Mendel realized that each reproductive cell, or gamete (corresponding to sperm or egg cells in human beings) contained only one gene of each pair. He also stated that it was completely a matter of chance which gene of each pair occurred in an individual gamete and was transmitted to an individual offspring.

Mendel's laws, although they have been modified slightly, remain the starting point of the modern science of genetics. How is it that Mendel, an amateur scientist, was able to discover those important principles that had eluded so many eminent professional biologists before him? Fortunately, he had selected for his investigations a species of plant whose most striking characteristics are each determined by a single set of genes. Had the characteristics he investigated each been determined by several sets of genes, his research would have been immensely more difficult. But this piece of good luck would not have helped Mendel had he not been an extremely careful and patient experimenter, nor would it have helped him had he not realized that it was necessary to make a *statistical* analysis of his observations. Because of the random factor mentioned above, it is generally not possible to predict which traits an individual offspring will inherit. Only by performing a large number of experiments (Mendel had recorded results for over 21,000 individual plants!), and by analyzing his results statistically was Mendel able to deduce his laws.

Semmelweis have been omitted in favor of Columbus, Copernicus, and Joseph Lister.

There are, however, differences between Mendel's case and the others. Mendel's work was forgotten only briefly, and once rediscovered, quickly became widely known. Furthermore, de Vries, Correns, and Tschermak, though they rediscovered his principles independently, eventually did read his paper and cite his results. Finally, one cannot rightly say that Mendel's work would have had no influence if de Vries, Correns, and Tschermak had never lived. Mendel's article had already been included in a widely circulated bibliography (by W. O. Focke) of works on heredity. That listing ensured that sooner or later some serious student in the field would come across Mendel's article. It might be noted that none of the other three scientists ever claimed credit for the discovery of genetics; also, the scientific principles discovered are universally referred to as "Mendel's Laws."

Mendel's discoveries seem comparable, both in originality and importance, with Harvey's discovery of the circulation of the blood, and he has been ranked accordingly.