

1 **From Gregor Mendel's 1865-lectures to his 1866-masterpiece**

2

3

4

5 Peter J. van Dijk, Keygene N.V., Agro Business Park 90, 6708 PW Wageningen, The Netherlands,

6 peter.van-dijk@keygene.com

7

8

9 and

10

11 T.H. Noel Ellis, Department of Biochemistry and Metabolism, John Innes Centre, Norwich Research

12 Park, Norwich, NR4 7UH, United Kingdom,

13 thnoeellis@gmail.com

14

15

16 **Abstract**

17 The two lectures Gregor Mendel gave in the spring of 1865 to the Natural Science Society in Brno can
18 be considered the ultimate origin of genetics. Here we reconstruct these lectures and their settings
19 using digitized historical newspapers, and we compare these to Mendel's 1866-paper "Experiments
20 on plant hybrids". The newspapers explained to their readers that Mendel used the term "*Hybriden*"
21 in the sense of "*Bastarden*". Naturalists commonly used the latter term to describe hybrids between
22 species in nature. Mendel's use of "*Hybriden*" and the avoidance of "*Bastarden*" in the 1866-paper
23 and early letters to Nägeli regarding *Pisum* are particular. In English translations, both German words
24 are translated as "hybrids" so that Mendel's differentiated use of words is no longer noticeable. We
25 argue that with the use of "*Hybriden*" Mendel did not need to take a position on whether
26 the *Pisum* parental forms were species or varieties, as Mendel considered these as extremes of a
27 continuum. That Mendel probably started his pea crossings as a breeder may also have played a role;
28 "*Hybriden*" was commonly used in horticulture. Mendel's use of "*Hybriden*" was unusual for the
29 naturalists in the Natural Science Society, and newspaper reports indicate that this led to confusion.
30 According to the *Brünner Zeitung*, legumes were not suitable for studies on *hybridisation* because such
31 interspecific hybrids were rare in nature. However, in his 1866-article, Mendel explained that the
32 garden pea was highly suitable for experimental hybridization due to its flower structure. In the
33 Concluding Remarks of the 1866-article, Mendel showed that his findings were relevant for hybrids
34 between wild species by reviewing the work of Gärtner and Kölreuter. We conclude that it is probable
35 that this section was not part of the lectures and was added later to the paper to accommodate points
36 raised in the discussion after the lectures.

37

38 *Introduction*

39 On Wednesday, February 8, and a month later, on Wednesday, March 8, 1865, Gregor Mendel
40 presented the results of his crossing experiments in *Pisum* in two lectures to the Natural Science
41 Society (NSS) in Brünn (nowadays Brno, Czech Republic). These lectures were the climax of the
42 experiments, which he had begun ten years earlier in 1856. The lectures were the only public
43 presentations Mendel made about his pea crosses. Likewise, the long paper “Experiments on Plant
44 hybrids” published in 1866, said to be based on the lectures, was Mendel’s only written report of his
45 results and interpretation; that paper constituted the basis for the science of genetics when it was
46 read and understood in the year 1900. Thus – two lectures alone, presented in one paper, laid the
47 foundation of a revolutionary science.

48 Mendel’s research was unique for the 19th century. Because the 1866 publication did not
49 generate response in his time, and his notes were destroyed after his death in 1884, it is difficult to
50 perceive his thought process and the development of his research programme.

51 We have earlier analysed the central question of *why* Mendel started making his crosses and
52 what he hoped to achieve with them (VAN DIJK *et al.* 2018, VAN DIJK *et al.* 2022). As with all research
53 projects, his questions and approaches changed direction in the course of achieving interesting results.
54 As can be expected, not many of these changes are explicitly described in the resulting paper, but
55 careful analysis of remaining sources can provide some insight into how the research evolved.

56 However, achieving interesting results and presenting them to an understanding audience is
57 very different from getting a paper based on the same results written and published. This is the topic
58 of our concern here: How did Mendel present his results? What were the reactions? How did Mendel
59 himself react to these when finalising his manuscript together with his own insights that he had
60 obtained from presenting and arguing for his results?

61 We have assembled available historical data and added some new pieces of information, to
62 answer some of these questions. We find, as expected, that the standard view that his famous
63 publication copies precisely what Mendel said in his two lectures is incorrect. In the writing of his

64 paper, many factors – internal and external – influenced Mendel. By identifying at least some of them,
65 we get a clearer picture of the making of this scientific masterpiece.

66

67 *The premises*

68 The NSS had been in existence for three years and was founded as an offshoot of the
69 Agricultural Society to promote fundamental science. The monthly meetings of the NSS were held on
70 the second Wednesday of the month in a classroom of the *Realschule* (secondary school), in the center
71 of Brünn, made available by the municipality. The *Realschule* was a new imposing building with 26
72 classrooms in a Florentine palace style (ANONYMOUS 1902) on the Johannesgasse (now *Jánská*),
73 which had opened at the end of 1859. Here, during the day, for 18 to 27 hours per week, Mendel
74 taught natural history and physics as a supply teacher for the second and third grades (WEILING 1991).
75 The society's library and collections were housed in rooms on the third floor and NSS members had
76 the opportunity to consult the collections and the library on Wednesday and Saturday afternoons. The
77 monthly meetings started at 6.00 pm and ended between 8.30 pm and 9.00 pm. The meetings were
78 held in German and announced in the German newspapers *Neuigkeiten*, the *Brünner Zeitung* and the
79 *Mährischer Correspondent* and in the Czech newspaper *Moravská Orlice*.

80 How many members attended the monthly meetings? The annual report of 1866 stated that
81 always 1/4 to 1/3 of the members living in Brünn were present. In 1865 there were 161 members from
82 Brünn, equating to 40-55 participants. As there was a steady increase in 1866, the average number of
83 participants by the beginning of 1865 would have been around 40. The meetings started with a
84 housekeeping section listing the new books and journals for the library obtained through exchanges
85 with other societies or donations from individual members. This was followed by an overview of new
86 acquisitions for the collections of animals, plants, rocks, and minerals. Then there was time for one
87 main or several shorter lectures. The topics of these were diverse.

88 In the early years of the NSS, nearly all lectures were given by the executive committee and
89 the board. The following issues were addressed in the three meetings before and after Mendel's

90 lectures. In November: coal deposits, the fluorescence of liquids and solid materials; and newly found
91 plant species in Moravia. In December: new theories in organic chemistry; large-scale production and
92 utilization of magnesium; newly found plant species. It is of particular interest and relevance that in
93 January Alexander Makowsky, Mendel's colleague at the Realschule, spoke about Darwin's theory of
94 "organic creation". In March, after Mendel's second lecture, there was a talk on peculiar stones. In
95 April, there was a lecture on meteors, and in May, a lecture on the mathematical shape of the earth.
96 Demonstration material was often shown at the lectures. Original experimental research, as in
97 Mendel's lectures, was rarely a subject; the lectures mainly covered new developments in a scientific
98 field, or the speaker's findings, for example, of plants or types of rock in Moravia. After the lecture,
99 new members were elected. Generally, a few days later, brief reports of the lectures appeared in the
100 three local German-language newspapers.

101

102 *Earlier descriptions of Mendel's lectures and new material*

103 Hugo Iltis (1924) gave a largely fictitious dramatized description of the two meetings in his
104 1924 Mendel biography¹. He based his account on the recollections of two board members of the NSS,
105 Gustav von Niessl-Mayendorf (1839-1919) and Alexander Makowsky (1833-1908), almost 40 years
106 after the event. In 1966 Joseph Sajner discovered two 1865-reports of the meetings in the local
107 newspaper *Neuigkeiten*. These *Neuigkeiten* articles were discussed by De Beer (1966b), Olby and
108 Gautrey (1968), and lately by Zhang *et al.* (2017). Searching in digitized historical newspapers², we
109 have found additional newspaper reports of the meetings in two other local newspapers: the *Brünner*
110 *Zeitung* and the *Mährischer Correspondent*. We use all these articles to reconstruct the contents of
111 the lectures. We also extracted information from these newspapers about the settings of the lectures.

112

113 *The February lecture*

114 According to the newspapers, Wednesday, February 8, was a sunny and clear day. However,
115 by late afternoon the sky quickly became cloudy. The sun was already setting at 5 pm, and it was minus

116 8.5 degrees Celsius in the evening. The moon was almost full but probably not visible because of the
117 clouds. Brünn's more than 900 street gas lanterns (DEUTSCH 1865) were lit early in the evening by the
118 lamplighters. The newspapers had announced Mendel's lecture on plant hybrids the day before. The
119 *Brünner Zeitung* had written in July 1861 that Mendel was trying "to approach the truth in a practical
120 manner", suggesting that the research he was going to present was not a complete surprise to all
121 attendees. The *Realschule* was in the city centre, less than half an hour's walk from the Augustinian
122 monastery in the suburb Altbrünn, a journey which Mendel made at least twice daily, but Mendel may
123 have used the monastery's carriage this time, especially if more priests came to listen to the lecture.
124 From St. Thomas Abbey, Thomas Bratranek and Benedikt Fogler were members of the society; Abbot
125 Napp, Mendel's patron, and Johann Lindenthal and Alipius Winkelmayr, who assisted Mendel in the
126 pea experiments, may also have been present.

127 Inside, the building was lit with gas lamps. The NSS lectures were held in classroom nr. 7, on
128 the 2nd floor. The stairs will probably have cost Mendel some effort, given his predisposition to
129 corpulence (Mendel reflected on this with self-deprecation two years later in a letter to Nägeli)³.

130 Gradually more listeners arrived, of whom teachers, roughly a third, made up the largest
131 group⁴. All were amateur naturalists, although some, especially the board members, took their hobby
132 very seriously, for example, several were working on the publication of the cryptogam flora of
133 Moravia.

134 For Mendel's first lecture, the chairman was Carl Theimer, the vice-president of the society
135 and a pharmacist in daily life. Theimer was an amateur botanist and three years before, at one of the
136 new society's first meetings in February 1862⁵, had given a lecture on hybrids in the wild
137 Thus, Theimer was knowledgeable concerning the topic of the meeting. The "recent experiments" that
138 Theimer had mentioned in that lecture most likely referred to Gärtner's, described in his 1849
139 standard work, which summarized the results from more than 10,000 artificial plant crosses. Natural
140 plant hybrids were an important topic in the first ten years of the NSS. At the December 1864 meeting,

141 two months before Mendel's first lecture, von Niessl had reported on a *Verbascum Bastard* which he
142 had found in nature in the vicinity of Brünn (VON NIESSL 1864).

143 According to the newspaper *Neuigkeiten*, the February meeting was very well attended, like
144 Makowsky's lecture on Darwin's "organic creation" a month before. The *Mährischer Correspondent*
145 was somewhat less generous and spoke of being "reasonably well attended".

146 Gregor Mendel took the floor for a lecture of probably 1.5 hours at maximum. He had
147 presented his meteorological data in several lectures for the NSS before, but this was his first botanical
148 lecture. He read his lecture from a script, which was later the basis for his 1866-paper (see 2nd letter
149 to Nägeli, CORRENS 1905). He would have explained the numbers, ratios, and formulas using the
150 chalkboard; perhaps he had written them beforehand. Mendel was an experienced teacher with
151 excellent didactic qualities⁶. We can assume that Mendel presented the lecture clearly and that the
152 algebra would have been well understood by the audience⁷.

153 *Neuigkeiten* reported on the meeting two days later, on February 10. Almost a month after
154 the lecture, on March 3, the *Brünner Zeitung* published an extract of the meeting minutes made by
155 the secretary of the NSS, Gustav von Niessl. The *Neuigkeiten* report clearly differs from that and must
156 have been made by an unknown person attending the meeting.

157 The *Brünner Zeitung* texts have, as far as we know, not been discussed previously. They partly
158 overlap and partly complement the *Neuigkeiten* articles. Below we have combined the reports of the
159 first lecture in *Neuigkeiten* (indicated as NK) and the *Brünner Zeitung* (BZ). We also marked in bold
160 some words that are discussed later. The numbers between brackets refer to our comments below
161 the combined reports. For the *Neuigkeiten* articles, we use the translation of Olby and Gautrey (1968),
162 except that we kept the German words "*Hybriden*" and "*Bastarden*" and forms thereof. Both words
163 are translated as "hybrids", but Mendel used these words very specifically, implying that for him they
164 had a different meaning. All other translations are ours.

165 NK: After the reading of the communications received, Herr Professor G. Mendel delivered a
166 long lecture, of special interest to botanists, on plant hybrids raised by artificial fertilization of
167 related species, that is by transfer of the male pollen to the seed plant.

168 BZ: He gave as an introduction a brief historical review of the most important observations
169 and experiments (1) in regard to plant **bastardization** (2).

170 NK: The lecturer emphasised the fact that the fertility of the *Pflanzenhybriden*, or **Bastarde**
171 (2) was proven but did not remain constant, and that these hybrids always tended to revert
172 to the stem species, this reversion being speeded up by repeated artificial fertilisations with
173 the pollen of the stem plants (2).

174 BZ: Subsequently, he presented his own numerous and carefully and successfully conducted
175 experiments that partly agreed with previous observations and partly disagreed.

176 NK: On this point the lecturer drew attention to his experiments carried out over several years
177 with success, which he had made especially with several kinds of pea (*Pisum sativum*, *P.*
178 *saccharatum* and *P. quadratum*)(3)

179 BZ: From his experiments, he drew several very interesting and important conclusions. The
180 observations were mainly made on Papilionaceous plants (**a family that according to well-**
181 **known researchers is not well suited for hybridisation**) (4) and continued for a number of
182 years and numerous generations.

183 NK: [He] exhibited examples from the generations in question, in which characters common
184 to both stem-parents were transmitted reciprocally, but differing characters gave rise to new
185 characters. The differentiating characters of the pea hybrids were seen in the form and colour
186 of the ripe seed and seed coat, in the colour of the flowers, in the form of the ripe pods and
187 their colour when unripe, in the position of the flowers and in the difference in length of the
188 stems. The numerical data with regard to the occurrence of the differentiating characters in
189 the hybrids and their relation to the stem species were worthy of consideration.

190 BZ: The results were so favorable that a number of mathematical formulas for the laws of
191 hybridization could be deduced from them with reasonable accuracy. The lecture was
192 illustrated with numerous samples (especially on fruits and seeds).(5)"

193 NK: That the theme of the lecture was well chosen and the exposition of it entirely satisfactory
194 was shown by the lively participation of the audience."

195 Our remarks to the newspaper reports of the February lecture:

- 196 1. The historical review in the introduction of the 1866-paper is also brief, but the discussion of
197 the work of Kölreuter, Gärtner, and Wichura in the concluding remarks section is extensive.
198 Gärtner (1849) was the standard work on plant hybridization and described both the loss of
199 fertility of hybrids over the generations (p 365 and further) and the reversion of hybrids to the
200 parental types by self-fertilization (p 422 and further) as well as the transformation of one
201 species into another by back-crossing (*Rücksläge, Vorsläge*). Gärtner also noticed that
202 reversion by self-fertilization of the hybrids was a prolonged process (p 460 and 473). The
203 members of the NSS will have been aware of Gärtner's ideas about plant hybridization.
- 204 2. In the German text of the 1866-paper, Mendel used the word "*Hybriden*" with respect to
205 *Pisum*, and only four times the word "*Bastarden*" with respect to studies by others. The
206 specific use of these words suggests that to Mendel these are not synonymous. The word
207 "*Hybriden*" however was unusual for naturalists. Therefore, both newspaper articles begin by
208 mentioning "*Bastarden*", to clarify the subject to their readers. We discuss the different
209 meanings of these two German words more extensively below.
- 210 3. In the 1866-paper Mendel refers to *Pisum sativum*, *P. quadratum* (i.e., round vs wrinkled), *P.*
211 *saccharatum* (i.e., parchmented vs parchmentedless) and *P. umbellatum* (flowers at the apex
212 rather than axillary). As *P. umbellatum* is not mentioned here, Mendel may not have
213 presented that data set.
- 214 4. This sentence in the *Brünner Zeitung* is remarkable because, in his 1866-article, Mendel
215 praised *Pisum* as especially suitable for artificial crossing since the flower structure minimizes

216 the risk of contamination by foreign pollen. The *Brünner Zeitung* criticism referred to natural
217 hybrids, which are rare in the large legume family (Leguminosae or Fabaceae; the
218 Papilionaceae are a subfamily that includes the genus *Pisum*). There seems to be a mismatch
219 between Mendel's interests and those of the members of the NSS. We will discuss this in more
220 detail below.

221 5. Mendel thus illustrated his talk with different new combinations of pea seed and pod
222 characteristics in different generations, presumably of dried material, unless Mendel had
223 grown some plants in his glasshouse specifically for the purpose of this illustration. For
224 example, one progenitor variety with yellow round seeds, when crossed with another with
225 green wrinkled seeds; formed a hybrid with yellow round seeds, and the progeny of the selfed
226 hybrid generated yellow round, yellow wrinkled, green round, and green wrinkled seeds. The
227 pod ("fruit") samples will have varied in the shape of the mature dried pod: inflated or
228 constricted. The time of the year probably would not have allowed other traits, like flower
229 colour, to be shown without some special effort in the glasshouse to produce plants for
230 illustration, although, as Mendel noted, some seed colour characters are a pleiotropic feature
231 of flower colour.

232 At the next month's meeting, Mendel would give a cell biological explanation for the "mathematical
233 formulas for the laws of hybridization".

234

235 *The March lecture*

236 One month later, on Wednesday, March 8, it snowed all morning heavily. The snow was
237 almost 20 centimeters deep in the fields at eight o'clock in the morning. The snow melted away in the
238 city. During the day, the temperature fluctuated around freezing. Due to the melting snow, the water
239 in the streams and rivers had swollen considerably. The sun was setting at a quarter to six. In the
240 evening, it started to snow again, but lightly. Due to the bad weather, the monthly meeting was only
241 moderately attended (*Mährischer Correspondent* 03-10-1865), so there were probably not more than

242 20 people⁸. That day there was another scheduled lecture by Makowsky, so Mendel's second lecture
243 will have been shorter than the first one. His second lecture focused on fertilization and pollen
244 hypothesis (cell theory). It is plausible that Mendel had discussed this topic intensely with his friend
245 Johann Nave (VAN DIJK *et al.*, 2022). However, Nave had died of tuberculosis in November 1864, only
246 a few months before the lectures.

247 The reports from *Neuigkeiten* (two days later) and *Mährischer Correspondent* (MC, three days
248 later) were short. The *Brünner Zeitung* report, one and a half weeks after the meeting, discussed the
249 content in more detail. The combined report reads as follows:

250 MC: Professor G. Mendel finished his lecture on plant hybrids. Before he gave his lecture, he
251 spoke of the cell and of the reproduction of plants by fertilization (1).

252 NK: Taking up the thread of last month's lecture, he spoke about cell formation, fertilization
253 and seed production (2) in general, and in the case of hybrids in particular, alluding to his
254 experiments undertaken with as much care as success, which he declared he would continue
255 next summer.

256 BZ: Professor G. Mendel finished his lecture on plant hybrids. He discussed the views on their
257 origin and formation, as well as the cross-fertilization, multiplication, and reproduction of
258 hybrids. The lecturer clearly reviewed the most recent research findings on the genesis and
259 development of the plant germ in general and sought to apply them to the formation of the
260 hybrids. He developed a hypothesis concerning the factors involved in this process, which,
261 confirmed by a large number of meaningful and highly successful experiments, could
262 significantly contribute to the elucidation of this hitherto inaccurately observed process.
263 Professor Mendel intends to continue his investigations into this subject and publish the
264 results in the proceedings of the Natural Science Society.

265 NK: At the end he said that in the last few years he had also undertaken artificial fertilisations
266 with many other related plants, which he named, in order to raise ***Bastarden***, and he felt

267 encouraged by the favourable results achieved not only to experiment further with such
268 **Bastardierungen**, but also to offer detailed reports. (3)

269 NK: Herr Professor von Niessl added to this lecture which was very well received that with the
270 aid of the microscope he had observed hybridisations in fungi, mosses and algae, and that
271 further observations of this kind not only supported existing hypotheses but will also give
272 further interesting clarifications."

273

274 Remarks on the newspaper reports of the March lecture:

275 1. The first two sentences are from the *Mährischer Correspondent* and indicate that Mendel first
276 gave an introduction about cells and fertilization before he presented his own experiments
277 and results.

278 2. In the mid-1850s, it was clear that the embryo did not arise from the extremity of the pollen
279 tube, as Schleiden had hypothesized, and which was incompatible with Mendel's results, as
280 Mendel discussed in the 1866-paper. In contrast, the general opinion was that the embryo
281 developed from the egg cell after the pollen tube made contact. The nature of this interaction
282 remained a mystery for decades. It was thought that the pollen tube tip might contain
283 spermatozoa, or possibly small openings in the membranes allowed the mixing of the pollen's
284 fertilizing substance with the contents of the germinal vesicle, or it may have been diffusion
285 through intact cell membranes (SACHS 1875). That the nucleus of the pollen tube would enter
286 the embryo sac and fuse with the egg cell's nucleus was not known until much later, with the
287 aid of better microscopes and staining methods (1884, STRASBURGER). In the 1866-paper,
288 Mendel proposed that characters for which plants had alternative forms (such as tall or dwarf)
289 could be represented by '*Elemente*', and these would be different in different true-breeding
290 lines. Because the offspring of hybrids between such true-breeding lines again had either one
291 or the other form, Mendel concluded that **both** types of '*Elemente*' must be present in F1
292 hybrids but that the pollen and egg cells of a hybrid could only contain **one** type of element

293 and that the types of reproductive cells would be formed in equal number. He also deduced
294 that one pollen grain united with one egg cell at random, which would produce a ground cell
295 from which the offspring plant would develop. This was entirely correct but completely new
296 in Mendel's time. Mendel tested these assumptions by three specific crosses and concluded
297 that his algebraic series "found rationale and explanation in the proven proposition" [p 32,
298 MENDEL 2016].

299 3. Three months later, at the June 1865 meeting, Mendel presented living *Verbascum*, and
300 *Campanula* interspecific hybrids obtained by artificial fertilization. The parent plants must
301 have been crossed the year before (in 1864), in accordance with the *Neuigkeiten* report.
302 Mendel also describes these hybrids in his third letter to Nägeli. Note that the newspaper now
303 uses the word "*Bastarden*" for these interspecific hybrids, whereas in the pea text above,
304 "*Hybriden*" is used. Olby and Gautrey (1968) translate "*Bastarden*" in this sentence with
305 "hybrids" thereby losing the distinction.

306

307 *The reception of Mendel's lectures*

308 Itlis wrote about the reception of the lectures: "The minutes of the meeting inform us that
309 there were neither questions nor discussion." (ILTIS 1965, p178). This explains why the *Brünner*
310 *Zeitung* article, based on these minutes, was silent about the discussion. In contrast, *Neuigkeiten*
311 commented on the discussion at the first meeting: "That the lecture's topic was a good one and that
312 the execution of it was a completely satisfactory one was proven by the active participation of the
313 audience." Mendel commented on the reception of his lectures in his second letter to Nägeli: "[I]
314 discussed the *Pisum* experiments at the meeting of the local society of naturalists. I encountered, as
315 was to be expected, divided opinion" (PITERNICK AND PITERNICK 1950). This also suggests that there
316 was a discussion about the lectures, although the discussion was not recorded in the minutes.

317 According to Richter (1941), Makowsky had told Itlis that the audience's reaction was "ridicule
318 and laughter" (*Spott und Gelächter*), but Itlis does not write about this himself⁹. Some later authors

319 have mentioned this in their Mendel publications (WEILING 1966, GUSTAFSSON 1969). Eichling, a seed
320 company representative, visited Mendel in Brünn in 1878 after first meeting with a client (EICHLING
321 1942). This client stated "while Mendel was one of the best beloved clerics in Brünn, not a soul
322 believed his experiments were anything more than a pastime, and his theories anything more than
323 the maunderings of a charming putterer". However, Mendel's obituary published by *Neuigkeiten* in
324 January 1884 called his plant research "epochmaking", arguing against the idea that Mendel was not
325 taken seriously.

326 It is interesting to recall another historical gathering of great significance: the reading of
327 Darwin and Wallace's essays on evolution by natural selection at the Linnean Society of London
328 meeting on Thursday, July 1, 1858. The essays were communicated by Darwin's friends Lyell and
329 Hooker and read by the secretary (DARWIN AND WALLACE 1858). Then there was no discussion
330 afterward because the ideas were too innovative (DARWIN 1887). The president of the society,
331 Thomas Bell, made in his 1859 presidential address the famous misjudgment: "The year which has
332 passed has not, indeed, been marked by any of those striking discoveries which at once revolutionize,
333 so to speak, the department of science on which they bear." (BELL 1859)¹⁰. Mendel's ideas may also
334 have been too new and original to bring about much discussion.

335 Another important factor determining the reception of the lectures will have been the interest
336 of the audience. Adolf Oborny, a fellow teacher of Mendel's at the *Realschule*, a *Hieracium*
337 (hawkweed) expert, and a member of the NSS since its foundation in 1861, reflected on the lectures
338 in 1922 in general terms:

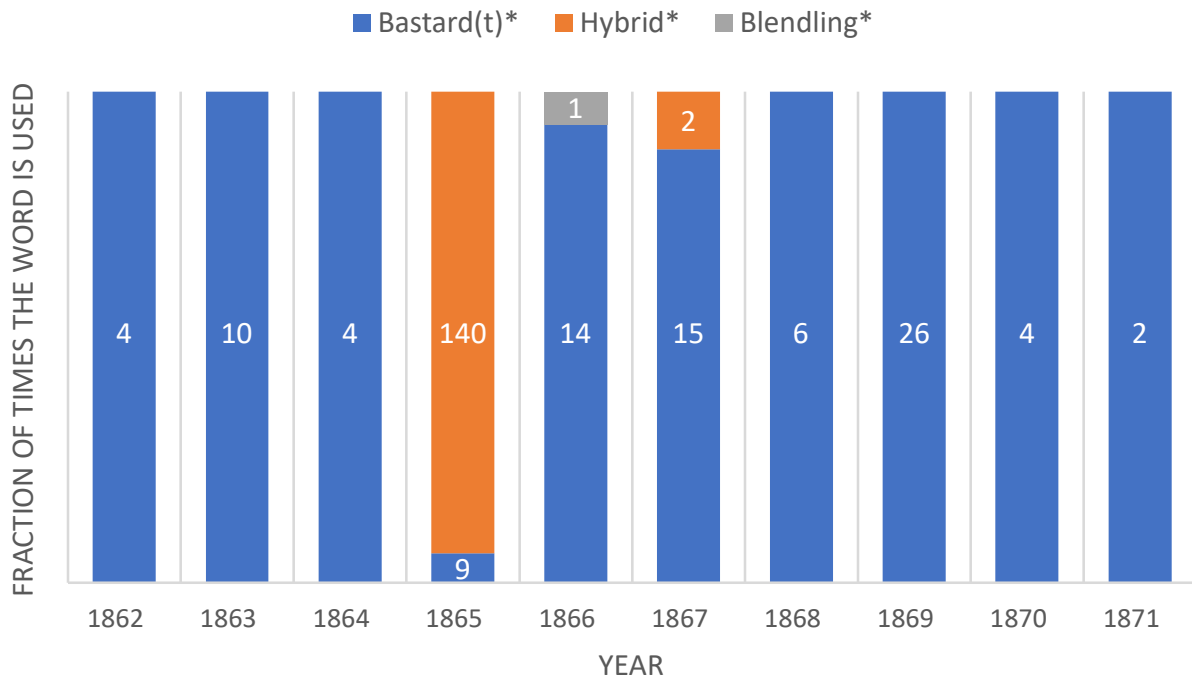
339 "Among his [Mendel's] close circle of friends at home, nobody had been involved in biological
340 studies. The botanists and zoologists were mainly taxonomists, and many of them will have
341 been astonished that Mendel restricted himself to the narrow range of some cultivated
342 species, such as peas, beans, *Aquilegia*, *Dianthus*, and *Nicotiana* species, and to a few wild
343 species." (OBORNY 1922)(see the appendix for the original German text)¹¹

344 As Mendel was requested to submit a manuscript for the Proceedings of the NSS, it is evident
345 that the board was convinced of the importance of Mendel's work. However, as is explained below,
346 parts of the concluding remarks are likely to have been added after the lectures, to meet the interest
347 of the members of the NSS.

348

349 *Confusion about "Hybriden" and "Bastarden"*

350 In the 1866 paper, Mendel consistently used the word "*Hybriden*" with respect to peas.
351 "*Bastarden*" was used only two times to describe the work of others; the members of the NSS were
352 interested in hybrids between species in the wild and therefore "*Bastarden*". The Proceedings of the
353 NSS contain reports of the topics at the monthly meetings and articles, such as that of Mendel from
354 1866. In the first ten years since the founding of the NSS hybridization was a frequently recurring topic.
355 Figure 1 shows the number of times the words "*Bastarden*" and "*Hybriden*" were used per year
356 between 1862 and 1871. The term "*Bastarden*" (or variants thereof) is used 61 times, whereas, if we
357 exclude Mendel's 1866 paper, the word "*Hybriden*" (or variants thereof) is used only twice. These two
358 instances of the use of "*Hybriden*" are in a paper about a supposed wild fern hybrid *Asplenium*
359 *adulterinum*, however in that paper "*Bastarden*" is used much more frequently (14 times, VON NIESSL
360 1868). The naturalists were interested in interspecific hybrids and used "*Bastarden*" to indicate a
361 morphologically intermediate growth form of a hybrid between two species growing in the wild. They
362 were not interested in intraspecific hybrids between varieties (NEILREICH 1851).



363

364 Figure 1. The use of the German words "*Bastarden*", "*Hybriden*" and "*Blendlingen*" and variants thereof in the first 10 volumes
 365 of the Proceedings of the NSS. The coloured bar is scaled to the fraction of usage and the actual number is given. Note that
 366 the proceedings were published one year later. For example, Mendel's *Pisum* paper appeared in Volume IV (1865), which
 367 was published in 1866. Mendel's use of "*Hybriden*" is very exceptional. The frequent use of "*Bastarden*" in 1869 is due to
 368 Mendel's *Hieracium* paper. Searches were performed with the search function in the Biodiversity Heritage Library.

369

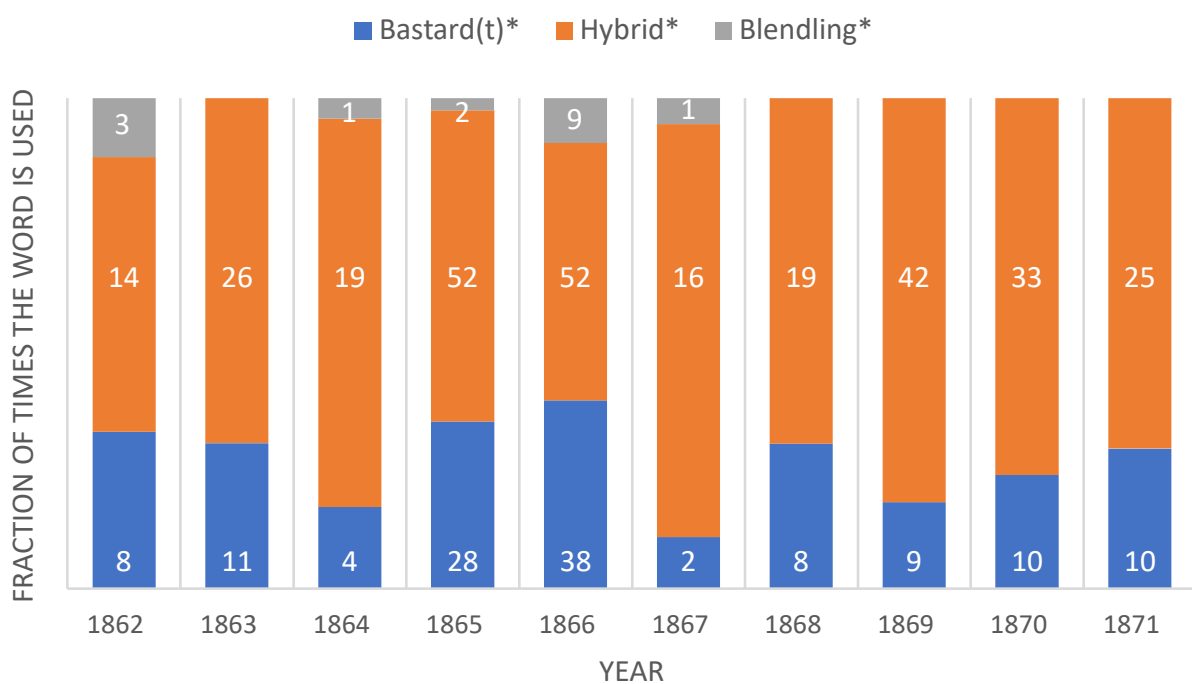
370 Mendel's use of "*Hybriden*" in his 1866 paper was thus very unusual for the naturalists of the NSS.
 371 In the two spring lectures of 1865, he also used "*Hybriden*". Both *Neuigkeiten* and the *Brünner Zeitung*
 372 felt it necessary to clarify that this was the same as "*Bastarden*". Since Mendel used the term
 373 "*Hybriden*" that was uncommon for naturalists, there must have been a difference between them.
 374 One reason could be that "*Bastarden*" were often considered to be hybrids between species. For
 375 example, the German translation of Darwin's *Origin*, of which Mendel possessed a copy, used the word
 376 "*Bastarden*" for hybrids between species and "*Blendlingen*", for hybrids between varieties (Darwin
 377 1863). Focke (1881) in his monumental reference work on plant hybrids (*Die Pflanzen-mischlinge*), also
 378 defined "*Bastarden*" as hybrids between two species and *Blendlingen* as hybrids between varieties.
 379 "*Hybriden*" however could be used to describe both inter and intraspecific hybrids (Focke 1881).

380 In the 1866 paper, Mendel leaves it open whether his *Pisum* forms were species or varieties:

381 "Incidentally, to the experiments in question, the hierarchical position that one assigns to them
382 [the various types of pea] in the system is of no concern at all. As little as one can draw a sharp
383 distinguishing line between species and varieties, so little has anyone succeeded so far to establish a
384 thorough difference between the hybrids of species and varieties." (MENDEL 2016, p6)

385 Mendel's use of "*Hybriden*" avoided the problem of the taxonomic rank of the pea forms.

386 Mendel's use of the word "*Hybriden*" instead of "*Bastarden*" may also reflect the fact that Mendel
387 initiated his experiments for breeding peas as a vegetable crop (VAN DIJK *et al.* 2022). In horticulture,
388 where artificial crosses were made, it was more common to speak of "*Hybriden*" than of "*Bastarden*"
389 (see, for example, *Hamburger Garten- und Blumenzeitung* (Figure 2). Neither botanists nor
390 horticulturalists commonly used *Blendlingen*.



391

392 Figure 2. The use of the German words "*Bastarden*" and "*Hybriden*" and variants thereof in the same period as Figure 1
393 (1862-1871) in volumes of the horticultural journal *Hamburger Garten- und Blumenzeitung*. Searches were performed with
394 the search function in Google Books.

395

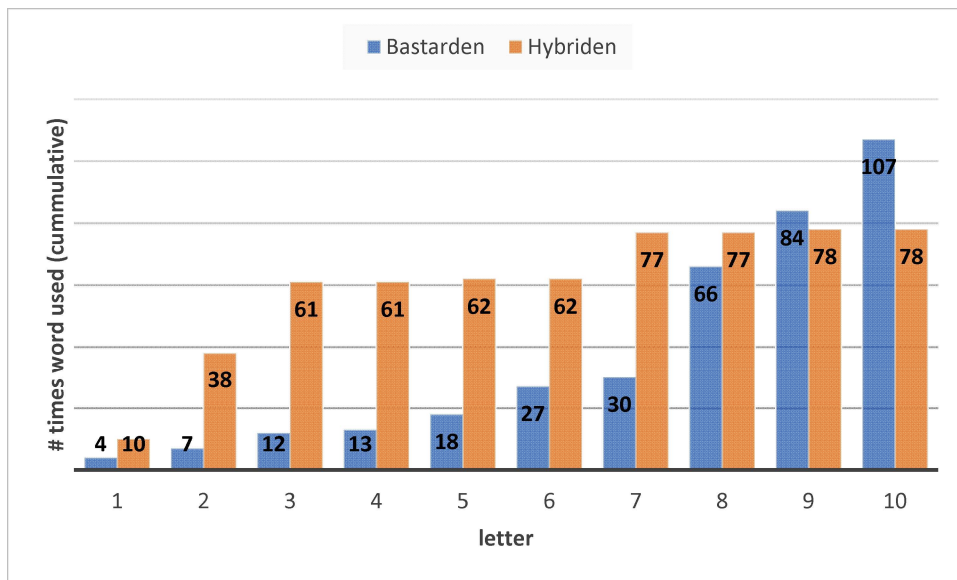
396 Also, in his letters to Nägeli (CORRENS 1905), Mendel uses "*Hybriden*" and "*Bastarden*" differently
397 (Figure 3). Consistent with the newspaper reports of the lectures and the 1866-paper, in his early
398 letters to Nägeli, dealing with mainly *Pisum*, Mendel almost exclusively uses "*Hybriden*". In contrast,
399 in his later letters, dealing with *Hieracium*, Mendel exclusively uses "*Bastarden*", probably because
400 here he was crossing wild plant species, instead of cultivated forms. In the title and text of the 1870
401 paper "On some *Hieracium-Bastarde* obtained by experimental fertilization" Mendel only uses the
402 word "*Bastarden*" (see Figure 1, the year 1869).

403 Mendel's use of "*Hybriden*" was correct but was unusual for the members of the NSS and led to
404 confusion. This is reflected in the *Brünner Zeitung's* comment about Mendel's first reading that
405 "according to well-known researchers, Papilionaceous plants were not well suited for hybridization".
406 In contrast, in the 1866-paper, Mendel argued that the Leguminosae were particularly convenient for
407 his experiments, due to their special flower structure.

408 Who were these prominent researchers that the *Brünner Zeitung* referred to? Certainly,
409 Gärtner, who wrote: "Incidentally, the reluctance of legumes to produce hybrids does not seem to us
410 to be at all in doubt" (GÄRTNER 1849). Gärtner had even stated that successful crosses between pea
411 varieties such as those Mendel made should not be considered as evidence for *Bastardization* in the
412 legume family: "Indeed, the combinations of the different varieties of *Pisum sativum* succeed easily
413 and perfectly but these are mere varieties and not pure species (p 173)". About the same time as
414 Mendel's lectures, other prominent botanists also wrote that hybridization in the legume family was
415 rare (KERNER 1865; NÄGELI 1866).

416 In the section "Selection of the Experimental Plants" of the 1866 article, Mendel wrote that
417 *Pisum* fulfilled all the requirements of a plant suitable for experimental hybridization. "The
418 experimental plants must of necessity: 1. Possess constantly differing traits, 2. Their hybrids must be
419 protected, or be easily protectable, from the influence of all alien pollen during the flowering period,
420 3. Hybrids and their descendants should suffer no noticeable disturbance in their fertility in successive
421 generations On account of their particular flower structure, particular attention was paid to the

422 Leguminosae right from the start. Experiments which were performed on several members of this
 423 family led to the result that the genus *Pisum* sufficiently meets the posited requirements." (MENDEL
 424 2016, p5). The hybridization comment in the *Brünner Zeitung* suggests that Mendel did not mention
 425 this advantage in his lectures.
 426



427
 428 Figure 3. Mendel's use of the words "*Hybriden*" and "*Bastarden*" in the ten letters to Nägeli that have
 429 survived (CORRENS 1905), displayed cumulatively. In the first three letters, Mendel mainly uses
 430 "*Hybriden*", rarely "*Bastarden*". In the last three letters, the preferred word use is reversed.

431
 432

433 *Were the Concluding Remarks of the 1866-paper part of the lectures?*

434 If we look at the 1866-paper with the criticism that Leguminosae species were not well suited for
 435 hybridization, there is another striking contrast. In the Concluding Remarks, Mendel discussed
 436 Kölreuter and Gärtner's experiments in detail and showed how his pea findings might explain the
 437 observations of these two hybridizers *e.g.*, reversion (through selfing of the F1) and transformation
 438 (by repeated back-crosses of the F1 to the parents). Kölreuter is mentioned four times in this section
 439 and Gärtner 15 times. If Mendel would have said this during his lectures, the criticism that the
 440 Papilionaceous plants were not well suited for hybridization would be hard to understand. An obvious

441 explanation is that Mendel added this section later to counter the criticisms expressed after the
442 lectures.

443 It, therefore, seems unlikely that the 1866-paper is identical to the content of the lectures Mendel
444 gave. De Beer (1966) concluded that the lecture and the paper were exactly the same because Mendel
445 wrote to Nägeli in his 2nd letter: "The paper presented is an unaltered reprint of the concept for the
446 mentioned lecture..."¹². However, it is important to keep in mind the context of Mendel's remark. In
447 his reply to Mendel's first letter Nägeli wrote that he could not judge Mendel's experiments well
448 because he did not know the experimental details: "I refrain from going into other points of your
449 communications since I could only speak conjecturally without knowing the details of the experiments
450 on which they are based."¹³ When Mendel replied that it was an unaltered reprint of the concept, he
451 referred to the limited details about the experiments; his comment does not necessarily apply to the
452 whole text, for example, to the concluding remarks.

453 From the newspaper reports, it is clear that the long first lecture dealt with the algebraic series
454 and the second short one with the cell biology and fertilization process. Mendel had to present all this
455 within about two hours. The 1866-paper is 45 pages long. We determined the number of words in the
456 German text of the *Versuche* as about 13,200. The normal "Read Out Loud" rate of German in
457 *Microsoft Edge* is 138 words per minute. Therefore, reading the full text of the 1866-paper would take
458 about 1 hour and 35 minutes. This reading speed, although fine for a novel or other forms of
459 entertainment, is too fast for a lecture that also needs thought processing. Since Mendel had to
460 explain his tables, formulas and calculations and demonstrate the pea samples, it is difficult to see
461 how the whole 1866-paper could be presented within two hours. For reasons of limited time alone, it
462 is likely that Mendel did not present the entire last two sections of the 1866 paper (*Experiments with*
463 *Hybrids of Other Species of Plants* and the *Concluding Remarks*) during the lectures.

464

465 *Did Mendel make use of Nägeli (1865) in the Concluding Remarks?*

466 In the first paragraph of the Concluding Remarks of the 1866-paper, Mendel wrote that it
467 would be interesting to compare his results with those of Kölreuter and Gärtner. The last sentence of
468 this paragraph also commented on variety hybrids and species hybrids: "The hybrids from varieties
469 behave just like species-hybrids, except that they possess even greater mutability of conformations
470 and a more pronounced tendency to revert to the parental forms" (MENDEL 2016, p38). The content
471 of this paragraph shows striking similarities to the end of Nägeli's article *Die Bastardbildung im*
472 *Pflanzenreiche* (1865) in which he summarized the work of Kölreuter and Gärtner and tried to draw
473 generalizations (see Appendix). Nägeli had given this lecture on December 15, 1865, in Munich for the
474 Royal Bavarian Academy of Sciences¹⁴. In paragraphs on p438-432, Nägeli described the intermediate
475 form and the two parental forms in the progeny of the hybrid, the comparison between species and
476 variety hybrids, and the greater tendency of the latter to revert to the parental forms. However, most
477 striking is the phrase: "*Diess gilt aber nicht für alle Varietätenbastarde*" ("This, however does not apply
478 to all variety hybrids" p234) which is almost identical to Mendel's "*Das gilt jedoch nicht von allen*
479 *Hybriden ohne Ausnahme*" ("This, however, is not the case with hybrids without exception") and which
480 in both texts refers to the occurrence of non-segregating, constant hybrids. Constant hybrids, "hybrids
481 which remain constant in their descendants and propagate themselves in the same way as pure
482 species." (MENDEL 2016, p40), which Mendel discussed in the paper as a different type from the
483 variable hybrids (such as *Pisum*), were not mentioned in the newspaper reports. This specific phrase
484 in the context of constant hybrids is unlikely to be due to chance. More likely, Mendel had read Nägeli
485 (1865) and used it for his manuscript. This is not unique; elsewhere in the 1866-paper there are also
486 indications for influences by other authors¹⁵.

487 Mendel's manuscript was discussed in the meeting of the NSS board in February 1866
488 (OPPENHEIM 1932). Mendel, therefore, had almost a year after the lectures to complete his
489 manuscript. On the monthly meeting of April 11, the issue of the Proceedings of the Royal Academy
490 of Sciences of Bavaria, 1865, Volume 2, containing Nägeli's *Bastardbildung*, was among the
491 communications received (ANONYMOUS 1867, p19). In it, Nägeli wrote that "[hybridization] sheds

492 some light on reproduction, more specific on how traits from the parents are transmitted to the
493 progeny". This was precisely what Mendel had studied. It is likely that Mendel read Nägeli's
494 *Bastardbildung*, around the end of March, possibly alerted by his friend, Gustav von Niessl, the
495 secretary of the NSS, who also had an interest in hybridization. At the board meeting on June 9, 1866,
496 it was decided to include Mendel's meteorological observations also in the Proceedings of 1866. Thus,
497 the submission deadline had not yet passed in June.

498 Mendel may even have had more time to rewrite his manuscript. On June 26, there was an
499 additional extraordinary monthly meeting because of the Austrian-Prussian war; at this meeting, it
500 was decided to postpone all NSS activities until October. Mendel's letter to his brother-in-law dated
501 31-08-1866 tells us that Brünn was occupied by 50,000 Prussian troops from mid-July till early
502 September (MATALOVÁ 2009). This caused a delay in the publication of the Proceedings, according to
503 the annual meeting report in December 1866 (ANONYMOUS 1867, p71-87). The delay in publishing
504 will have given Mendel the opportunity to modify the manuscript to include some ideas he had read
505 in Nägeli (1866). It is hard to believe that Mendel would not have grasped that opportunity, and the
506 first paragraph of the *Concluding Remarks* suggests that he did.

507 Mendel probably received the reprints shortly before the end of 1866, as he sent a reprint
508 with a long covering letter, explaining his experimental results as well as revealing his future plans, to
509 Nägeli on New Year's Eve. In contrast, the reprint he sent to Kerner the next day had only a short cover
510 letter – a copy of the first formal paragraph of the letter to Nägeli. This reveals Mendel's eagerness to
511 enter into correspondence with Nägeli, a renowned Botany professor interested in inheritance.

512

513 *Conclusion*

514 We have argued that the extensive discussion of interspecific hybrids in the 'Concluding
515 Remarks' section of Mendel's 1866-paper is not consistent with the newspaper reports of his 1865
516 lectures but is consistent with a response to the discussion of his lectures. This proposal suggests that
517 Mendel intended to show that his findings were relevant for hybrids between wild species. It is also

518 striking that the constant hybrids, which "propagate themselves in the same way as pure species."
519 (MENDEL 2016, p40), which Mendel discussed in the paper as a different type from the variable
520 hybrids (such as *Pisum*), are not mentioned in the newspaper reports. Interspecific hybrids, both
521 constant and variable, were of greater interest to the members of the NSS than inter-varietal hybrids,
522 considered as of interest in horticulture. Such a broader relevance may have been required for
523 publication of the manuscript in the NSS journal rather than in a horticultural journal. In conclusion, it
524 is likely that much of the text of the concluding remarks was added after the lectures, and these
525 comments do not indicate the subject for which the pea experiments were initially conducted.

526

527 **Acknowledgements**

528 We are very grateful to Adrienne Jessop, Bengt Bengtsson, and Julie Hofer, for their comments and
529 suggestions on this paper's draft versions and to Franjo Weissing for improving our translations.

530

531 **References**

532 ANONYMOUS, 1862. Verzeichniss der in Oesterreich lebenden Botaniker. Oesterreichische botanische
533 Zeitschrift 12: 395-403.

534 ANONYMOUS, 1863. Meeting on February 12 1862. Verhandlungen des naturforschenden Vereines
535 in Brünn 1: 19.

536 ANONYMOUS, 1866. Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften. Mathematisch-
537 Naturwissenschaftliche Classe Abt. K.K. Hof und Staatdruckerei, Wien.

538 ANONYMOUS, 1867. Verhandlungen des naturforschenden Vereines in Brünn 5: 71-87.

539 ANONYMOUS, 1902. Festschrift zur Erinnerung an die Feier des fünfzigjährigen Bestandes der
540 Deutschen Staats-Oberrealschule in Brünn. Verlage der Schülerlade der deutschen Staats-
541 Oberrealschule, Carl Winiker, Brünn.

542 BATESON, W.,1902. Mendel's principles of heredity: a defence. Cambridge University Press,
543 Cambridge.

544 BELL, T. 1859. Address of Thomas Bell, ESQ, F.R.S., The President, read at the annual meeting of the
545 Linnean Society, on Monday, May 24, 1859. Taylor and Francis, London.

546 DARWIN, C., WALLACE, A., 1858. On the Tendency of Species to form Varieties; and on the
547 Perpetuation of Varieties and Species by Natural Means of Selection. Communicated by C. Lyell and
548 J.D. Hooker. Journal of the Proceedings of the Linnean Society of London. Zoology, 3: 46–62,
549 doi:10.1111/j.1096-3642.1858.tb02500.x

550 DARWIN, C., 1863. Über die Entstehung der Arten im Thier- und Pflanzen-Reich durch natürliche
551 Züchtung, transl. Bronn H. G. E., Schweizerbart'sche Verlagshandlung und Druckerei, Stuttgart.

552 DARWIN, F., 1887. The Life and Letters of Charles Darwin, Vol 1, Murray, London. DE BEER, G., 1966a.
553 Genetics: the centre of science. Proc. R. Soc. Lond. B.164: 154–166.

554 DE BEER, G., 1966. Mendel, Darwin, and Fisher. Addendum. Notes Rec. Roy. Soc. 21: 64–71.

555 DEUTSCH, E., 1865. Führer durch Brünn und Umgebung. Fr. Karafiat, Brünn.

556 https://books.google.nl/books?id=Jek22a-K-cMC&hl=nl&source=gbs_navlinks_s

557 EICHLING, C., 1942 I talked with Mendel. Jour. Heredity 33:243-246.

558 FAIRBANKS D., J., RYTTING B., 2001. Mendelian controversies: a botanical and historical review.
559 Am. J. Bot. 88: 737–752.

560 FAIRBANKS, D., J., ABBOTT, S., 2016. Darwin's influence on Mendel: evidence from a new translation
561 of Mendel's paper. Genetics 204: 401–405.

562 FOCKE, W., O., 1881. Die Pflanzen-Mischlinge. Gebrüder Bornträger, Berlin.

563 GÄRTNER, C., F., 1849, Versuche und Beobachtungen über die Bastarderzeugung im Pflanzenreich.
564 Hering, Stuttgart.

565 GUSTAFSSON, A., 1969. The life of Gregor Johann Mendel - tragic or not? Hereditas 62: 239-258.

566 HOPPE, B., 1971. Die Beziehung zwischen J.G. Mendel und C.W. Nägeli auf Grund neuer Dokumente.
567 Folia Mendeliana 6: 123–138.

568 ILTIS, H., 1924. Gregor Johann Mendel: Leben, Werk und Wirkung. Springer, Berlin.

569 ILTIS, H., 1966. Life of Mendel. (Translated by Paul E. and Paul C. George), Allen and Unwin, London.

570 KERNER, A., 1865. Aus dem botanischen Garten in Innsbruck. Oesterreichische botanische Zeitschrift
571 15: 205-213.

572 MATALOVÁ, A. 2009. Primary sources to Johann Gregor Mendel's early years. Folia Mendeliana 42-43:
573 7-82.

574 MENDEL, G. 2016. Experiments on Plant Hybrids (1866). Translation and commentary by Staffan
575 Müller-Wille and Kersten Hall. British Society for the History of Science Translation Series.
576 <http://www.bsbs.org.uk/bsbs-translations/mendel>.

577 MENDEL, G. 1871. Über einige aus künstlicher Befruchtung gewonnenen Hieracium-Bastarde.
578 Verhandlungen des naturforschenden Vereines in Brünn 8: 26-31.

579 NÄGELI, C., 1865. Die Bastardbildung im Pflanzenreiche. Sitzungsberichte der Königl. Bayerischen
580 Akademie der Wissenschaften, Vol 2: 395-443. F. Straub, München.

581 NEILREICH, A. 1851. über hybride Pflanzen der Wiener Flora. Verhandlungen des Zoologisch-
582 Botanischen Vereins in Wien, 1: 114-131.

583 OBORNY, A., 1922. Erinnerungen an Gregor Mendel. Znaimer Tagblatt, 22-12-1922, p25.

584 OLBY, R., Gautrey, P., 1968. Eleven references to Mendel before 1900. Ann. Sci. 24: 7–20.

585 OPPENHEIM, J., 1932. Aus dem Archiv des Naturforschenden Vereines in Brünn. Tagesbote 19.7.1932.

586 PETERS, J., 1959. Classic Papers in Genetics. Prentice-Hall, London.

587 PITERNICK, L., K., PITERNICK, G., 1950. Mendel, G. 1950. Gregor Mendel's Letters to Carl Nägeli.
588 Genetics, 3: 1–29.

589 RICHTER, O., 1941. 75 Jahre seit Mendels Großtat und Mendels Stellungnahme zu Darwins Werken
590 auf Grund seiner Entdeckungen. Verhandlungen des naturforschenden Vereines in Brünn, 72: 110-
591 173.

592 SACHS, J., 1875. Geschichte de Botanik vom 16. Jahrhundert bis 1860. K. Oldenburg, München.

593 SAJNER, J., 1966. Neue Forschungen über Gregor Mendel. Schriften Ver. Verbreitung naturwiss.
594 Kentnisse in Wien 106: 163 –182.

595 SCHLEIDEN, M., J., 1846. Grundzüge der wissenschaftlichen Botanik. Engelmann, Leipzig.

596 STERN, C., SHERWOOD, E., 1966. The Origin of Genetics. A Mendel Source Book. Freeman, San
597 Francisco.

598 STRASBURGER, E., 1884. Neue Untersuchungen über den Befruchtungsvorgang bei den
599 Phanerogamen, als Grundlage für eine Theorie der Zeugung. Gustav Fischer, Jena.

600 VAN DER POST, C., C., 1866. Overzicht van de boeken, kaarten, penningen enz. ingekomen bij de
601 Koninklijke Akademie van Wetenschappen te Amsterdam, ten geschenke of in ruil ontvangen in de
602 maand mei 1866. De Roever en Kröber, Amsterdam.

603 VAN DIJK, P., J., WEISSING, F., J., ELLIS, T., H., N., 2018. How Mendel's Interest in Inheritance Grew out
604 of Plant Improvement. *Genetics*, 210: 347–355.

605 VAN DIJK, P., J., JESSOP, A., P., ELLIS, T., H., N., 2022. How did Mendel arrive at his discoveries? *Nat.*
606 *Genet.* 54, 926–933.

607 VON NIESSL, G., 1864. Floristic Notes. *Verhandlungen des naturforschenden Vereines in Brünn* 3: 85-
608 88.

609 VON NIESSL, G., 1868. Ueber *Asplenium adulterinum* Milde und sein Vorkommen in Mähren und
610 Böhmen. *Verhandlungen des naturforschenden Vereines in Brünn* 6: 165-176.

611 WEILING, F., 1966. J. G. MENDELS „Versuche über Pflanzen-Hybriden“ und ihre Würdigung in der Zeit
612 bis zu ihrer Wiederentdeckung. *Züchter*, 36: 273-282.

613 WEILING, F., 1991. Historical Study: Johann Gregor Mendel 1822-1884. *American Journal of Medical*
614 *Genetics* 40: 1-25.

615 ZIRKLE, C., 1958. The First Recognized Plant Hybrid? *Journal of Heredity*, Volume 49: 137-138.

616 ZHANG, H., CHEN W., SUN K., 2017. Mendelism: New Insights from Gregor Mendel's Lectures in Brno.
617 *Genetics* 207:1-8. doi: 10.1534/genetics.117.201434.

618 **Appendix**

619 All translations are made by the authors, unless otherwise indicated. In some cases, only the passages
620 about Mendel's lectures are translated. Untranslated parts of the German text are indicated by [.....].

- 621 I. First lecture article in *Neuigkeiten*
- 622 II. First lecture article in the *Brünner Zeitung*
- 623 III. First lecture report in the *Märischer Correspondent*
- 624 IV. Second lecture article in *Neuigkeiten*
- 625 V. Second lecture article in the *Brünner Zeitung*
- 626 VI. Second lecture article in the *Märischer Correspondent*
- 627 VII. Original German text (OBORNY, 1922)
- 628 VIII. Possible influences from Nägeli (1865) on Mendel's 1866-paper

629

630

631

632 **I. First lecture article in *Neuigkeiten* February 10, 1865.**

633 *Nach bekanntgabe der Einlaufe hielt Herr Prof. G. Mendel einen längeren, besonders für Botaniker*
634 *interessanten Vortrag über Pflanzen-hybriden, welche durch künstliche Befruchtungen*
635 *stammverwandten Arten und zwar durch Übertragung des männlichen Blütenstaubes auf die*
636 *Samenpflanze hervorgebracht werden. Er hob dabei hervor, dass die Fruchtbarkeit der*
637 *Pflanzenhybriden, oder Bastarde zwar erwiesen sei, aber nicht konstant bleibe und das dieselben stets*
638 *geneigt waren, zur Stammart rückzukehren, welche Rückkehr eben auch durch wiederholte künstliche*
639 *Befruchtungen mit dem Blütenstaube der Stammpflanzen beschleunigt werden kann. Der*
640 *Vortragende betonte hierauf seine durch mehrere Jahrer mit Erfolg gemachten Versuche die er*
641 *namentlich mit mehreren Erbsengattungen (*Pisum sativum*, *P. sacharatum* und *P. quadratum*)*
642 *anstellte und zeigte die Proben aus bezüglichlichen Generationen vor, wonach gemeinsame Merkmale*
643 *gegenseitig uebergangen waren, Differenzmerkmalen aber ganz neue Charaktere hervorbrachten. Die*

644 *Differenzmerkmalen der Erbsenhybriden zeigten sich im Gestalt, dann Färbung des reifen Samens, und*
645 *der samenschale, in der Farbe der Blüten, in der Form der reifen und in der Farbe der unreifen*
646 *Samenhüllen, in der Stellung der Blüten und im Unterschiede der Achsenlänge. Beachtenswerth*
647 *waren die ziffermaessigen Zusammenstellungen mit Rücksicht auf die eingetretenen Differenz*
648 *Merkmale der Hybriden und deren Verhältnis gegenüber der Stammarten. Dass der Vorwurf des*
649 *Vortrages ein glücklicher und die Durchführung desselben eine ganz befriedigende war, bewies die rege*
650 *Theilnahme des Auditoriums.*

651 *[Über Antrag des Vereins-Ausschusses wurde ferner beschlossen, die Pfarrhauptschule in Weißkirchen*
652 *auf ihre Bitte mit einer Kollektion von Pflanzen und Käfern zu beschenken, dann mit einer Wiener und*
653 *Leipziger Pflanzentauschanstalten behufs Komplettirung der Vereinsherbariums in Verbindung zu*
654 *treten. Der Verein selbst erhielt schließlich durch die Wahl von fünf neuen Mitgliedern einen weiteren*
655 *Zuwachs.]*

656

657 Translation by Olby and Gautrey (1968):

658 After the reading of the communications received, Herr Professor G. Mendel delivered a long
659 lecture, of special interest to botanists, on plant hybrids raised by artificial fertilization of related
660 species, that is by transfer of the male pollen to the seed plant. The lecturer emphasised the fact that
661 the fertility of the plant hybrids [*Pflanzenhybriden*], or crossbreds [*Bastarde*] was proven but did not
662 remain constant, and that these hybrids always tended to revert to the stem species, this reversion
663 being speeded up by repeated artificial fertilisations with the pollen of the stem plants. On this point
664 the lecturer drew attention to his experiments carried out over several years with success, which he
665 had made especially with several kinds of pea (*Pisum sativum*, *P. saccharatum* and *P. quadratum*) and
666 exhibited examples from the generations in question, in which characters common to both stem-
667 parents were transmitted reciprocally, but differing characters gave rise to new characters. The
668 differentiating characters of the pea hybrids were seen in the form and colour of the ripe seed and
669 seed coat, in the colour of the flowers, in the form of the ripe pods and their colour when unripe, in

670 the position of the flowers and in the difference in length of the stems. The numerical data with regard
671 to the occurrence of the differentiating characters in the hybrids and their relation to the stem species
672 were worthy of consideration. That the theme of the lecture was well chosen and the exposition of it
673 entirely satisfactory was shown by the lively participation of the audience.

674

675 **II. First lecture article in the Brünner Zeitung (Brünner Morgenpost) March 6, 1865.**

676 *Monats-Versammlung des Naturforschenden Vereins in Brünn am 8. Februar 1864 [sic!].*

677 *(Auszug aus dem Sitzungsprotokolle)*

678 *[Nach Eröffnung der Sitzung durch den zum ersten Male den Vorsitz führenden Herrn Vicepräsidenten*
679 *C. Theimer und Mittheilung der feit der letzten Versammlung eingegangenen Geschenke und*
680 *Sendungen] hielt Professor G. Mendel den angekündigten Vortrag über Pflanzenhybriden. Derselbe*
681 *gab als Einleitung eine kurze Geschichte der vorzüglichsten in Bezug auf Pflanzenbastardirung*
682 *angestellten beobachtungen und Versuche und die Resultaten derselben, und ging dann auf seine*
683 *selbständigen zahlreichen, mit eben so viel Umsicht als Erfolg angestellten Versuche über, um deren*
684 *zum Theil mit alteren Angaben übereinstimmende, zum Theile abweichende Ergebnisse mitzutheilen*
685 *und aus denselben Reihe höchst interessanter und wichtiger Schlusse zu ziehen. Die einschlägigen*
686 *Beobachtungen würden meist an Papilionaceen (einer selbst nach namhaften Forschern zur*
687 *hybridisation wenig geeigneten Familie) gemacht und durch eine Reihe von Jahren an zahlreichen*
688 *Generationen fortgesetzt, und gaben so günstige Ergebnisse, das aus denselben mit ziemlicher*
689 *Genauigkeit eine Anzahl mathematischer Formeln für die Gesetze der Hybridenbildung gewonnen*
690 *werden könnte. De Vortrag wurde durch zahlreiche Belegfunde (namentlich Früchten und Samen)*
691 *erläutert erklärt. [Auf Antrag des Ausschusses wurde beschlossen, die Pfarrhauptschule in Weißkirchen*
692 *mit Naturalien zu betheilen und zur Vervollständigung des Vereinsherbars mit den*
693 *Pflanzentauschanstalten in Wien und Leipzig in Verbindung zu treten. Als Mitglieder wurden gewählt*
694 *die Herren: Leopold Haupt, Großhändler; Dr. Robert Heym, Secretär der Handelskammer; J. U. Dr. Adolf*

695 *Promber, Finanzprocuraturbeamter; J. ü. Dr. Carl Koch, Bezirksgerichtsadjunct, und Adolf Heißler,*
696 *Sudmeister in Brünn.]*

697

698 (Extract from the minutes of the meeting)

699 *Professor G. Mendel gave the announced lecture on plant hybrids. He gave as an introduction a brief*
700 *historical review of the most important observations and experiments in regard to plant*
701 *bastardization. Subsequently, he presented his own numerous and carefully and successfully*
702 *conducted experiments that partly agreed with previous observations and partly disagreed. From his*
703 *experiments, he drew several very interesting and important conclusions. The observations were*
704 *mainly made on Papilionaceous plants (a family that according to well-known researchers is not well*
705 *suited for hybridization) and continued for a number of years and numerous generations. The results*
706 *were so favorable that a number of mathematical formulas for the laws of hybridization could be*
707 *deduced from them with reasonable accuracy. The lecture was illustrated with numerous samples*
708 *(especially on fruits and seeds).*

709

710 **III. First lecture article in the Mährischer Correspondent, February 10, 1865.**

711 *[Der gestrigen Versammlung von 9 Februar war ziemlich zahlreich besucht. Der Sekretär, Med. Dr.*
712 *Kalmus, berichtete zuerst über die Einlaufe seit der letzten Sitzung; unter den letzteren befanden sich*
713 *auch 1500 Exemplare Conchylien, welche dem Vereine von Herrn Ullepitsch in Kärnten geschenkt*
714 *wurden, und 4000 geordnete Pflanzen-Exemplare welche ein Geschenk des hierortigen Apothekers*
715 *Herrn Theimer sind.] Hierauf hielt Hr. Realschullehrer P. Gregor Mendel einen Vortrag über die*
716 *Künstliche Befruchtung der Pflanzen und theilte die gelungenen Resultate seiner Versuche auf diesem*
717 *Gebiete mit.*

718 *Subsequently, Herr high school teacher P. Gregor Mendel gave a lecture about artificial fertilization in*
719 *plants and communicated the successful results of his experiments on this subject.*

720

721 **IV. Second lecture article in *Neuigkeiten* March 10, 1865.**

722 *Sitzung des naturforschenden Vereins. Brünn 8. März,*

723 *Nach Eröffnung der Sitzung durch den Vizepräsidenten Theimer und Mitteilung der seit der letzten*
724 *Versammlung eingegangenen Geschenke und Sendungen hielt Herr Professor G. Mendl seinen zweiten*
725 *Vortrag über Pflanzenhybriden, Anknüpfend an die bezüglichen Mittheilungen in der letzten*
726 *Vereinsversammlung am 8. V. M. sprach er über Zellenbildung, Befruchtung und Samenbildung*
727 *überhaupt und bei den hybriden insbesondere unter Hinweisung auf sein bei Pisum (Erbse) mit eben so*
728 *viel Umsicht, als Erfolg angestellten Versuche, welche er auch im nächsten Sommer fortzusetzen*
729 *erklärte. Zum Schlusse theilte er mit, das er auch mit vielen anderen, namentlich angezeigten,*
730 *stammverwandten Pflanzen künstliche Befruchtungen zur Erzielung von Bastarden in den letzten*
731 *Jahren vorgenommen habe, und sich durch die erlangten günstigen Resultate aufgemuntert fühle,*
732 *derlei Bastardierungen nicht nur weiter zu versuchen, sondern auch hierüber eingehende Berichte zu*
733 *erstatten. Diesem mit vielfacher Anerkennung belohnten Vortrage fugte Herr Professor v. Niessl bei,*
734 *dass auch von ihm bei Pilzen, Mosen und Algen mit Hilfe des Mikroskopes Hybridisationen beobachtet*
735 *worden seien, und dass weitere diessfällige Beobachtungen nicht nur bisherige Hypothesen*
736 *begründen, sondern auch weitere interessante Aufklärungen bringen werden.*

737

738 Translation by Olby and Gautrey (1968):

739 After the opening of the meeting by the Vice-President, Herr Theimer, and the notifying of the
740 gifts and communications received since the last meeting, Herr Professor G. Mendel gave his second
741 lecture on plant hybrids. Taking up the thread of last month's lecture he spoke about cell formation,
742 fertilisation and seed production in general, and in the case of hybrids in particular, alluding to his
743 experiments undertaken with as much care as success, which he declared he would continue next
744 summer. At the end he said that in the last few years he had also undertaken artificial fertilisations
745 with many other related plants, which he named, in order to raise hybrids, and he felt encouraged by

746 the favourable results achieved not only to experiment further with such hybridisations, but also to
747 offer detailed reports.

748 Herr Professor von Niessl added to this lecture which was very well received that with the aid of the
749 microscope he had observed hybridisations in fungi, mosses and algae, and that further observations
750 of this kind not only supported existing hypotheses but will also give further interesting clarifications.

751

752 **V. Second lecture article in the *Brünner Zeitung*, March 20, 1865.**

753 *Monats-Versammlung des naturforschenden Vereins in Brünn am 8. März 1865.*

754 *(Auszug aus dem Sitzungsprotokolle)*

755 *[Der Sekretär Dr. Kalmus erstattete Bericht über die seit der letzten Monatsversammlung*
756 *eingelaufenen Geschenke. Unter denselben sind namentlich eine reiche Sammlung russischer und*
757 *französischer Pflanzen von dem Mitgliede Herrn Dr. Paul von Kühlewein, k. russischen Collegienrathe,*
758 *ferner Mineralien und Bücher von demselben und Herrn C. Bauer, die neuesten Hefte der Bryotheca*
759 *europaea, von dem Herausgeber Herrn Dr. Ludwig Rabenhorst in Dresden und eine Collection*
760 *Arachniden von Herrn Julius Mueller, hervorzuheben.] Herr Professor G. Mendel beendete seinen*
761 *Vortrag über Pflanzenhybriden. Derselbe besprach die Ansichten über die Bildung und das Entstehen*
762 *derselben, sowie die Kreuzung, Vermehrung und Fortpflanzung derselben. Nach einer übersichtlichen*
763 *Darstellung der neuesten Ergebnisse der Untersuchungen über die Entstehung und Entwicklung des*
764 *Pflanzenkeimes im Allgemeinen, suchte der Vortragende dieselben bei der Bildung der Hybriden zu*
765 *verwerthen und stellte in Bezug auf die bei diesem Acte wirksamen Factoren eine Hypothese aus,*
766 *welche durch eine große Anzahl sinnreicher, vom besten Erfolge gekrönter Versuche getragen, nicht*
767 *wenig zur Aufklärung dieses bisher noch ungenau beobachteten Processes beitragen dürfte. Herr*
768 *Professor Mendel gedenkt seine Untersuchungen über diesen Gegenstand fortzusehen und seiner Zeit*
769 *das Resultat der selben in einer im Jahreshefte des naturforschenden Vereines zu veröffentlichenden*
770 *Arbeit bekannt zu geben.*

771

772 (Extract from the minutes of the meeting)

773 Professor G. Mendel finished his lecture on plant hybrids. He discussed the views on their origin
774 and formation, as well as the cross-fertilization, multiplication, and reproduction of hybrids. The
775 lecturer clearly reviewed the most recent research findings on the genesis and development of the
776 plant germ in general and sought to apply them to the formation of the hybrids. He developed a
777 hypothesis concerning the factors involved in this process, which, confirmed by a large number of
778 meaningful and highly successful experiments, could significantly contribute to the elucidation of this
779 hitherto inaccurately observed process. Professor Mendel intends to continue his investigations into
780 this subject and publish the results in a paper published in the proceedings of the Natural Science
781 Society.

782

783 **VI. Second lecture article in *Märischer Correspondent* March 11, 1865.**

784 *Auf der Tagesordnung stand ein Vortrag des Herrn Realschullehrers P. Gregor Mendel über Pflanzen-*
785 *Hybriden. Ehe derselbe den von ihm angekündigten Vortrag hielt, sprach er über die Zelle und über die*
786 *Fortpflanzung der Gewächse durch Befruchtung. Die Versammlung war diesmal wegen der*
787 *ungünstigen Wetters nur schwach besucht.*

788 On the agenda was a lecture by the real school teacher P. Gregor Mendel about plant hybrids.
789 Before he gave his lecture, he spoke of the cell and of the reproduction of the plants by fertilization.
790 The gathering was only weakly visited this time because of the unfavourable weather.

791

792 **VII. Original German text (Oborny, 1922)**

793 *Unter seinem engeren Freundeskreis in der Heimat fand sich niemand, der sich mit biologischen*
794 *Studien beschäftigt hatte. Die Botaniker wie auch Zoologen waren durchwegs Systematiker und*
795 *mancher von ihnen dürfte sich gewundert haben, dass Mendel sich nur mit dem engen Kreise einiger*
796 *Kulturgewächse, wie Erbsen, Bohnen, Aquilegia, Dianthus und Nicotiana-Arten wie auch nur mit*
797 *wenigen wildwachsenden Pflanzenarten so eingehend beschäftigt hat.*

798 Among his close circle of friends at home, nobody had been involved in biological studies. The
799 botanists and zoologists were mainly taxonomists, and many of them will have been astonished that
800 Mendel restricted himself to the narrow range of some cultivated species, such as peas, beans,
801 *Aquilegia*, *Dianthus*, and *Nicotiana* species, and to a few wild species.

802

803 **VIII. Possible influences from Nägeli (1865) on Mendel's 1866-paper**

804 The underlined and numbered sentences in Mendel's and Nägeli's papers correspond.

805

806 Mendel (2016, p 38):

807 *Concluding Remarks, first paragraph*

808 It might not be without interest to compare the observations made in Pisum with the results
809 that the two authorities in this area, Kölreuter and Gärtner, arrived at in their researches. According
810 to the concurring view of both, hybrids either keep the middle form between the parent-species with
811 regard to external appearance, or they approach the type of one or the other, sometimes being hardly
812 distinguishable from the same. From the seeds of these hybrids, if fertilisation happened through their
813 own pollen, various forms usually originate that deviate from the normal type. As a rule, the majority
814 of individuals resulting from a fertilisation retain the form of the hybrid, whilst a few others become
815 more similar to the seed plant and one or the other individual comes close to the pollen plant. This is
816 however not valid for all hybrids without exception (1). With some individual hybrids the descendants
817 partly approach one, partly the other parental plant more closely, or they lean more towards one or
818 the other side all together; but in some, they remain perfectly similar to the hybrid, and propagate
819 themselves without being changed (2). The hybrids from varieties behave just like species-hybrids,
820 except that they possess even greater mutability of conformations (3) and a more pronounced
821 tendency to revert to the parental forms (4).

822

823

824 Nägeli (1865, p438-432):

825 *Final paragraphs*

826 *9. In general, the hybrids in the first generation [F1] vary less the further apart the parental forms are*
827 *in the kinship, i.e., the species hybrids less than the variety hybrids; the former are often characterized*
828 *by great uniformity, the latter by great diversity (3). When the hybrids are self-fertilising, the variability*
829 *increases in the second and succeeding generations the more completely it is lacking in the first; and*
830 *indeed, the farther apart the ancestral forms are, the more certain three different varieties appear,*
831 *one corresponding to the original type, and two others which are more like the ancestral forms. But*
832 *these varieties have little constancy, at least in the next few generations; they easily transform into*
833 *each other. A real reversion to one of the two parent forms (in the case of pure inbreeding) takes place*
834 *primarily when the parent forms are very closely related, i.e., in the hybrids of varieties and variety-*
835 *like species (4) [as Mendel had found albeit with reversion to both parental forms]. When it occurs in*
836 *other species hybrids, it seems to be confined to those cases where one species has exerted a greater*
837 *influence in hybrid fertilization.*

838 The variability of the hybrids, i.e. the variety of forms belonging to the same generation, and
839 their behavior in single or repeated reproduction by self-fertilization, constitute two points in the
840 theory of hybridization which are as yet least established, and which also seem to be least subject to
841 fixed rules.

842 The hybrids of the varieties are exceedingly apt to vary (3). [apparently Nägeli refers to
843 varieties that are not true breeding] When one variety is fertilized by another, the progeny are often
844 so varied and polymorphic that no plant resembles any other perfectly. Therefore, hybrid pollination
845 within species is often employed by gardeners to obtain new forms. If the variety hybrid reproduces
846 by inbreeding, the variety increases in the following generations; at the same time, however, some
847 individuals revert to the parent varieties. The hybrid form degenerates, as the gardeners say.

848 However, this does not apply to all variety hybrids (1) [Mendel used almost the same
849 sentence]. There are also those that are still uniform in the first generation and only become variable

850 in the following [variable hybrids between true-breeding parents; *Pisum*] , and those that retain their
851 uniformity through several generations (2) [constant hybrids; *Hieracium*].

852 Among the species hybrids there are also those which show a marked variability even in the
853 first generation. These are especially those which descend from very closely related species, such as
854 the hybrid of *Lychnis diurna* Sibth. and *L. vespertina* Sibth.

855 The least variability is found, as a rule, in the hybrids of those parental species which are
856 mutually related. If these hybrids are fertile, they will produce offspring with greater diversity, which
857 can increase in the following generations. The change first affects the flowers, but then also the other
858 organs and the whole habitus. Varieties are formed. Among them, one retains the (intermediate) type
859 of the original hybrid form (A+B), a second approaches one parent species (A), a third the other parent
860 species (B). One of the last two can be absent, or both. In the latter case the original hybrid form
861 remains uniform and constant. This is observed e.g., in some very fertile *Dianthus* hybrids (2)
862 [Mendel's constant hybrids].

863 If a second-generation species hybrid with some individuals has more closely approximated
864 one progenitor (A), the offspring of the same (third generation) may be even more similar to that
865 progenitor A. However, they can also change back to the original type (A+B) or, in rarer cases, even to
866 the opposite, in other words they can approach the other parent species (B).

867 As we have just seen, the species hybrids approach the parent species as individual varieties in the
868 course of the generations. However, whether they really achieve them and whether they can, as they
869 say, return to the parental species (zurückschlagen) still needs to be confirmed. In the case of the
870 variety hybrids, however, the complete return is a fact (4); it occurs irregularly and in leaps and
871 bounds. In the case of the species hybrids, an irregular and abrupt changeover of their varieties into
872 one another is observed. In any case, there is no question of a constant approximation to a parent
873 species through a series of generations. Incidentally, Gartner also claims that the reversion is merely
874 an exceptional phenomenon that affects only a few species hybrids and among these only a few
875 individuals.

¹ Iltis' narrative contains some obvious errors, such as that Mendel's friend Johann Nave was one of the attendants. However, Nave had died from tuberculosis two months before the meetings. The 1966-English translation of Iltis (1924) erroneously mentions that "at the very same [first] meeting Alexander Makowsky.....referred with the utmost enthusiasm to Darwin's theory of the origin of species", and that this "must have held the minds of biologists captive." Therefore, people would not trouble themselves to make a place in their minds for the profound and peculiar ideas of Mendel". However, Makowsky's lecture on Darwin's theory was in January, not in February.

² We searched in the following databases: DIFMOE (Digitales Forum Mittel- und Osteuropa; <https://www.difmoe.eu/>), the Digital Library of the Moravian Library (<https://www.digitalniknihovna.cz/mzk>) and ANNO (AustriaN Newspaper Online; <https://anno.onb.ac.at/>)

³ "I am no longer very fit for botanical field trips, for heaven has blessed me with an excess of avoirdupois, which becomes very noticeable during long travels afoot, and, as a consequence of the law of general gravitation, especially when climbing mountains." (6-10-1867, p12 PITERNICK AND PITERNICK, 1950)

⁴ 33%, followed by civil servants with 16%, doctors with 14%, technicians and chemists 8 %, and lawyers with 6%.

⁵ "The pharmacist Carl Theimer spoke about the formation of *Bastards* in the plant kingdom and showed a *Bastard* plant *Cirsium praemorsum* Michl (*Cirs. Oleraceo-rivulare* Dc), which was new to Moravia and which he discovered near Adamsthal in August 1861, as well as *Cirsium cano-oleraceum* Koch known earlier from the Moravian flora. At the end of the lecture, the speaker remarked that infertility ascribed to the *Bastard* plants has not been confirmed in recent experiments with various *Bastard* plants and that these *Bastards* often produce germinable seeds". (ANONYMOUS 1863)

⁶ In the second letter to Nägeli he mentioned the importance of not presenting every detail (18-04-1867, p 5 PITERNICK AND PITERNICK 1950)

⁷ It is sometimes suggested that the algebra was too complex for the listeners, but combination theory and the binomial were standard elements of *Realschule* curriculum. Its application in biological processes, however, was indeed new.

⁸ This is in contrast with Iltis (1924) who wrote that that the second meeting in March was well attended.

⁹ This characterization goes back to third-hand information from Richter (1941): "after an oral statement by Professor Makowsky to Hugo Iltis, from which Professor Dr. A. Fietz informed me" (*Nach einer mündlichen Äußerung H. Professors Makowsky and Hugo Iltis, von der ich durch Herrn Dozenten Dr. A. Fietz erfuhr*; p132).

¹⁰ Bell's paragraph continues: "it is only at remote intervals that we can reasonably expect any sudden and brilliant innovation which shall produce a marked and permanent impress on the character of any branch of

knowledge or confer a lasting and important service on mankind. A Bacon or a Newton, an Oersted or a Wheatstone, a Davy or a Daguerre, is an occasional phenomenon, whose existence and career seem to be especially appointed by Providence, for the purpose of effecting some great important change in the condition or pursuits of man."

¹¹ That Mendel was not a botanist in the sense of a taxonomist/florist is also clear from his absence from the list of 274 living Austrian botanists that was published in the *Oesterreichische botanische Zeitschrift* in 1862. In contrast, eight other members of the NSS, including Alexander Makowsky, Johann Nave, Gustav von Niessl, and Carl Theimer, were on this list (ANONYMOUS 1862).

¹² „Die überreichte Abhandlung ist eine ungeänderte Abdruck des Conceptes für den erwähnten Vortrag...“

¹³ *Ich unterlasse es, auf andere Punkte ihrer Mittheilungen einzugehen, da ich ohne die Versuche, die denselben zu Grunde liegen, in allen Einzelheiten zu kennen, doch nur vermutungsweise sprechen könnte.* (Hoppe 1971)

¹⁴ Although Nägeli's lecture was held ten months after Mendel's lectures, it is unlikely that Nägeli knew about Mendel's work since besides, in the local newspapers, there were no accounts published.

¹⁵ Fairbanks and Abbott (2016) have shown by text analysis that the part of the 1866-article preceding the *Concluding Remarks* session contains many words from the German 1863 translation of Darwin's *Origin of species*. Sometimes, in his 1866-paper, Mendel copied expressions from other authors. For example, the strictest definition of a species that Mendel gives in the introduction is literally from Schleiden (1846): "If one wanted to apply the strictest definition of the species concept, according to which only those individuals belong to one species which under entirely identical circumstances also exhibit entirely identical traits,...." (MENDEL, 2016 p6). („Wollte man die schärfste Bestimmung des Artbegriffes in Anwendung bringen, nach welcher zu einer Art nur jene Individuen gehören, die unter völlig gleichen Verhältnissen auch völlig gleiche Merkmale zeigen, so könnten nicht zwei davon zu einer Art gezählt werden.“(p6). Schleiden (1846) wrote: To one species belong all individuals who exhibit, independent of time and place, and under the same circumstances, precisely the same characters." („Zu Einer Art gehören alle Individuen, die, abgesehen von Ort und Zeit, unter völlig gleichen Verhältnissen auch völlig gleiche Merkmale zeigen.“ (p518). Also, the phrase in the introduction of the 1866-paper "To this task, careful observers such as Kölreuter, Gärtner, Herbert, Lecoq, Wichura and others have sacrificed part of their lives with untiring endurance" (MENDEL 2016, p3), „Dieser Aufgabe haben sorgfältige Beobachter, wie Kölreuter, Gärtner, Herbert, Lecoq, Wichura u. a. einen Theil ihres Lebens mit unermüdlicher Ausdauer geopfert.“), maybe based on Nägeli (1866) ("who devoted the work of their lives to solving this problem, „die die Arbeit ihres Lebens auf die Lösung dieses Problems verwendeten.“, p398) or the German translation of Darwin (1863) ("who have devoted almost their whole lives to this subject; „welche fast ihr ganzes Leben diesem Gegenstande gewidmet haben.“ (p275).