

Coda

QJM

Did Darwin read Mendel?

Read no further if you want a definite answer to this question. It is a sort of detective story with clues scattered around. The circumstances surrounding the question however are so interesting since they involve two of the most important scientific publications of the 19th century.

The truly ground-breaking studies of Gregor Mendel were read before the Society for the Study of Natural Science of Brunn in 1865 entitled *Versuche uber Pflanzen-Hybriden* (Experiments in Plant Hybridization). Mendel ordered 40 reprints of his paper to send to famous European scientists; Darwin by then was certainly one of the most famous. Darwin's book on *Origin of Species* had been out for 6 years and was already in its 3rd edition. It had been translated into German, French, Dutch, Spanish, Polish and Russian.

Mendel had of course read and studied the *Origin of Species* in the German translation, *Ueber die Entstehung der Arten* as soon as the second edition appeared in 1863. In his personal copy, he made many notes in the margin with his small and careful handwriting with double underlines of some of the text and even interspersed with the occasional exclamation mark. He bought most of Darwin's other works and studied them carefully making frequent annotations. So it would be natural for him to send Darwin, as an eminent English naturalist, one of his 40 reprints.

Of the 40 reprints of Mendel's article records exist that one was sent to each of the following scientists: von Marilaun, Kerner, Beijerinck, Boveri, Schleiden, and the Swiss botanist Karl Wilhelm von Nageli, now working in Munich. The last exchanged letters with Mendel over 7 years on the topic. More copies of the reprint were to be found in learned societies around Europe including the Royal Society, the Linnaean Society and the Greenwich Observatory in Britain.

Where were the other remaining reprints sent (about 29)? At the time Darwin's house in Kent was

a sort of communication hub for European naturalists. Darwin was writing (and receiving) letters on a daily basis about issues and problems of natural history. If Darwin had received and read Mendel's article, he would have found a detailed analysis of the frequencies observed for different inherited traits from generation to generation of the edible pea. But these results were given in a mathematical form that might have put Darwin off from reading any more of the article. Darwin said that: 'Mathematics in biology was like a scalpel in a carpenter's shop – there was no use for it.' The concluding remarks of the paper made quite far reaching claims that the author had discovered laws that could predict the appearance of the different hybrid characters in successive generations of the edible pea, and that this would probably apply to other plant species. Of course it needed confirmation by further experimentation, but in view of the unity in the developmental plan of all organic life one may assume it to be correct. The final two paragraphs argued that the transference of characteristics amongst cultivated plants, such as the edible pea, can be accomplished and seems to occur by discrete integral steps which if accumulating in one species of plant could 'transform' it into a different species. Mendel's conclusions left no room for blending inheritance that Darwin believed to occur.

Darwin was usually meticulous in assimilating new material and making notes. He could read German slowly, a few pages at a time. He was already corresponding with several top European scientists who were working on the broad issue of heredity. There was Carl F von Gaertner in Southern Germany working in the small town of Calw and later in Stuttgart; August Weismann in Freiberg and also von Nageli. If Darwin thought German articles were important enough he would get them translated by William Dallas, a competent naturalist who often prepared the indexes of Darwin's books. In the

case of Mendel's article, it was left to the *Royal Horticultural Society* to translate the work into English a few decades later.

Even if Darwin did not receive a reprint he had yet other chances to read of Mendel's work in the early 1870s. Hermann Hoffman, a Professor of Botany at Giessen had written a little book on plant hybrids in 1869 and on page 52 was a long excerpt from Mendel's paper of 1865. On Darwin's copy of the book (now preserved in the Cambridge University Library) are hand written notes in the margins by Darwin on pages 50, 51, 53 (facing page 52), 54 and 55. These are close to the citation of Mendel's paper but it may be that Darwin skipped over this passage or did not appreciate its significance.

Darwin had a further chance to read about Mendel's work in 1881. A student of his, George Romanes, was preparing an article for the *Encyclopedia Britannica* on plant hybridization. He enlisted Darwin's help to suggest names of eminent botanists who should be included. Darwin replied by sending Romanes a copy of a recently received book by Wilhelm Focke on the topic, published in 1881. Mendel's work was summarized on three pages (108–111) and the section ended stating that: 'Mendel thought he had found constant numerical relationships between the different types of crosses'. But these pages were uncut in Darwin's copy and Romanes left them so. Mendel's name was included by Romanes in his article for the *Encyclopedia*, but he never read what Mendel had done.

Did Darwin miss the significance of this one jewel out of the many plant hybrid papers that were being published at the time? He could have easily checked the results for himself. Darwin had personally done and was still doing large numbers of plant breeding experiments using more than 50 plant species including the edible pea, orchid, snapdragon, flax, primrose, etc., but never with the idea of primarily studying the transmission of plant characters. He was more interested in the problem of hybrid vigour and its role for evolution. His main question was whether seeds from cross-fertilized flowers would produce superior plants than seeds derived from self-fertilized flowers. It seems he never thought of performing plant breeding experiments to check the results of Mendel, even though he had the required skill, knowledge, resources and the patience to do this sort of work. In his book on *The variation of animals and plants under domestication* (1868) he wrote that he had planted 41 varieties of English and French edible pea to study the extent of their variation. He observed the variations that Mendel had studied: smooth vs. wrinkled peas; tall plants vs. short ones; differences in flower colour, etc.; but he

did not study any hybrids. However, he did do crosses using the common snapdragon with the rarer (peloric) form. In the second generation of hybrids that he obtained, he counted 90 to be the common variety (with two as an intermediate type) and 37 to be the rarer form. He thus obtained a ratio very close to 3:1; but he made no comments on this. Darwin was still thinking along the lines of blending inheritance where one would never expect to get constant ratios in the inheritance of parental traits. And he held this view until his death in 1882.

The unsolved mystery therefore remains: did Darwin actually receive a copy of Mendel's article? And if so did he bother to read it? A catalogue of Darwin's library from Down House published in 1908 (that is 26 years after Darwin's death) did not record any of Mendel's papers. However after Darwin's death in 1882 his scientific library passed to his son Francis. Down House was cleared of its contents in 1896 following the death of Emma Darwin and the house then leased to a school. Francis Darwin later bequeathed the library to the Professor of Botany at Cambridge University and a catalogue of the library was prepared by H.W. Rutherford (the one published in 1908). There was thus ample time for small items to go astray.

The catalogue did record the presence of Focke's and Hoffmann's books; and the former mentions Mendel's claim to have found 'constant numerical relationships' among the different phenotypes of the F₂ generation of the edible pea.

Even if Darwin had received Mendel's reprint did he read it? He was not sympathetic to a mathematical presentation of data and Mendel's paper was full of algebraic reasoning. If he did read it there is no evidence that Mendel's analysis influenced Darwin's firmly held views on blending inheritance. This might have held up the progress of genetics for Darwin's colleagues in England (G. Romanes, T.H. Huxley, F. Galton, etc.) for at least two decades.

David Galton

Further reading

Curt S, Sherwood ER. *The Origin of Genetics: A Mendel Source Book*. San Francisco, W H Freeman, 1966.

Henig RM. *A Monk and Two Peas*. London, Phoenix, 2001.

She writes that a reprint was sent to Darwin and she obtained her information about this from Anna Matlova, who was director of the previously named

Mendel Museum in Brunn. Of course sending a reprint is not the same as receiving one.
Iltis H. *Life of Mendel*. New York, Norton, 1932.
Mendel GJ. *Versuche uber Pflanzen-Hybriden. Verk naturf. Ver in Brunn; band iv 1865*. English translation in *J R Hortic Soc* 1901 and in Bateson W. *Mendel's Principles of Heredity*. Cambridge, Cambridge University Press, 1902.

Olby RC. *Origins of Mendelism*. Chicago, University of Chicago Press, 1985.
Olby R, Gantrey P. Eleven references to Mendel before 1900. *Ann Sci* 1968; **24**:7–20. This is a scholarly account of the uptake of Mendel's work before 1900.
Orel V. *Gregor Mendel: The First Geneticist*. Oxford, Oxford University Press, 1996.