

**Jiří Sekerák \***

## **Gregor Mendel and the scientific milieu of his discovery \*\***

MENDEL IS THE DISCOVERER of elements of inheritance (i. e. genetic information) and the author of the first model of the transfer of genetic information from generation to generation.

Mendel published his discovery in the Natural Science Research Society in Brno in two meetings on serialization in 1865. His classic paper *Versuche über Pflanzen-Hybriden* (Experiments in Plant Hybrids) was printed in the annual volume of that Society in 1866. In 1865 the Natural Science Society distributed its annual volume to more than to 130 scientific institutions in Europe and overseas. To Vienna, e. g., the annual volumes with Mendel's paper were sent to the Royal and Imperial Academy of Sciences, R. I. Institute of Geology, R. I. Central Institute of Meteorology, R. I. Society of Geography, R. I. Society of Zoology and Botany, R. I. Alpine Society. In Berlin Mendel's paper was sent to Royal Academy of Sciences, Botanical Society of Brandenburg Province, German Geological Society, Society for the Improvement of Horticulture in Prussia, Society for General Knowledge on Earth, Society of Physics. In Wrocław the annual volume was addressed to Silesian Society for Culture of the Country, Silesian Central Society of Horticulture, Society of Arts and Industry.

Of interest are also personalities and institutions to whom Mendel sent his reprints. In this connection it may be interesting to point to the origin of the Natural Science Society in Brno in 1861.<sup>1</sup> It was founded by the members of the former Natural Science Section of the Agriculture Society in Brno who aimed at theoretical explanation of natural phenomena and changes in Nature. In the opening of the Natural Science Research Society its author stressed the necessity of abandoning speculations and starting research, of abandoning vague words and beginning to create a new terminology.

The modern science laid the foundations to European technical culture. From the viewpoint of the history of science it is important to study the interactions of ideas in the community of modern 19<sup>th</sup> century scientists. The spectrum of positions may disclose the aims of scientific endeavour, origin and development of institutions and progressive methods that were basic for the development.

In Moravia natural science became definitely institutionalized at the beginning of the 19<sup>th</sup> century following the era of the humanistic, patriotic, freemason, secret, semi-secret and private societies.<sup>2</sup> Already in July 1770 Moravian Agriculture Society (*Agricultur Societät in dem Markgrafthume Mähren*) was formed followed by a constitution of the Silesian Society later in August in the same year. At universities the revolution of science and technology was marked by the introduction of natural sciences instead of cultivating the Aristotelian tradition. The supporters of the concept of science as might were mostly influenced by the Enlightenment and humanity movement. The progress of science was supposed to improve the social status of the individual generally. Science was considered as an important factor in achieving freedom of the society against superstition, fanaticism, intolerance and stagnation. The vision of a free and open society was considered a driving force for a creative milieu that was first developed in learned societies.

In Brno a private Moravian Society for Nature Science and Knowledge of the Country (*Mährische Gesellschaft der Natur und Vaterlandskunde*) was established mostly by former illuminates and free masons. In 1799 a private Society of Friends of Nature Science and Knowledge of the Country

---

\* Mendelianum Musei Moraviae, Brno, Czech Republic; email: [genetika@mzm.cz](mailto:genetika@mzm.cz).

\*\* Supported by the IZ MK00009486202.

<sup>1</sup> Orel V., "Die Auseinandersetzung um die Organisation der Brünnener Naturforscher in der Zeit, da G. Mendel seine Pisum-Versuche durchführte", *Folia Mendeliana*, vol. 5 (1969), p. 55–72.

<sup>2</sup> See Kroupa J., *Alchymie štěstí* (Kroměříž a Brno, 1987).

(Freunde der Natur- und Vaterlandskunde) originated by former rosicrutians. However, the first societies were extremely formal and bureaucratic. The Brno scientific milieu underwent a reform controlled by Count J. N. Mittrovsky who elaborated the guidelines of empirical and analytical research by the end of the 18<sup>th</sup> century. In this scientific milieu mineralogy and botany became established. They were considered as a path to exploitation of a potential source of wealth of the country. Inventories of minerals and plants were made. Musea became the depositories of the riches of Nature. Implementation of machines especially in mining and textile production accelerated the trade and dissemination of ideas in new practical appliances. The opening of the society aimed at changing the mind of people who hindered technological and scientific progress. The most conservative circles were losing their social influence. The invitation of foreign scientists and managers to participate in the introduction of new centres of research and industrial production played a major role in the industrialization of Moravia. One of the invited managers was e. g. the mineralogist Christian Carl André (1763–1831) from Saxony who in 1806 assisted to Count H. F. Salm-Reifferscheidt in Brno to unite learned societies under the éguide of the Royal and Imperial Moravian Association for Improvement of Agriculture, Knowledge of Nature and of the Country (Königlich-kaiserlich Mährische Gesellschaft zur Beförderung des Ackerbaues, der Natur- und Landeskunde). The Agriculture Society was oriented economically. In 1811 Silesia joined the Moravian Society that extended its radius of activity to the Moravian and Silesian Society.

Having gathered valuable experience with publishing journals *Patriotisches Tagesblatt* and *Hesperus*, André started to publish *Oekonomische Neuigkeiten und Verhandlungen* in Brno in 1811. The journal reported about the latest achievements of science and technology. André developed an international body of reporters that guaranteed the exchange of ideas among the individuals and the societies. *Oekonomische Neuigkeiten und Verhandlungen* are considered the most popular German speaking economical journal in Central Europe (OREL, 29). The capitalist basis of textile and machinery in Brno was formally built by the Austrian patriots influenced by the ideas of enlightenment. Feudal estates profited from sheep breeding supplying wool for textile factories. Brno could develop to an Austrian Manchester because Maria Theresia lost the textile power of Silesia. André supposed that the new Association would fulfil the role of the academy of sciences in Moravia. According to André the Association was supposed to create scientific atmosphere for such great discoveries as Kopernick's heliocentric system, Watt's steam engine or Diviš' lightning conductor. According to the example of Musée Naturelle in Paris he suggested the establishment of a Moravian regional museum in Brno as a depository and showcase of country's riches and achievements. Research and education were substantial for any academy in those days.

After the revolutionary 1848 year the economic Association underwent restructuralization.<sup>3</sup> Groups of specialized experts were established for branches of the Central Board of the Association comprising agriculture, forestry, horticulture, pomiculture, viniculture, history and statistics and natural sciences. Natural Science Section started its activity in 1850 and had 27 members. It developed creating collections of museal items, diagnostic, descriptive, conservational and depository work in botany, zoology, entomology, mineralogy and geology continuing developing the 18<sup>th</sup> century naturalist conceptions.

In 1861 a conflict arose among young liberal scientists who preferred to investigate and test the logic of Nature as a system experimentally. The leading idea of the time was the concept of individual developmental phases of matter. Mendel reflected the new approach in his discovery paper. The old term FORM was making place to GESTALT and BESCHAFFENHEIT. The elements and the interrelationship of elements in the dynamics of the natural system started to be more important than the elements as such. The experiment were considered to play the major role. Generalizations aimed at concepts based on mathematics and physics. Mathematics and physics were considered exact sciences based on theoretical models. Chemistry was making its way to an independent and self-contained natural science. Its position of aid science to physics has been overcome with help of progress in the experimental work in laboratories. Much of the experimental evidence of physicists was exploited in practice.

---

<sup>3</sup> See Šohajková M., "Natural Science Society (Naturforschender Verein) – an important Moravian learning center", *Folia Mendeliana* vol. 35–36 (2000–2001), p. 5–19.

Specialization of scientific branches needed new scientific language for communication among scientists. The vocabulary of theologically and philosophically speculations describing the microworld and cosmos were found insufficient for the scientific era. Microscopes and telescopes searching for new structures symbolized new approach of studying Nature.

The clash of the old and the new approach in studying Nature can be illustrated with the obstructions Unger had to go through at the University of Vienna at the fifties of the 19<sup>th</sup> century. In the enthusiastic atmosphere of scientific progress especially in cellular studies Professor Franz Unger, the plant physiologist, was appointed teacher at the University of Vienna.<sup>4</sup> Gregor Mendel was Unger's pupil. Unger's provoking *Botanische Briefe* (Botanical Letters) developed the concept of development of the cell through different stadia of the growth of the plant. In 1861 Unger supported the Nature Research Society (*Naturforschender Verein*) as its honorary member. The Nature Research Society in Brno was established mostly from the members of the Natural Science Section (*Naturwissenschaftliche Sektion*). First the conservative Association obstructed the effort of the origin of a liberal society of young naturalists. The transformation of the Natural Science Section of the conservative Association into the liberal Nature Research Society in 1861 brought about the end of the conservative Natural Science Section two years later in May 1863. The papers and protocols of the section were taken over by A. Heinrich, the custodian of the Moravian museum on May 1, 1863.

The liberal Nature Research Society was supported morally and materially by the Brno Mayor Christian d'Elvert. The Mayor of Brno housed the seat of the Society in a new modern state school building in the centre of Brno. It became the meeting place of liberal scientists. Its library and experimental laboratories was an open living place of scientific activities of young enthusiastic scholars from Brno and surroundings. Gregor Mendel was both a member of the Nature Research Society and a teacher of physics and natural science. In the modern school Mendel found the atmosphere of creative activity as a teacher and researcher.

One of the most active members of the liberal Nature Research Society was the director of the school J. Auspitz. He was a political proponent of the German Liberal Party. This may elucidate the non-traditional vote of Gregor Mendel he gave to the proconstitutional Liberal Party in 1870. Neglecting the Conservative Party proves that Mendel remained intellectually connected with the modern school staff even after he had left the school after his being elected abbot in 1868.

Auspitz opened the first meeting of the Nature Research Society stressing that science should no longer occupy a position of a servant. After Auspitz' opening an address by Cal Allé, the second secretary of the Society presented its goals composed in verse. Some of the ideas were typical for the oncoming era as e. g.

*Wir wollen nur den Stoff und seine Kraft ergründen,  
Die Metaphysik bleibt ganz aus dem Spiel;  
Die Regeln fuer den Stoff und seinen Wechsel künden,  
Das ist das ernst uns vorgesteckte Ziel.*

We want only to disclose the matter and its force  
Metaphysics is not our interest  
Our earnest and future goal has been  
to disclose the principles of matter and its phases of development.

As the poem was printed on a separate loose sheet of paper added to the *Verhandlungen* journal of the Nature Research Society, it may be considered as nonconform and provoking.

Financially Mendel payed higher membership fee to the Nature Research Society (30 guilders) than the Royal and Imperial Association (20 guilders).

An impetus for organizing an independent Nature Research Society was given by the High Modern School teaching staff headed by its director Auspitz. The aim was a constitution of freeing science from its submissive position in the monarchy. Mendel's achievement cannot be evaluated

---

<sup>4</sup> Olby R., "C. Franz Unger and the Wiener Kirchenzeitung: An Attack on One of Mendel's Teachers by the Editor of a Catholic Newspaper", *Folia Mendeliana*, vol. 2 (1967), p. 29–37.

without the scientific background of the Nature Research Society. Mendel was one of the founding 17 experts responsible for various scientific branches. Mendel was entrusted with documenting meteorological observations of Moravian and Silesian network of meteorological stations. There were three experts responsible for mineralogy, botany and entomology, two experts for zoology, chemistry, astronomy, mechanics, physics and astronomy, one for metrology, medicine and physiology and natural history. In the first year of its existence the research society had 171 members. They were engaged in effective research, collection making and improvement of education. While the Royal and Imperial Association was represented by honourable feudals and church dignitaries, the research society members was open to people irrespective of their social status.

After the Battle of Austerlitz the horizon of Brno was changing by growing chimneys of factories. The new scientific research group in Brno was internationally communicating with a scientific journal *Verhandlungen des naturforschenden Vereines*. In its fourth volume Mendel published his discovery paper *Experiments in Plant Hybrids*. However, Mendel's work found little echo in and outside the Habsburg monarchy scientists.

The rediscovery of Mendel's paper in 1900 occurred long after Mendel's death. A reasons for this was seen in Mendel's not pushing his work through to the international scientific community. A further reason should be Mendel's publishing his work in an "obscure" journal in a provincial town. Both arguments seem to be untenable. Looking at the mailing list of addressees of the Nature Research Society we can see that the paper was sent to most decisive scientists of his day and the Nature Research Society was not isolated at all.

The annual volumes with Mendel's paper were sent to:<sup>5</sup>

**Austria**, Vienna: *Royal and Imperial Academy of Sciences, R. I. Institute of Geology, R. I. Central Institute of Meteorology, R. I. Society of Geography, R. I. Society of Zoology and Botany, R. I. Alpine Society*; Graze: *Natural Science Society in Steiermark*; Innsbruck: *Ferdinandeam*; Linz: *Francisco-Carolinum Museum*;

**Belgium**, Brussels: *Royal Academy of Sciences*;

**Croatia**, Zagreb: *Croatian-Slavonic Agricultural Society*;

**Czech Republic**, Brno: *Royal and Imperial Moravian and Silesian Agricultural Society, Beekeepers' section of the R. I. Moravian and Silesian Agricultural Society, Werner Society for Geological Research in Moravia and Silesia*; Prague: *Royal Bohemian Scientific Society, Natural History Society "Lotos"*

**Finland**, Helsinki: *Finnish Scientific Society*

**France**, Cherbourg: *Imperial Natural History Society*; Strasbourg: *Natural History Society*;

**Holland**, Amsterdam: *Royal Academy of Sciences*; Utrecht: *Royal Netherlands Institute of Meteorology*;

**Germany**, Berlin: *Royal Academy of Sciences, Botanical Society of Brandenburg Province, German Geological Society, Society for the Improvement of Horticulture in Prussia, Society for General Knowledge on Earth, Society of Physics*; Bonn: *Natural History Society of Rhenish Prussia*; Frankfurt: *Society of Physics, Society of Zoology*; Goettingen: *Royal University, Royal Scientific Society*; Halle: *Nature Research Society*, Hamburg: *Natural Science Society*; Hanover: *Natural History Society*; Heidelberg: *Natural History - Medical Societ*; Mannheim: *Society for Natural Sciences*; Munich: *Royal Academy of Sciences*;

**Great Britain**, London: *Royal Society, Linnean Society*; Greenwich: *Royal Observatory*;

**Hungary**, Budapest: *Royal Hungarian Society for Natural Sciences*;

**Ireland**, Dublin: *Natural History Society*;

---

<sup>5</sup> Selected Mailing list from *Verhandlungen des naturforschenden Vereines in Brünn*, vol. 4 (1865), *Abhandlungen*, p. 3–4.

**Italy**, Palermo: *Royal Institute for Support of Agriculture, Arts and Manufacture*; Venice: *Royal Institute for Sciences*;

**Latvia**, Riga: *Nature Research Society*;

**Poland**, Gdansk: *Nature Research Society*; Wrocław: *Silesian Society for Culture of the Country, Silesian Central Society of Horticulture, Society of Arts and Industry*;

**Romania**, Sibiu: *Romanian Natural History Society*;

**Russia**, Moscow: *Imperial Natural History Society*, Saint Petersburg: *Imperial Academy of Sciences*, Kaliningrad: *Royal University*;

**Slovakia**, Bratislava: *Natural Science Society*;

**Sweden**, Stockholm: *Royal Academy of Sciences*; Uppsala: *Royal Academy of Sciences*;

**Switzerland**, Berne: *Nature Research Society*; Basel: *Nature Research Society*; Aarau: *Nature Research Society*; Zurich: *University Swiss Nature Research Society*;

**Ukraine**, Lvov: *Royal and Imperial Galician Agricultural Society*;

**USA**, Washington: *The Smithsonian Institution*; Boston: *Society of Natural History*; Philadelphia: *Academy of Natural Sciences*.

Mendel's paper was also sent to the Nature Research Society honorary members such as Professor A. Heinrich, curator of the Moravian museum in Brno, Professor A. Hlasiwetz from the Polytechnical Institute in Vienna, Professor V. Kosteletzky, Professor H. Leonhardi and Professor J. E. Purkyně from the University in Prague, botanist L. Rabenhorst from the university in Dresden, Professor G. Tschermak and Professor F. Unger from the university in Vienna. It would be completely false to think of Mendel as a monk working in seclusion behind the monastic walls.

Mendel had 40 reprints of his paper made and some of them distributed. The most discussed reprint is that sent to C. Naegeli in Munich that was accompanied by Mendel's letter in 1866 that opened scientific correspondence with both of them about the hybrids of plants especially about hawkweed. Personally Mendel sent a reprint to botanist Anton Kerner von Marilaun in Innsbruck, Th. Boveri in Tuebingen, M. W. Beijerinck's reprint of Mendel's paper has been preserved in the Botany Institute of the University in Amsterdam and one has been deposited in the Institute of Systematic Botany of the University of Graz (perhaps Unger's papers). Mendel corrected printing errors in the copies preserved in Vienna, Tuebingen and Graz. Some of his corrections were substantial. It is surprising that mathematical misrepresentation of Mendel's developmental series appeared even in the 20<sup>th</sup> century reprinted version of Mendel's work, such as e. g. Mendel's "=" was printed erroneously as "+".

The belated recognition of Mendel's elementary concept of heredity and variation had been ascribed to many factors (Mendel's passivity, seclusion, publishing his paper in an obscure journal, Naegeli's obstruction to recognize Mendel's work etc.). I have tried to disprove this in the above considerations about the live societal life in the European countries.

It is not Mendel's fault that the phenomenon of the 3:1 segregation in the generation of the offspring became a synonymum for his discovery. The views of the scientists of the 20<sup>th</sup> century (mostly geneticists and biologists) were projected counter to the arrow of time into the 19<sup>th</sup> century. As a result it has been accepted that Mendel discovered the gene, some scientist even think Mendel has chromosomes in mind even though Mendel could not see them. Biologists and geneticists gave rise to Mendelism that until much later developed to genetics.<sup>6</sup> Neither Mendelism was identical with Mendel's ideas, nor Darwinism was identical with Darwin's ideas. There is no wonder that Mendelism and Darwinism had to clash in a battle of isms.

Contradictory evaluations of Mendel's achievements have been provoking the historians of science permanently: „According to this view Mendel was not a Mendelian if that term is defined as one who explicitly supports ‘the existence of a finite number of hereditary elements which in the

---

<sup>6</sup> See Olby R. C., “Mendel No Mendelian”, *History of Science*, vol. 17 (1979), p. 53–72.

simplest case is two per hereditary trait, only one of which may enter one germ cell.' (...) On the other hand, if by Mendelian we mean one who treats hereditary transmission in terms of independent character-pairs, and the statistical relations of hybrid progeny as approximations to the combinatorial series, then Mendel surely was a Mendelian."<sup>7</sup> But we have to point out that this concept of interpretation is not possible to identify as "Mendelian" from the historical point of view. Jan Sapp see *Nine Lives of Gregor Mendel*:<sup>8</sup>

1. Mendel was a non-Darwinian. Although Mendel was an evolutionist, he did not entirely agree with Darwin's views and set out to disprove them.
2. Mendel was a good Darwinian. His experimental protocols and reported results can be explained on the assumption that he had no objections to Darwinian selection theory.
3. Mendel was not directly concerned with evolution at all. He placed it on the back burner while he investigated the laws of inheritance.
4. Mendel rejected evolutionary theory.
5. Mendel laid out the laws of inheritance which justifiably carry his name. (Standard view.)
6. Mendel was no Mendelian. He was not trying to discover the laws of inheritance, and several Mendelian principles are lacking in his papers.
7. Some of Mendel's data was falsified.
8. None of Mendel's data was falsified.
9. Mendel's reported experiments set out in his paper of 1866 are wholly fictitious.

The Mendelianum as a workplace for the history of science has been putting Mendel in its original context. We have evaluated Mendelism and antiMendelism to follow the processes of acceptance and evaluation of Mendel's ideas that taught us to understand why Mendel's hereditary concept was not plausible in his day. Now Mendelianum has prepared comments on Mendel's paper showing the interrelationship of Mendel's ideas within the context of the conceptual shift to an open science realized in Brno in the foundation of the Nature Research Society that became Mendel's channel of scientific communication and intellectual home of his research.

---

<sup>7</sup> *Ibid.*

<sup>8</sup> Sapp J., "The Nine Lives of Gregor Mendel", *Experimental Enquiries* (ed. LE GRAND H. E. Netherlands: Kluwer Academic Publishers, 1990), p. 137–166.