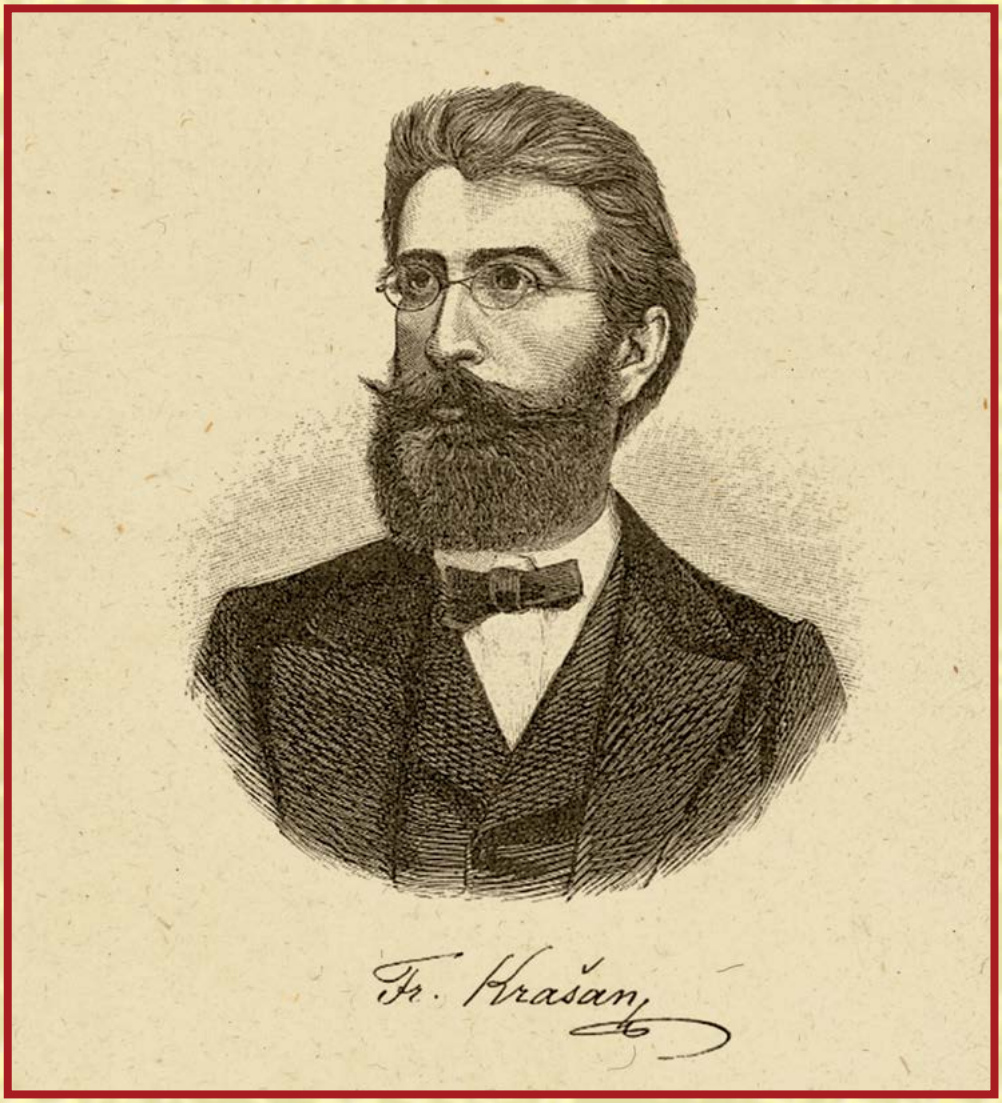
PRIRODOSLOVNI MUZEJ SLOVENIJE / MUSEUM HISTORIAE NATURALIS SLOVENIAE

SCOPOLIA

Revija Prirodoslovnega muzeja Slovenije

Journal of the Slovenian Museum of Natural History

107 2024



ISSN 0351-0077

SCOPOLIA 107 2024

ISSN 0351-0077

Glasilo Prirodoslovnega muzeja Slovenije, Ljubljana /
Journal of the Slovenian Museum of Natural History, Ljubljana

Izdajatelj / *Publisher:*
Prirodoslovni muzej Slovenije, Ljubljana, Slovenija /
Slovenian Museum of Natural History, Ljubljana, Slovenia

Sofinancirata/ *Subsidised by:*
Ministrstvo za kulturo in Javna agencija za raziskovalno dejavnost Republike Slovenije /
Ministry of Culture and Slovenian Research Agency

Naslov uredništva in uprave / *Address of the Editorial Office and Administration:*
Prirodoslovni muzej Slovenije, Prešernova 20, p.p. 290, SI – 1001 Ljubljana, Slovenija /
Slovenian Museum of Natural History, Prešernova 20, PO.B. 290, SI - 1001 Ljubljana, Slovenia

Račun pri UJP / *Account at UJP:*
01100-6030376931

Lektor za slovenščino in angleščino / *Slovenian and English language editing:*
Henrik CIGLIČ

Oblikovanje / *Design:*
Boris JURCA

Tisk / Printed by:
Schwarz print d.o.o., Ljubljana

Izideta najmanj dve številki letno, naklada po 600 izvodov /
The Journal is published at least twice a year, 600 copies per issue.

Natisnjeno / *Printed:*
november 2024 / *November 2024*

Naslovnica / *Front cover:*
Franc Krašan, prominenten slovenski botanik in naravoslovec 2. polovice 19. stoletja (Krasser, 1907). /
Franc Krašan, a prominent Slovenian botanist and naturalist of the 2nd half of 19th century (Krasser, 1907)

Cena posamezne številke / *Price per issue:* 8,50 €

Revija je v podatkovnih bazah / *Journal is covered by:*
COBIB, Biological Abstracts, BIOSIS Previews, CAB Abstracts, Referativnyy Zhurnal, Zoological Record

Krašan as a leading Slovenian botanist

Stanislav JUŽNIČ[1]

Abstract

Krašan remained a Grammar School teacher, but his publication put him on the Parnassus of Slovenian botany besides his own Viennese teacher Franz Unger of Maribor-Višnja Gora origin. Both Krašan and Unger owned a copy of G. Mendel's famous hybridization article (1866), relied on experimental and field works, and used Darwinian evolutionary theory in their ways to the modern epigenesis. As a young expert, Unger experimented with Brownian motion, while Krašan even published few articles on pure mathematical-physical pedagogy and mineralogy. The trained biologist-physicist-mathematician, Krašan was also obligated to teach mathematics, physics, and chemistry in his Grammar Schools besides biology, while the trained physician Unger avoided that burden by his jobs of private tutoring of the wealthy, physician, and finally the university professor. As a Darwinist and popular writer, Unger suffered biased attacks at the hands of the Viennese clergy, while his students Mendel and Krašan behaved more carefully by avoiding any popularization. As an expert from the Habsburgian Littoral under nationalistic threats from other groups, Krašan never abandoned the Slovenian spelling of his name: the Styrian and Carinthian experts Unger, Krašan's Grammar School teacher Blaž Kocen, and Jožef Stefan never went that far which might have enabled their better academic posts in the Habsburg Monarchy under the occasionally biased rule of the emperor Franz Josef who feared any kind of nationalism.

Key words: Franc Krašan, Franz Unger, Jožef Stefan, Marian Koller, Gregor Mendel, Charles Darwin, epigenesis, botany, 19th century, Habsburgian Littoral

Izvleček

Gimnazijskega profesorja Krašana so odmevne objave postavile na Parnas slovenske botanike poleg njegovega dunajskega učitelja Franza Ungerja mariborsko-višnjegorskega rodu. Tako Krašan kot Unger sta imela kopijo znanega članka o hibridizaciji G. Mendela (1866), oprla sta se na eksperimentalna in terenska dela ter uporabila Darwinovo evolucijsko teorijo na svojih poteh do sodobne epigeneze. Unger je kot mlad strokovnjak eksperimentiral z Brownovim gibanjem, Krašan pa je objavil celo nekaj člankov osredotočenih na matematično-fizikalno pedagogiko in mineralogijo. Izučeni biolog-fizik-matematik Krašan je moral na svojih gimnazijah poleg biologije obvezno poučevati tudi matematiko, fiziko in kemijo, medtem ko se je izučeni zdravnik Unger temu bremenu izognil s svojim zasebnim poučevanjem premožnih, zdravniško službo in končno kot univerzitetni profesor. Kot darvinist in poljudni pisatelj je bil

[1] Dunajska 83, Ljubljana & Univerza v Oklahomi, juznic@hotmail.com

Unger deležen pristranskih napadov dunajske duhovščine, medtem ko sta se njegova učenca Mendel in Krašan obnašala previdneje izogibajoč se kakršni koli popularizaciji evolucije. Kot poznavalec habsburškega Primorja pod nacionalističnimi grožnjami sosedov Krašan ni nikoli opustil slovenskega zapisa svojega imena: štajerski in koroški strokovnjaki Unger, Krašanov gimnazijski profesor Blaž Kocen in Jožef Stefan nikoli niso šli tako daleč, saj bi slovenjenje lahko ogrozilo njihov akademski prestiž v habsburški monarhiji pod občasno pristransko vladavino cesarja Franca Jožefa, ki se je bal kakršnega koli nacionalizma.

Ključne besede: Franc Krašan, Franz Unger, Jožef Stefan, Marian Koller, Gregor Mendel, Charles Darwin, epigeneza, botanika, 19. stoletje, habsburško Primorje

Contents / *Vsebina*

Introduction

Tone Wraber (1938–2010) proclaimed Krašan the most successful Slovenian botanist (Wraber, 2005, 171). Of course, Tone Wraber knew very well what he was talking about, because it was Tone and his father Maks Wraber[2] with the first Ljubljana botanical doctorate in the year when Hitler took power in 1933 who were the main botanists of their days. Maks did a lot for botany of the area of Gorizia, especially as far as forestry botany was concerned.

The most essential thing, which can be summarized from the successful actions by Carniolan erudite like Krašan, Janez Vajkard Turjaški (Auersperg), or Marian Koller, as well as the Carinthian Jožef Stefan, or the favourite student, his Slovenian son-in-law Ludwig Boltzmann, was the prosperity of the Habsburg Monarchy. That ancient empire was by no means a prison of nations as claimed by the WW1 propaganda, especially not of the Slovenian peoples. The talented and dedicated Carniolan was as committed to success as any other Habsburgian subject, if not even more so: until the national ravages fell upon the benevolent empire, unfortunately forever.

[2] Maks Wraber (1905 Kapla on Kozjak – 1972 Ljubljana)

Figure 1: Krašan's portrait (Krasser, 1907, 166ff).

Slika 1: Krašanov portret (Krasser, 1907, 166ff).

Franc Krašan[3] began his education with his parents' explicit wish to become a priest (Krašan, January 1888, *Oesterr. botanic. Zeitschrift*, 38/1: 1). In those times, Slovenian farming population could not even imagine anything better than the priesthood. The surname Krašan designated someone from the karst (kras), but also something beautiful. And Krašan decided that the local karst flowers could be more beautiful.

[3] Franc Krašan (Franc, 2 October 1840 Šempas near Gorizia – 12 May 1907 Graz)

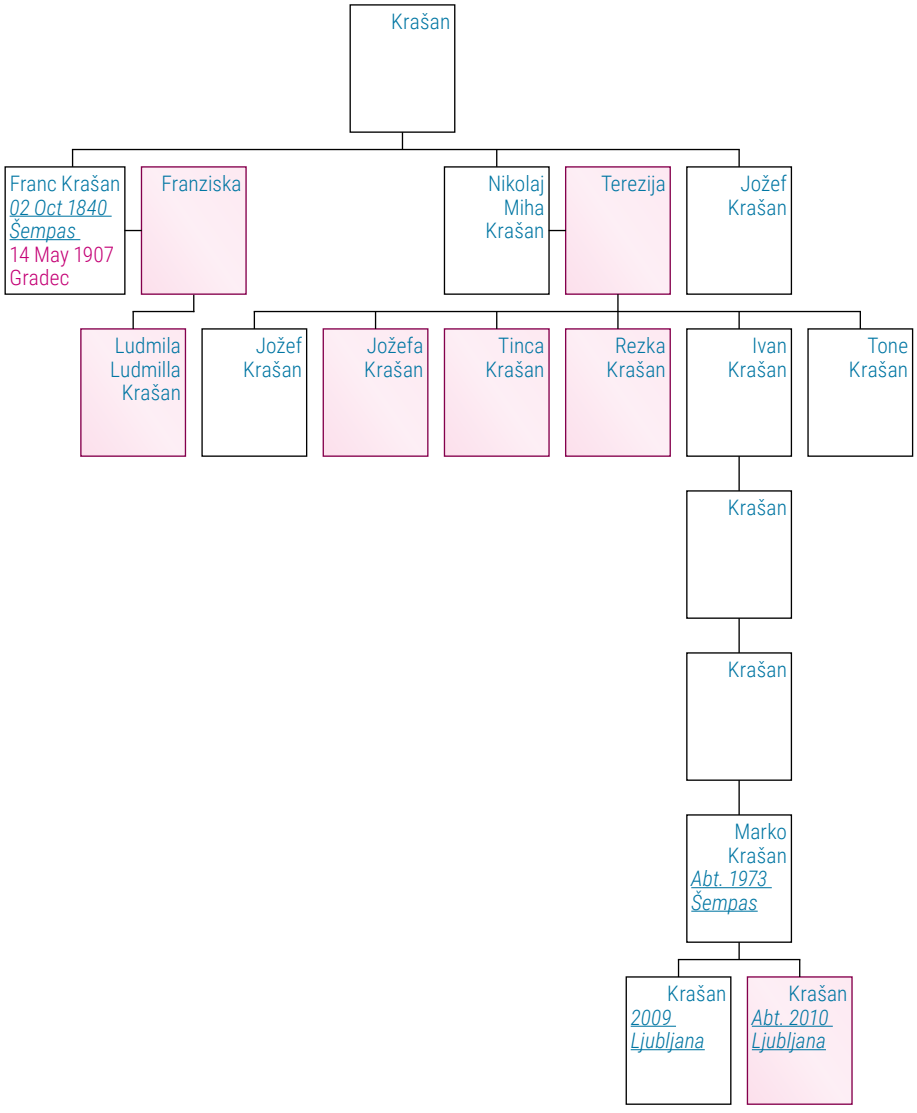


Figure 2: Krašan's family tree (drawn by the author).

Slika 2: Krašanovo družinsko drevo (risal avtor).

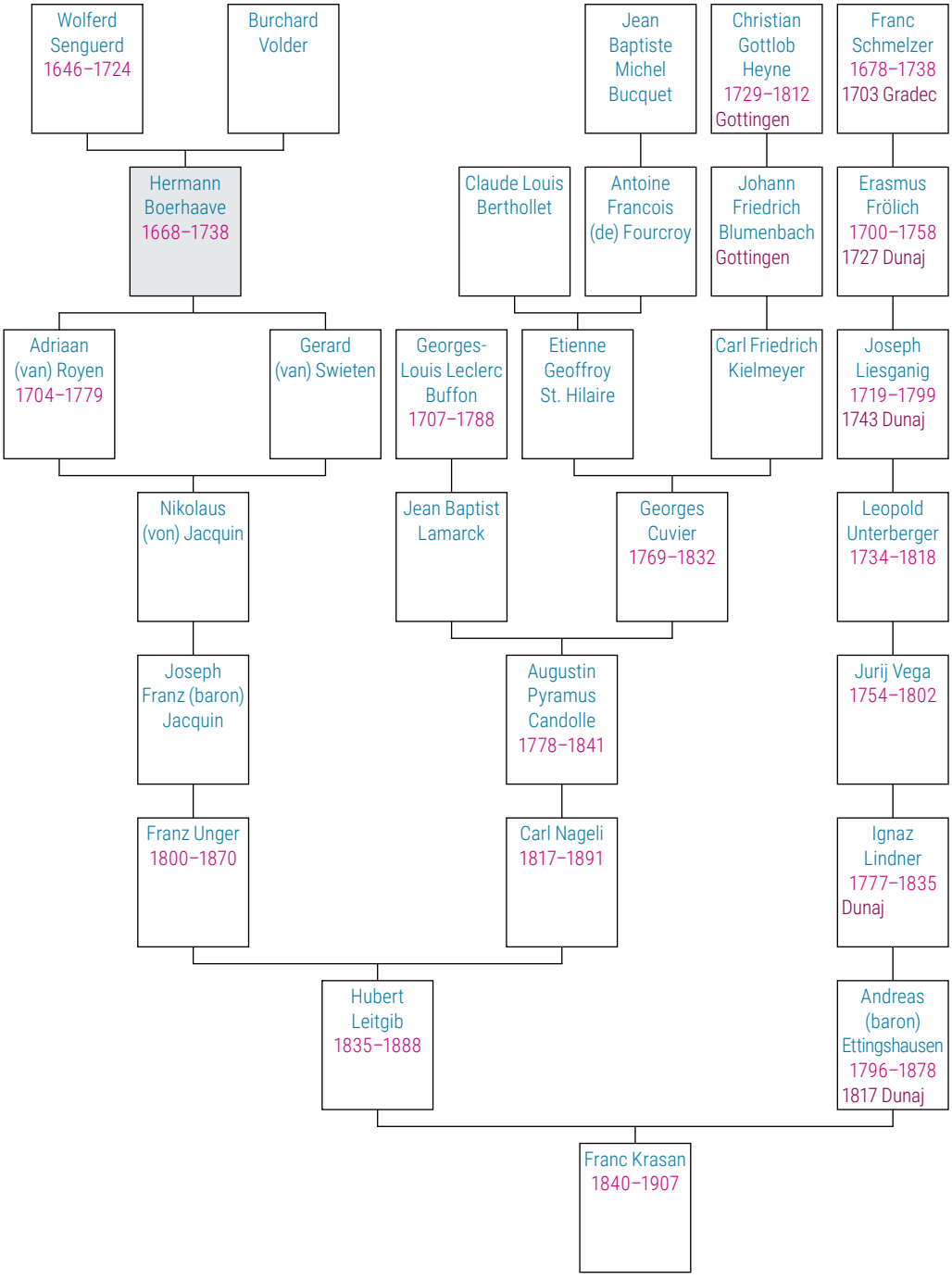


Figure 3: Krašan's academic ancestors according to his studies in Gorizia and Vienna (drawn by the author).

Slika 3: Krašanovi akademski predniki glede na študij v Gorici in na Dunaju (risal avtor).

Studies

Krašan graduated at the Gorizia High School as the student of physics and Natural History of the subsequently famous geographer Blaž Kocen (Kozenn) in lower grades: Hubert Leitgib taught him Natural History in 5th and 6th grades. Krašan was a protegee of the cooperator-curator in Šempas M. Saunik, priest Zucchiati in Ecken,[4] and priest Fr. Podreka (Podrecca) in autumn 1862 (Krašan, January 1888, *Oesterr. botanic. Zeitschrift*, 38/1: 2). In 1876, Osek and Vitovlje became independent vicarages. Franc Podreka prophetically assessed that Franc Krašan was more suitable for a scientist than a priest; he was a relative of the better-known poet pastor Petar Podreka (Podrecca, 1822 Špeter Slovenov (San Pietro al Natisone) - 1889 Ronec near Podbonesec (Pulfar, Pulfero) in Friuli). Krašan catalogued the seeds of the Gorizia area already when attending the Gorizia High School. Krašan wrote his graduation essay about botanics in Hubert Leitgib's class (Fridolin Krasser, Franz Krašan, *Mitteil. d. Naturwissenschaftl. Ver. f. Steiermark* 1907, 44: 156). The German Hubert Leitgib[5] passed the teacher's examination a decade before Krašan in 1857 (Dassenbacher, 1868). In 1853, there could possibly be some other expert named Leitgib who published papers on mathematics in the *Reports of Grammar School (gymnasium) Trieste*, as Hubert was at that time only an 18 years old student in Graz. The other was very likely his relative considering that his father was a wealthy farmer. Hubert attended the Klagenfurt Grammar School as a classmate of his neighbour Jožef Stefan, but Hubert matriculated at the University of Graz already as a sixteen years old kid. From 1852, Hubert studied in Graz and earned his PhD in 1855. From 1859 to 1864, he taught in Celje and in the Gorizia Grammar School. He was writing and publishing natural history articles in the *Reports of Grammar School Gorizia*. From Gorizia he went to Linz and then to Graz to teach at the Grammar School there. In 1869, he became a full professor at the University of Graz, where he was appointed director of the botanical garden in 1873. In the years 1876/77, H. Leitgeb was a dean at the Faculty of Philosophy in Graz and in the years 1884/85 a rector at Graz University. At the same time, Hubert lectured on general botanics with accompanying demonstrations. He taught Nikola Tesla in the second year of Tesla's studies at Graz Polytechnics as a specialist for anatomy and morphology of plants. In 1876, Hubert was the president of the Styrian Natural History Society with Krašan as his secretary.

A Slovenian Franc teaches a Slovenian Franc (Franc Unger as Franc Krašan's professor)

In Vienna, F. Krašan studied natural sciences, mathematics, and physics in the classes of Franz Unger, Ch. Doppler (1803-1853) who was soon disgraced, Petzval, and Andreas Ettingshausen in 1862-1865. Previously, Franz Unger and Andreas Ettingshausen had jointly experimented on Brownian motion. In 1863, M. Koller's protegee Jožef Stefan became an assistant professor for mathematics and physics in Vienna and taught five years younger Krašan. Soon after Krašan finished his undergraduate studies, Unger retired and lived on his farm near Graz in 1866-1870.

[4] (St. Martin in Osek southeast of Šempas, not Koti, Vogel, Vogu, or Voglarji north of Šempas)

[5] Leitgeb (* 1835 Portendorf in Magdalensberg (Partovca near Šenttomaž at Štalenska gora) northeast of Klagenfurt in Carinthia; † 1888 Graz)

Professor

After graduating in Vienna, Franz Krašan taught at a high school in Linz as a substitute lecturer in 1865-1866, together with his former teacher Hubert. In Gorizia, Krašan was again a substitute lecturer teaching natural history, mathematics in 4th grade, and physics in 4th grade in 1866/67. In 1867, Krašan as a lecturer in Gorizia passed his teacher's examination for natural history at the University of Vienna, which G. Mendel never accomplished as his examiner was not F. Unger who approved basic roles of eggs in creating new life, but his opponent Fenzl (Kreissl, Frantz & Gepp, 2002 *Biographie*). After Krašan and Hubert Leitgib left Gorizia, Fran Erjavec in 1871 and Anton Šantel in 1872 took over the professorships at the Gorizia Secondary School and Grammar School.

As a full High School professor Krašan taught in Kranj from 1869 to 1873/74 also as the district school supervisor in 1870-1871. Krašan lectured at the Celje Grammar School in 1875-1879, and in 1880-1900 at the Second State Grammar High School in Graz. In Graz, he proactively worked as secretary, president, and librarian of the botanical section of the Natural History Society for Styria (Naturwissenschaftl. Ver. f. Steiermark), together with his former teacher Hubert, Boltzmann, Franc Močnik, and Simon Šubic. Krašan corresponded with the Ljubljana Museum curator Karl Dežman (Deschmann) and Dannenfeldt[6], a wealthy entrepreneur, politician, and private scholar who spent his last years in Gorizia (Fridolin Krasser, Franz Krašan, *Mitteil. d. Naturwissenschaftl. Ver. f. Steiermark* 1907, 44: 159; Krašan, 1888, 4).

Krašan was retired in 1900. In Prague in November 1907, Krasser[7] wrote Krašan's obituary with his photo. Krasser obtained his PhD in Vienna in 1887 and knew Krašan's merits (Fridolin Krasser, Obituary, Franz Krašan, *Mitteil. d. Naturwissenschaftl. Ver. f. Steiermark* 1907, 44: 156–166).

Local Botany

In his youth, Krašan dealt with the flora of his native Gorizia and later expanded his research to his adopted homeland Styria. Apart from floristic, paleontological, and physiological questions, he was interested in theoretical problems of the (Darwinian) evolutionary descent, to which he also sought answers through experiments. He studied pollination, how the conditions of plant habitats affect plants through the changed heat and light. He published his many discussions in high school programs, in the Viennese *Denkschriften* (1888, 1889, 1891, 1894), *Sitzungsberichte of the Viennese Academy* (*Wien.Ber.* 1873, 1887), Adolf Engler's (1844–1930) *Botanische Jahrbücher für Systematik, Pflanzengesch. und Pflanzengeogr.* (1881–1885, 1887–1888, 1891, 1901, 1906), *Mitteilungen des Naturwissenschaftl. Vereines f. Styria* (1887, 1890, 1893–1896, 1898 to 1901, 1904–1906), *Oesterr. botanic. Zeitschrift* (1864–1869, 1883, 1887–1889), the Viennese *Verhandlungen der zoolog.-botan. Gesellsch.* in Wien (1863, 1865, 1880, 1883, 1885), in then already deceased Marian Koller's *Zeitschr. d. Österr. Gesellsch. f. Meteorologie* (1871, 1873, 1880), *Natur und Schule* (1902, 1905), in Genevan *Archives des sciences physiques et naturelles* (1890–1891), and the *Actes du Congrès international de Botanique* (1900). Krašan probably avoided publishing in Slovenian language like his correspondent Karl Dežman in his mature years.

Krašan dealt primarily with the flora of the Slovenian soil in the following writings: Beiträge zur Flora der Umgebung v. Görz (*Oesterr. bot. Zschr.* 1863, 1865), Eine Exkursion in das Gebirge von Tolmein (Tolmin) und Karfreit (*Oesterr. bot. Zschr.* 1867), Bericht über meine Exkursion

[6] Joseph Claudius Pittoni Ritter von Dannenfeldt (1797 Vienna-1878 Graz)

[7] Fridolin Krasser (31 December 1863 Jihlava in Moravia (Iglau, Mähren) - 24 November 1922 Prague)

in das Lascek-gebirge zwischen Canale u Chiapovano (Laščck, Kanal, Čepovan in Karst), *Verhandl. d. zool.-bot. Gesellsch.* in Wien 1868), Pflanzenphänologische Beobachtungen für Görz (*program Grammar School Gorica (Gorizia)* 1868), Über einige pflanzenphänologische Erscheinungen aus der Flora von Görz (*Oesterr. bot. Zschr.* 1869), Studien über die periodischen Lebenserscheinungen d. Pflanzen im Anschlusse an die Flora von Görz (*Verhandl. d. zool.-bot. Gesellsch.* 1870), Phänologisches aus der Flora von Görz u. Krainburg (*Zeitschr. d. österr: Gesellsch. für Meteorologie* 1873), Mineralogisch-geognostische Untersuchungen über die bei Cilli vorkommenden Eruptivgesteine (*Celje Grammar School program* 1879), Vergleichende Übersicht d. Vegetationsverhältnisse Görz u. Gradisca (*Oesterr. bot. Zschr.* 1880), Bericht d. Kemmision für die Flora v. Deutschland, Steiermark, Kärnten u. Krain (*Ber. d. d. Bot. Ges.* 1886), Beiträge zur Flora von Untersteiermark (*Mitteilgn. d. Naturwissenschaftl. Ver. f. Steiermark* 1894), Beiträge zur Flora v. Untersteiermark … (*Mitteilgn. d. Naturwissenschaftl. Ver. f. Steiermark* 1900), Beitrag zur Charakteristik der Flora von Untersteiermark (*Mitteilgn. d. Naturwissenschaftl. Ver. f. Steiermark* 1902).

On 7 October 1886 in Graz, Krašan wrote his paper Ueber der Ursache der Haarbildung in Pflanzenreiche (About the cause of hair formation of plants, Krašan, 1887, *Oesterreichische botanische Zeitschrift*, volume 37: 7-12, 47f, 93-97). A year later in November 1887 in Graz, Krašan sent his autobiography (Krašan, January 1888, *Oesterr. botanic. Zeitschrift*, 38/1: 1-6).

Krašan used his mathematics and physics abilities like Unger and Mendel did: that was a modern trend in the Habsburg Monarchy promoted by Alexander von Humboldt (1769-1859). The Viennese professor of morphology and systematics of plants Fenzl[8] helped Krašan as Fenzl was a director of the imperial collection which was later passed to the Viennese botanical garden, even if Fenzl failed G. Mendel on exam. Since 1867, Fenzl was the father-in-law of J. Stefan's critic, the mineralogist Gustav Tschermak, and consequently the grandfather of Gustav's son Erich von Tschermak-Seysenegg. Erich revitalized Mendel's theory: did his deceased grandfather Fenzl protest? The Viennese academician Fenzl denied his antagonist academician Unger's, Krašan's, and Mendel's Darwinian claims that the fertilization combines male and female cells. These Unger's ideas eventually echoed in popular new western ideas of feminist gender equality. Their fusion of gametes supported by the Germanized cell theory propelled the spleen of the Spring of Nations and vice versa. They soon disproved Fenzl's preformationist Paracelsus' and Goethean Faustian homunculus claims: these modern experts, Krašan included, favoured the good old Aristotelian epigenesis. Their biological cells and soon also the modern genes followed their analogy from newly revived atomic theory: all of them were subordinated to the modernized dehumanized impersonal statistics of Krašan's four years younger Viennese classmate Ludwig Boltzmann. The Trnava Jesuit professor Andreas Jaszlinski (1715 near Košice - 1783) refuted Aristotle already in 1761: but Aristotelian biology was nice, anyway. Just like Athanasius Kircher's acoustics, while most of other Kircher's, Aristotelian, or Cartesian physics went into oblivion. The modern Krašan's and Unger's epigenesis might overcome Richard Dawkins' (* 1941) *Selfish Gene* bias.

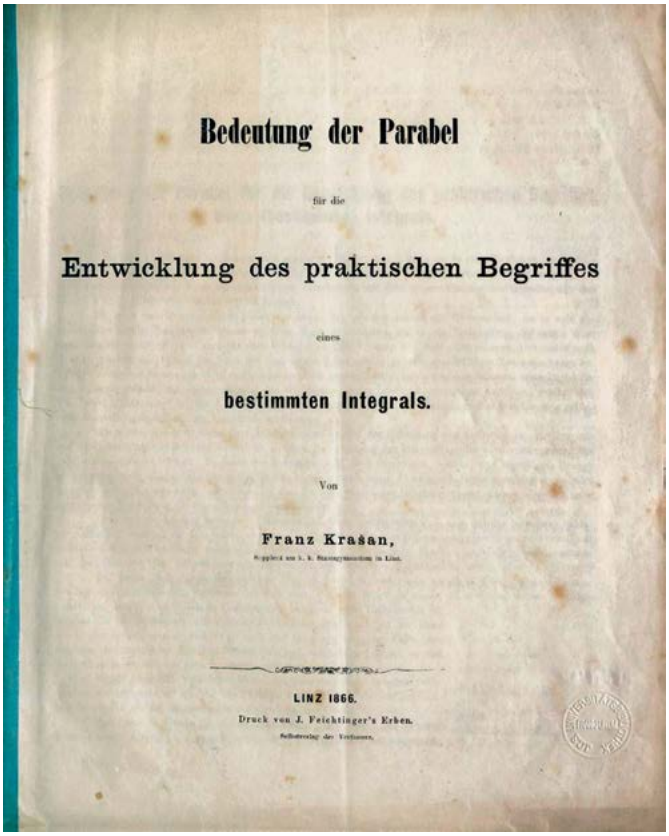
In summer 1873, Krašan made botanical excursion with the local priest Valentin Plemel (1820 Bled - 1875 Koroška Bela) and the priest Simon Robič (1824 Kranjska Gora - 1897 Šenturška Gora). In summer 1885, Krašan researched the plants in the Upper Carniola with the mycologist Wilhelm Voss (1849 Vienna - 1895 Vienna). In 1874, Voss became a professor at the Secondary School in Ljubljana where he taught the bawdy writer Ivan Cankar (1876-1918): in 1894, Voss returned to Vienna (Krašan, 1888, 4).

[8] Eduard Fenzl (1808 Krummnußbaum in Lower Austria - 1879 Vienna)

Krašan published over 138 works. He began with flora of his native Gorizia areas (1863, 1865) and brambles (raspberries, blackberries, and dewberries) in 1863 as a part of his studies in Unger's class. Krašan continued with Styrian flora after he resettled to Celje and Graz (Krašan, Die haupttypen der blüthenstände europ. Rubusarten und die entfaltungsfolge ihrer blüthen (The main types of inflorescences European. *Rubus* species (brambles) and the development sequence of their flowers), 1863; Krašan, Einiges zur Inflorescenz der Gageen (Some things about the inflorescence of the Gageen, *Oesterr. botanic. Zeitschrift*, June 1863 15: 192–196). Krašan based this study on Gagea arvensis of the lily family, the harbinger of spring, the adornment of the fields, meadows and groves.

Krašan's mathematical physics

As a newly appointed lecturer in Linz, Krašan quickly published his only mathematical-physical tractate about the history of use of parabola for the development of the practical concept of a definite integral used for physics. He quoted nobody while that work full of computation and integrations could have possibly been done for his studies with Doppler, Ettingshausen, and Petzval. Krašan began his narration full of included small illustrations: "It is a well-known experience that aspiring mathematicians, when they are about to apply the infinitesimal calculus to their teachings of geometry and physics, encounter difficulties which, as they themselves later realize, require a more thorough understanding and a longer time for the fixing the basic concepts of the integrals which could easily have been overcome. As long as one has no other purpose in mind than the development of science, it is permissible not to use what is already known to any further extent than is absolutely necessary to connect the new propositions. But anyone who wants to help the beginner should not be afraid to repeat what is already known more often, so that what is new appears in a clearly visible context with what is already known. While a new result arouses particular interest for trained mathematicians, for beginners it is precisely this connection that is most important. Every textbook, at least the one that bears the title of an "introduction" to any part of mathematics, must therefore make a purified presentation of its main aim. The transition from the differential to the integral undoubtedly appears to be the most difficult for the beginner, and what he" (not she!) "primarily notices is the lack of secure mastery of the integral concept in the application of the infinitesimal calculus. Therefore, if the learner is not one of those who, out of a premature urge for new material, immediately covers the first leaves of the book after a fleeting glance, he will certainly fervently wish that this was the case with the initial principles of the integral calculus, especially with a detailed assessment of the terms. He would like to linger longer. Because how much is the beginner interested in his current case, he might be helped with the well-known explanation, according to which the integral calculus is called the inverse operation of the differential calculus and according to which the original function should be found for a presented differential by going back the way in which the differential was derived from this function? At this level of mathematical knowledge, anyone attempting to solve small geometric and physical problems would ask the following question to their catechism: How does it come about that the function to be sought is the integral of that differential which directly relates the nature of the problem presented? It helps? Once he has clearly grasped the correct connection between differentials and integrals, even if only in a single case, he will easily find the way to solving other, more difficult problems." That was clearly the idea of Krašan's Viennese professor, the Slovakian Joseph Petzval (1807-1891), who promoted the perturbations in his way to obtain complicated results from the previous simple ones described by his differential equations. Except for Lagrange's textbook (1788) even



Bedeutung der Parabel

für die

Entwicklung des praktischen Begriffes

eines

bestimmten Integrals.

Von

Franz Krašan,

LINZ 1866.

Druck von J. Feichtinger's Erben.

Figure 4: Krašan's sketches needed to explain the physical and mathematical concept of definite integral (Krašan, 1866, 3ff).

Slika 4: Krašanove skice, potrebne za razlago fizikalnega in matematičnega koncepta določenega integrala (Krašan, 1866, 3ff).

Karl Marx in his much later published mathematical papers found the infinitesimal calculus somewhat mystic because it was borrowed from the Indic Kerala without the relevant Indic philosophy. Krašan continued: "But there is no simpler way to illustrate the connection between differentials and integrals in a way that is useful for the beginner than the calculation of a parabolic surface." To do this, Krašan provided his Figure 1 (Krašan, *Bedeutung der Parabel für die Entwicklung des praktischen Begriffes eines bestimmten Integrals (Significance of the parabola for the development of the practical concept of a definite integral),* 1866, Linz: J. Feichtingers Erben, 17 pages of text, here introductory page 3). Krašan taught mathematics and physics until his retirement, but never repeated such fundamental pedagogical mathematical publications. Similarly, B. Kocen taught High School physics, but his main energy went to geography and mapmaking.

Darwinist and Mendelian

On 1 September 1867, Krašan published Ueber Einige (Culturversuche) mit *Potentilla verna* und *cinerea* (Cinquefoils). He checked the influences of light and heat on flowering in a quite Mendelian manner as he reported from Vienna on 23 July 1867 during his holidays when he prepared his transfer from Linz to his native Gorizia: "It was in May 1865 (while Krašan was

finishing his Viennese studies) when I decided to carry out outdoor cultivation experiments with *Potentilla verna* and *cinerea* in order to be fully convinced of the extent to which these two species are reciprocal. The reason for this decision was the well-known fact that *P. verna* and *cinerea* never grow together on the same type of soil, with the latter growing in Viennese dry sandy soil, while the former is peculiar to the Viennese sandstone. However, in (my native) Primorska Littoral, *P. cinerea* occurs on dry limestone soil, never on the tertiary sandstone … Now to find out whether the form of *P. verna* in fact is caused by the influence of sunlight and whether this influence occurs in a short time or requires a longer time to become noticeable in the changed plant - I chose a few specimens for experiment - which had the character of the shadow form in the most striking way …" Krašan concluded: "The characteristic hairiness of *P. cinerea* had not changed in any noticeable way in two years. It goes without saying that no firm conclusions can be drawn based on such isolated cultivation experiments, which are limited to such a short period of time. On this very date, it would be desirable if the experiments I started were to be taken up again by one of the nature friends living here (in Vienna) who is interested in this direction of botanical study and carried out in the same way for several years. It is simply a matter of moving the test plants on the Türkenschanze and any other place suitable for the experiment in such a place in Vienna that they can be easily found again, not to be confused with similar plants in the surrounding area and can therefore be observed frequently if one can pay attention. Such experiments will certainly lead to extremely interesting results in a few years. In general, this area is an extremely fertile, yet untrodden field for all friends of truth and scientific progress" (Krašan, 1867, *Österreichische Botanische Zeitschrift*, vol. 17, no. 9: 273–276). The Türkenschanze was formerly also called Hohe Warte or Hohenwarth connected to the Carniolan count Hohenwart[9] as the Viennese "prime minister" from February to October 1871. It is a plateau-like elevation in Viennese 18th district of Währing. It lies about 80 meters above the level of the Danube and is 3-4 km away from it. Krašan invited other experts to continue his own experimentation, but he predominantly did it himself, although mostly not in Vienna anymore.

In 1868, Franc Krašan as a field researcher published a report on his excursion to the Laščck hills between Kanal and Čepovan from 5 to 8 August 1867. He explained that he explored the entire area of the Lokovska Plateau and its surroundings: Čepovanska dolina with both slopes to Trebuša, Banjšica with a slope to Grgarje, Kanal and along the left bank of the Soča to Kal. At that time, he used the official name of the area Laščck (Laščck Gebirge, Gorovje Laščck, Lokovška plateau). On that occasion, Krašan checked Balthasar Hacquet's a century earlier data. In summer 1861, Krašan met the Trieste botanist, recently retired Mayor Tommasini.[10] They remained friends for good. Tommasini persuaded Krašan to check B. Hacquet's notes about kranjski glavinec (*Centaurea carniolica, Centaurea nigrescens vochinensis*) in the area of Banjščica which Sendtner[11] + and Tommasini checked prematurely in June 1843 as it was not flowering so early. Krašan stated that Hacquet published his data long after he visited those places and therefore confused Devin or Nabrežina with the Banjščica (Banjška plateau) between Čepovanski dol (Čepovan valley), the valley of the lower Soča River and the lower reaches of the Idrijca River.

Krašan became the very first Slovenian researcher of meteorological influence on plants. He relied on the Viennese work of Anton Kerner Ritter von Marilaun (Joseph, 1831 Lower Austria-1898 Vienna) but also on the meteorology of Krašan's Slovenian compatriot Marian Koller, a Viennese Benedictine from Bohinj (Krašan, 1868; Krašan, January 1888, *Oesterr. botanic. Zeitschrift*, 38/1: 3; Wraber, 2005, 179).

[9] Karl Siegmund von Hohenwart (1824 Vienna - 1899 Vienna) from Kolovec near Kamnik
[10] Muzio knight Tomasini (1794 Trieste - 1879) of Livorno origin
[11] Otto Sendtner (1811 Munich - 1859)

Krašan's Mendel

Krašan was the chairman and secretary of the Botanical Section in Graz. In 1895, under Krašan's direction, the preparatory work for the "Flora Styriaca" of the Natural History Society for Styria was carried out, and in 1896 a section library was created. In 1900, he created a card catalogue for the Styrian Flora, which he continued until his death. Krašan obtained a separate print of G. Mendel's work on hybrid, while Krašan carried out his own phenological, physiological and phylogenetic research (Tone Wraber, 1989, 203; Richard Steinbach*, Österreiche Botaniker des 19. Jh., die nicht an Hochschulen wirkten,* phil. Diss. Wien, 1959; Meixner, *ÖBL* 1815-1950, volume 4 (Lfg. 18, 1968), pp. 211ff; Mendel, 1866 Brno). That made Krašan the early follower of new genetics, like his teacher Unger: as Unger died near Graz in 1870, his copy of Mendel's work might have been passed to Unger's other student Krašan who was then still in Kranj but got a job in Graz in 1880. Mendel sent forty separate printing of his Hybrid work to Unger, Darwin, and other experts, but just nine among them are still in evidence today. In 1984, during his exhibition on 100th anniversary of Mendel's death in Salzburg and Klagenfurt, Gerhard Czihak (1928 Vienna - 2011) was surprised to find Krašan's copy obtained after Krašan's death for the botanical institute in Graz. Czihak stated that Krašan mostly researched at the southern part of the Habsburgian Monarchy and therefore probably never met eighteen years older Bohemian monk Mendel in person. But Wraber knew that Krašan was the very best botanist and only Slovenian with Mendel's work in the 19th century: but, in fact, Unger was the other Slovene, who had it too, after Mendel personally sent that item to Unger who was his favourite teacher. Wraber was unaware of Unger's Slovenian origins. Indeed, Unger and Krašan did not quote Mendel in their own publications, but Krašan's and Unger's ownership proved that Mendel was not forgotten for three decades. Not at all. While Mendel was sending the offprints, Krašan was still teaching in Gorizia; as the high school lecturers, they could have met at one of the teachers' meetings of the time, but it is more likely that Krašan took over or bought Mendel's article from Unger's heirs (Gerhard Czihak; Vítězslav Orel; Gregor Mendel. 1984. *Johann Gregor Mendel (1822-1884): dokumentierte Biographie und Katalog zur Gedächtnisausstellung anlässlich des hundertsten Todestages mit Facsimile seines Hauptwerkes, "Versuche über Pflanzenhybriden",* Salzburg: Druckhaus Nonntal; *Botanik profesor Franc Krašan*, illustrated folder, 6 pages, Nova Gorica 2009/2011).

Within phyto-palaeontology, which deals with plants, Krašan tried to find out the epigenetic influence of climate and soil on the shape of plants and thereby the changeability of species through his own experiments (Krašan, Beiträge zur Kenntniss des Wachsthums der Pflanzen (Contributions to the knowledge of plant growth), Wien, 1873).

Krašan supports Pasteur

As a professor in Celje, Krašan also touched the then most important problem of Pasteur and Krašan's already deceased teacher Unger: the spontaneous generation. As a youngster, Unger imagined some transformation of plants into animals, but that kind of Schillerian or Hegelian Natural-Philosophy of algae proved to be unpopular later. Krašan cited the experiments of the natural history professor at Rouen F. A. Pouchet, performed in 1858, Pasteur, and Nägeli (Nägeli, *Entstehung und Begriff der naturhistorischen Art (Origin and concept of the natural history art),* Munich 1865; Krašan 1876, 5).

Félix-Archimède Pouchet (1800–1872) was a French naturalist and a leading proponent of spontaneous generation of life from non-living materials. As such he was an opponent

of the much younger Louis Pasteur's germ theory. Initially, they had a polite quarrel, but soon everybody was forced to take sides as Pasteur accused Pouchet of bad and polluted experimentations. Pouchet also published on history of medieval sciences. To decide in favour of Pasteur, Krašan prepared his own experiments and observations on smaller bacteria, using sugar and phosphorus salt in his first series of experiments on 11 December 1875. He used 6 grams of distilled water in a bowl with 15 milligrams freshly taken samples (Krašan 1876, 7). He made new experiments on 26 December 1875, 2 January 1876 (Krašan 1876, 13), 2 February 1876, and later. His electrical twitches appeared very lively, but he could not see any division or development (Krašan 1876, 24). He made additional attempts on 19 September 1876 (Krašan 1876, 30). He stated: "If someone wants to trace the origin of a monad or a bacterium, let him say the previously guiding principle: Omne vivum ex ovo lebe wol (Every living thing is from an egg, Everything alive from the egg, All life from egg lives well)! May my own experience by the present investigations convince him that it is not enough to establish a doctrine if men of outstanding reputation give it a letter of safe conduct and the most thinking and non-thinking people believe in it. The history of science provides us with hundreds of proofs of this. The rule here is: check and keep the better result" (Krašan 1876, 32). Krašan continued: "Based on what has been said so far, I can rest assured that I am convinced to express that our usual ideas about the origin of organic beings, which are taken from our knowledge of the higher animals and plants. Based on experience, we express those with the terms: germination, budding, division, development from what we call an egg. Whereby we attribute to every generation a change, to a similar, constantly repeating mother form. No matter how rich and uninterrupted a cycle of forms. One does not find any thorough application to the lowest organisms, such as those that arise in infusions. The transfer of these concepts (or schemes) to the origin of bacteria and monads is based on defective induction, so it could only be justified as a hypothesis so long as direct observations confirm or refute it. According to the clear results of the present investigations, it has also lost this right. Nägeli's warning voice should at least have received better attention from the more thoughtful natural scientists" (Krašan 1876, 34). The Swiss Carl von Nägeli (1817–1891) was also G. Mendel's vivid correspondent, albeit Nägeli failed to encourage Mendel's research properly.

Krašan's tools

At that time, in 1876, Krašan as a professor in Celje taught natural history in grades I, II, V and VI, mathematics in grades I and II, and physics in grades III and IV, altogether 19 hours per week. In the Grammar Schools in Gorizia and later in Celje in 1876, physics and mathematics were taught in higher classes by Adalbert Deschmann who married Maria Dormann. Adalbert Deschmann taught in Celje Grammar School in 1874-1884. Krašan was a curator in the natural history laboratory, while Adalbert took care of the physics laboratory. In the year 1876 in the natural history laboratory at Celje Grammar School, besides the biological items Krašan acquired a goniometer for determining angles in crystals, made of wire and platinum sheet. Krašan used the goniometer three years later for his paper (Krašan, Mineralogisch-geognostische Untersuchungen über die bei Cilli vorkommenden Eruptivgesteine (Mineralogical-geognostic studies of the igneous (Magmatic) rocks occurring near Cilli, *Celje Grammar School program* 1879, pp. 1-37). In that same year 1876 in Celje Grammar School, Deschmann acquired for his physics laboratory the following:

1. Reversing pendulum which also explains the moment of inertia.
2. Parallelogram of forces according to Frick. 3.

3. Chemical balance as a beam balance instrument that is used in a quantitative measure of the chemical with great precision. That Analytical balance was developed by Joseph Black: Krašan might have used it for his precise experimentations.
4. A spring (for Hooke's law).
5. Pressure pump, also the principle of the fire engine.
6. Stroboscopic drum with stroboscopic images and wave drawings.
7. Pneumatic lighter.
8. Cryophore.
9. Bunsen battery with 20 Elements.
10. Ruhmkorff's spark inductor.
11. 4 coils for induction (2 main, 2 for lecturing in higher grades)
12. Geissler's cathode ray tube (invented two decades earlier) with melted uranium glass. 12.
13. Pocket spectroscope.
14. 10 pieces of Bolognese tears.
15. 10 pieces of glass.
16. Several minor items (Programm Celje 1876, 41, 64; Krašan, Generatio spontanea. *Programm des K.K. Staats-Gymnasiums in Cilli:* Buchdr. v. Johann Rakusch, 1876, pp. 3-34).

Krašan's later biophysics

Krašan published several other works related to the biophysics:

Bemerkungen über den Einfluss der Temperatur auf die Lebenserscheinungen der Pflanzen. (Aus der Flora von Görz) (Comments on the influence of temperature on the life phenomena of plants. (From the Flora of Gorizia)), 1869, *Österreichische Botanische Zeitschrift*, 19, 18690101, 14.

Mineralogisch-geognostische Untersuchungen über die bei Cilli vorkommenden Eruptivgesteine (Mineralogical-geognostic studies on the igneous (Magmatic) rocks occurring near Cilli), Celje: Buchdr. von Johann Rakusch, Cilli, 1879, *Celje Grammar School program* 1879, pp. 1-37. In it, Krašan quoted many local sources including the initiator of Gondwana continental drifts Eduard Suess (* 1831 London; † 1914 Vienna), G. Tschermak, and K. Sima, but not F. Unger who researched around Celje and Socka few years earlier (Krašan 1879, 18, 27). The hydrostatic pressure metamorphosed those rocks by the cohesion of their particles (Krašan 1879, 31). K. Ettinghausen also researched the same topics. Some of Unger's 320 fossils of plants from Socka, Radoboj in Croatia and other places were kept in Krašan's natural history laboratory in Celje which was a special honour to Unger's student Krašan (Krašan 1879, 33; Unger, *Denkschiften* 1850).

Krašan finished with analytical examination of his minerals (Krašan 1879, 35-37). At that time, in 1879, Krašan as a professor in Celje taught natural history in grades I, II, V and VI, mathematics in grades I and III, and physics in grades III and IV, altogether 19 hours per week. In 1779 in Celje Grammar School, Adalbert Deschmann taught physics in grades VII and VIII, and mathematics in grades V to VIII, altogether 20 hours per week (Celje Grammar School program, 1879, 38). They used Močnik's mathematical textbooks, Krist's, J. Schabus', Pisko's, and Handl's physical-chemical textbooks, Gustav Adolph Kenngott's (1818–1897) mineralogy textbook, Pokorny's zoology textbook, and Wretschko's botany textbook (*Celje Grammar School program*, 1879, 49; Mathias Wretschko*, Vorschule der Botanik für den Gebrauch an höheren Classen der Mittelschulen und verwandten Lehranstalten ... Mit ...*

Holzschnitten, Vienna, 1865/66). They bought Johann Gustav Vogt's (1843 Firenze-1920) *Die Kraft* and Johann Heinrich Jakob Müller's (1809-1875) *Lehrbuch der Physik.* They obtained as presents the *Wien. Ber.* which Krašan used widely, and B. Kocen's *Leitfaden der Geographie (Geography).* The Natur-Philosopher Johann Gustav Vogt's monism influenced the Darwinist Ernst Haeckel, Friedrich Nietzsche, and then the already suspicious concepts of aether which A. Cauchy developed in Gorizia just before Krašan's birth nearby (*Celje Grammar School program*, 1879, 62-63; Johann Gustav Vogt, *Die Kraft: Eine real-monistische Weltanschauung von Johann Gustav Vogt. 1 Die Contraktionsenergie, die letztursächliche einheitliche mechanische Wirkungsform des Weltsubstrats,* Leipzig: Haupt & Tischler, 1878). Krašan was still a curator in the natural history laboratory and Adalbert in the physics laboratory. In 1879 in the natural history laboratory at Celje Grammar School, Krašan acquired, besides other biological items, a very young crocodile from a 1st class student and many minerals. Deschmann bought for his physics laboratory among others, a Chinesische Treppen-Läufer (running stairs), Franz Emil Melde's (1832 near Fulda - 1901 Marburg) Stimmgabelaparat (tunning forks for the observation of standing waves), the radiometer, microphone, Marloje's diaspason (diapason for acoustics), Endosmometer, several voltaic elements, thermophone, apparatus for Fraunhofer's spectral lines, apparatus for electrical light (probably Edison's), and Kundt's cathode ray tube (Glassröhre). Altogether, Deschmann acquired 46 new items. They also had some mathematical models (Celje Grammar School program, 1879, 64-66).

Krašan's Darwinism

According to the ideas of his teacher Unger, Krašan soon developed his evolutionary theories in his own paper (Krašan, Zur Geschichte der Formenenwicklung der roburoiden Eichen (On the history of the development of forms of roburoid oaks), *Botanische Jahrbücher Für Systematik, Pflanzengeschichte Und Pflanzengeographie*, 1887, 8: pp. 165-202, with 3 tables of illustrations of his leaves of oaks at the end). Almost at the very beginning, the brave Krašan explicitly expressed his Darwinism: "The changes in form that take place in the living species of our oak trees can currently only be envisaged with some success from one side, namely insofar as the conditions of existence of these plants, which are well known to us, are involved. These are primarily climatic factors and the substantial ones: condition of the soil. These dual agents are generally variable within wide limits, but they only become important for the design of the plant when they have reached one or the other extreme of their amplitude. So can the common oak during the growing season, which in Styria begins without damage, but also without any consequences for their traditional shape towards the end of April at around 12 °C, with a depression in temperature up to 0 °C and its elevation up to 38 °C: but if a frost hits them during or shortly after the leaves have formed, the leaves are scorched, sometimes even completely killed, and a new shoot appears, which is more or less similar in terms of leaf shape but different from the first. The same can be said of *Q. pubescens* and no less of *Q. sessiliflora*, except that for the latter the upper limit of the temperature amplitude does not seem to be so high; it just reflects the changes that both suffer in their growth economy due to the frost … (Krašan, 1887, 165)". *Quercus pubescens* (also considered as synonyms *virgiliana*, downy oak, pubescent oak, Italian oak) is a species of white oak (genus *Quercus* sect. *Quercus*) native to southern Europe and southwest Asia. Krašan bravely defended Darwin but did not dare to publish any popular works about the evolution as Unger did to his own proud sorrow.

Krašan continued: "First of all, there are influences which increase the susceptibility of plants to stimuli; As a rule, however, each type of stimulus also presupposes its own type of

agent that promotes it; those circumstances, which promote heliotropism, cannot also increase the plant's ability to reproduce, to accomplish the so-called Darwinian curvatures (Darwin'sche Krümmungen zu vollbringen). We find this quite natural a priori, because otherwise there would only be one type of stimulus (Krašan, 1887, 167)". Darwinian curvature was an archaic term for the curvature in the growth of a root, leaf, etc. caused by damage to one side of it. We call heliotropism the diurnal or seasonal motion of plant parts (flowers or leaves) in response to the direction of the Sun. The habit of some plants to move in the direction of the Sun by a form of tropism was already known by the Ancient Greeks or Chinese. The French academician Jean-Jacques d'Ortous de Mairan was one of the first to experimentally study heliotropism with the *Mimosa pudica* plant (sensitive plant, sleepy plant, action plant, touch-me-not, shame-plant, a creeping annual or perennial flowering plant of the pea/legume family Fabaceae). Mairan was R. Bošković's correspondent praised by the Jesuits in Ljubljana and in Krašan's Gorizia. The phenomenon was studied by Charles Darwin and published in his penultimate book *The Power of Movement in Plants*, a work which included other stimuli to plant movement such as gravity, moisture, and touch published in London by John Murray on 6 November 1880.

That book by Charles Darwin on phototropism, heliotropism, and other types of movement in plants further promoted his doctrine of evolution by natural selection. There Charles and his son Francis continued in producing evidence for the theory of natural selection within the necessary experiments. The careful Krašan certainly read that Darwin's book even if he did not dare to quote it explicitly because of supposed reactions of catholic clergy. Krašan continued: "The situation is different with the triggering causes of irritation; however, a wide variety of mechanical impulses, injuries, the administration of certain food substances in excess, etc. can sometimes result in the same irritating effects. You can see it, for example, in young *Taraxacum* (dandelion) plants, epinastic curvature of the leaf surface can be caused in spring by treating the soil with sodium chlorine, but the same phenomenon is caused by frost on young oak leaves in spring when it surprises them at their vulnerable stage of development (Krašan, 1887, 167)." The epinastic growth is differential growth of the upper or adaxial part of a plant organ, for example as the growth of the upper side of the petiole (the stalk by which the leaf is attached to the stem), causing the leaf to be bent downwards. Krašan concluded: "Final word. These are the results of my recent oak studies. I believe, however, that although the idea that I have put down here arose from the diligent and conscientious observation that I have devoted to oaks for several years, the same may have been the case for a long time by other researchers who are on a similar path in the important question about the **evolution of plant species** to seek to approach the truth. This is considered certain with regard to some leading ideas concerning the temporary return of fossil forms; because it was already in the years 1877-1880 when Prof. Constantin Ettingshausen expressed the view and justified it with evidence with numerous examples of phenomena in living and fossil plants, that under certain circumstances, formations appear in living species that cannot be otherwise explained in the phylogenetic context of fossil species, i.e. with reference to previous species that should be viewed as their original forms. Constantin Ettingshausen called them "regressive formal phenomena." When Charles Darwin's *On the Origin of Species* was first published in 1859, the fossil record was poorly known. Darwin described the perceived lack of those Krašan's transitional fossils as "the most obvious and gravest objection which can be urged against my theory." He tried to explain it by relating it to the extreme imperfection of then geological record. He noted the limited collections available at the time but described the available information as showing patterns that followed from his theory of descent with modification through natural selection. Just two years later, in 1861, Darwin cheered when Archaeopteryx was discovered: it represents a classic transitional form: it was staging between earlier non-avian dinosaurs and the modern birds.

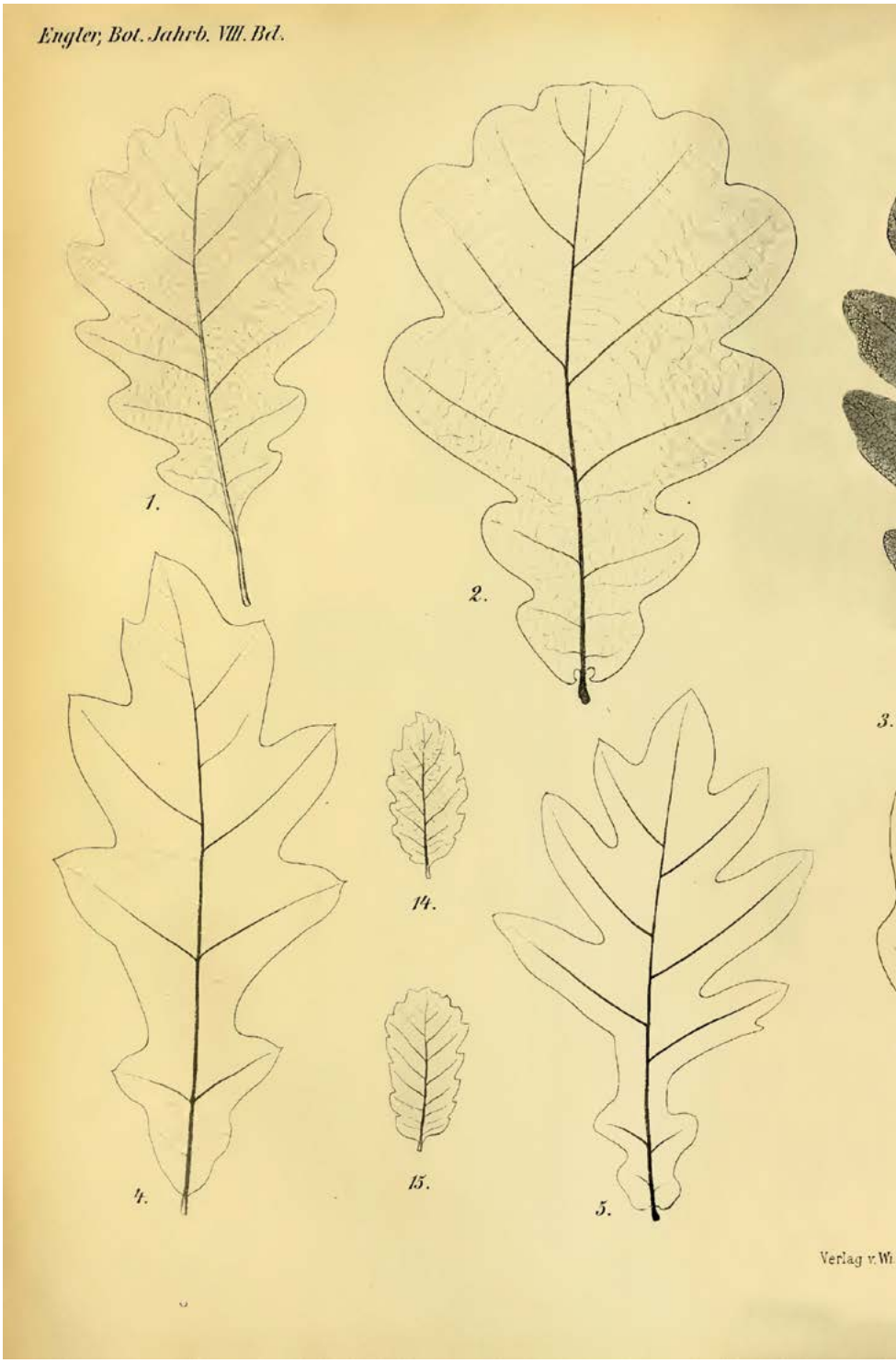
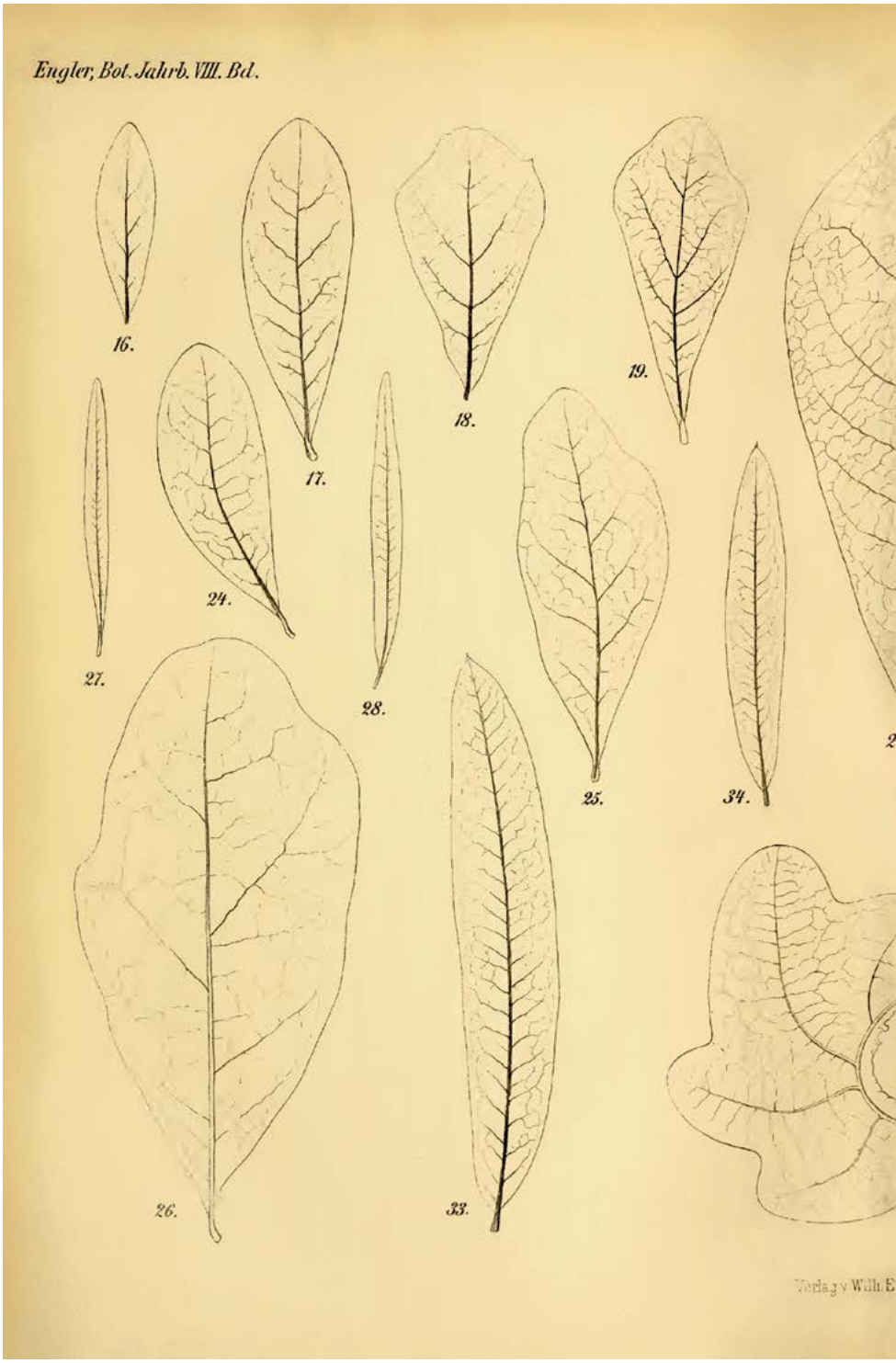

Engler, Bot. Jahrb. VIII. Bd.
1.
2.
3.
4.
5.
14.
15.
Verlag v. Wi

Figure 5:
Krašan's tables of illustrations of his leaves of oaks at the end of his article (Krašan, 1887, 202ff).

Slika 5:
Krašanove skupine ilustracij hrastovih listov na koncu članka (Krašan, 1887, 202ff).


Engler, Bot. Jahrb. VIII. Bd.
16.
17.
18.
19.
24.
27.
28.
25.
34.
26.
33.

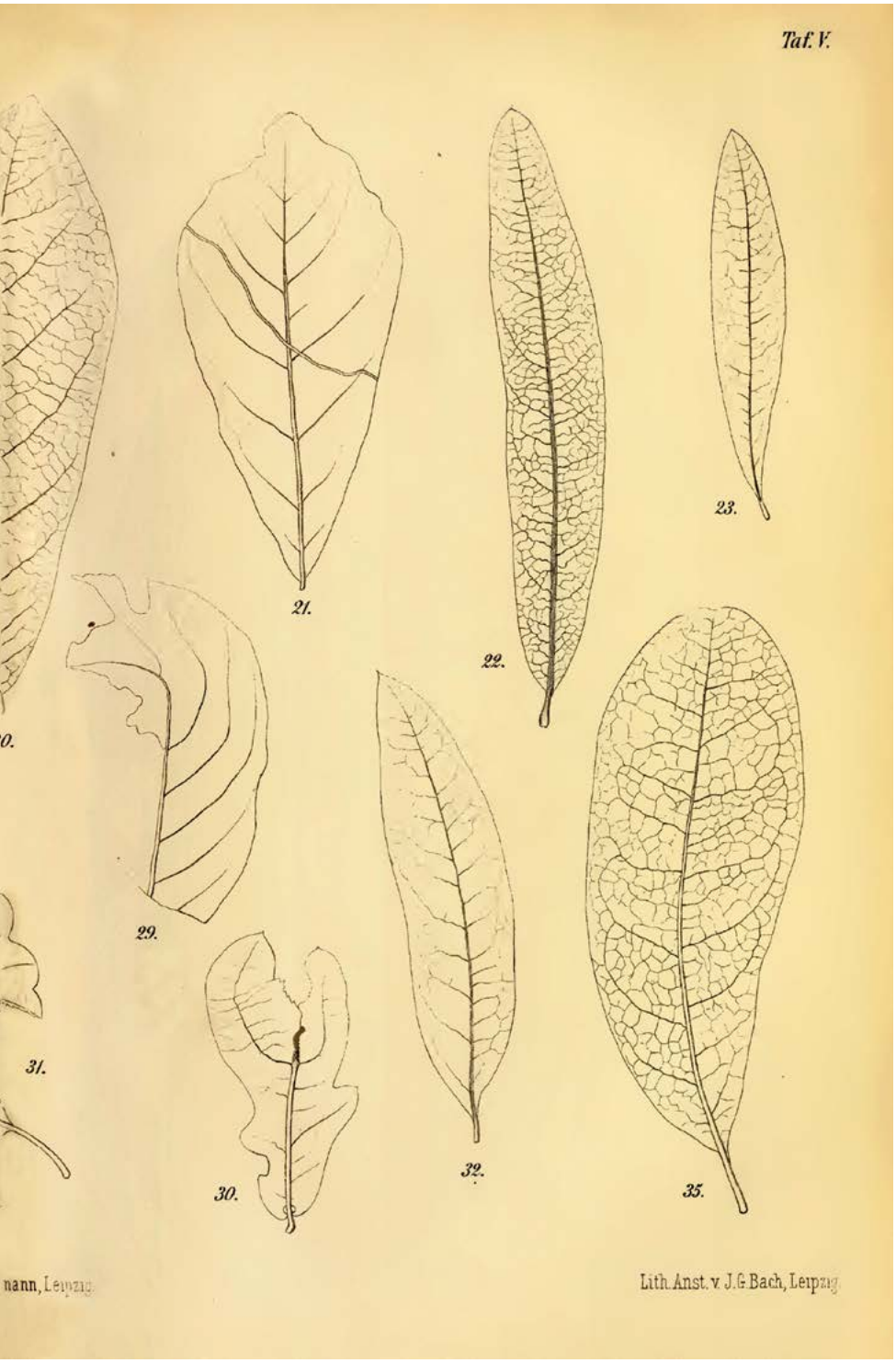


Figure 5:
Continuation

Slika 5:
nadaljevanje

Krašan did not dare to mention Darwinism on that occasion as he concluded: "No less, it gives me great satisfaction to see that Dr. Focke in Bremen long ago established the fact of the temporary separation and reunification of the characteristics through observations on spotted varieties of the legume bush or European holly flowers (*Ilex aquifolium*). His views on Rubus Leesii Babingt contributed to knowledge of the phylogeny of plants." In 1847, Babingt described that plant, while Wilhelm Olbers Focke promoted it almost a quarter of a century later (Wilhelm Olbers Focke, *Ueber rubus Leesii Babingt*, Bremen: Müller, 1870)."

Krašan further narrated: "Focke agrees with my views in all points where there are connections with the oaks. I also gather from Focke's letters that he thinks similarly to me about the nature and meaning of the lower leaves of plants. It is partly thanks to the inspiration that came from his friendly messages that I decided to clarify my thoughts on this matter more precisely and in more detail. Above all, I thank the government councillor Prof. Constantin baron Ettingshausen. I am deeply indebted to him as for the kind support he gave me through advice and action, and especially by making the scientific treasures of the phyto-palaeontological institute (in Graz) available to me in the most liberal manner for the purpose of my studies. I would also like to express my deep gratitude to Mr. Farkaš Ritter Vukotinović, the emeritus Ober-Mayor in Zagreb (Agram), for having the kindness to leave me a very valuable collection of (leaves of) the Croatian oaks, and to my esteemed student colleague Mr. J. Freyn in Prague for kindly sending his rich oak collection (of leaves), as well as for the friendly advice, through which he helped me to use it (Krašan, 1887, 200-201; Constantin Ettingshausen, Beiträge zur Erforschung der Phylogenie der Pflanzen. *Denkschr. der k. Akad. der Wissensch, in Wien, mathem.- naturw. Klasse*, Bd. XXXVIII. und XLIII. (*Memoir the k. Acad. of Science in Vienna, mathematics and natural sciences. Class,* Vol. XXXVIII. and XLIII); Vorläufige Mitteilungen über phyto-phylogenetische Untersuchungen. *Sitzungsber. der k. Akadem. der Wissensch. in Wien, mathem.- naturw. Klasse* (Preliminary communications on phyto-phylogenetic studies, *Meeting of the k.k. Academy of science in Vienna, mathematics - naturalistic*. Class) 1879, Vol. LXXX; Focke, *Jena magazine (Jenaische gelehrte Zeitungen,* Jena: Cröcker & Melchior Cuno, Strauß Cröcker & Gollner*),* V. Volume, no. 1)." Krašan's correspondent Wilhelm Olbers Focke (1834 Bremen-1922 Bremen) was a doctor and botanist. He was the great-grandson of the astronomer Wilhelm Olbers and the older brother of Johann Focke (1848 Bremen - 1922 there Bremen) who was a syndic of the Free Hanseatic City of Bremen and founder and director of the Focke Museum named after him in Bremen. Josef Franz Freyn (1845 Prague - 1903 Prague-Smíchov) was a Habsburgian civil engineer and botanist as the son of forester Josef Freyn from Obecnice near Příbram. After 1862, Josef Franz Freyn studied at the Polytechnic (Technische Hochschule) in Prague but interrupted his study for a placement in forestry. In 1865-1867 he studied engineering at the Polytechnic (Technische Hochschule) in Vienna where he met Krašan. Afterwards Josef Franz Freyn was employed in the construction of railways in Hungary and later worked in Istria (1874–1878), and in the meantime conducted investigations of regional flora. In 1878, he relocated to Opočno near Hradec Králové. Later, in 1881, he returned to Prague: there he owned a construction company. Freyn was a self-taught botanist— he reportedly never attended a formal lecture on botany even if Krašan described him as his Viennese student colleague. In addition to research of Hungarian and Istrian flora, he processed botanical collections from the Iberian Peninsula, Bosnia-Herzegovina, Turkestan, and others. As a botanical collector he collaborated with Joseph Friedrich Nicolaus Bornmüller, Eduard Hackel, Paul Sintenis, Krašan, and J. J. Manissadijan. Freyn is remembered for his specialized studies

of individual plant species, especially those within the genera *Ranunculus* (buttercups, spearworts, water crowfoots) and *Hieracium*. The Croatian evolutionist of Hungarian origin the poet Ljudevit Farkaš Vukotinović (1813 Zagreb-1893 Zagreb) graduated in Pest. Together with Josip Kalasanc Knight Schlosser, he published the grandiose work *Flora Croatica* in 1869, a sort of compendium of plant species in Croatia. Vukotinović was also a prominent researcher in the field of natural history writing about the geological relations in Lika, Samobor, Zagreb, and Moslavačka gora as the author of the first Croatian geological map. He was the great prefect Križevački from 1861 to 1867. On January 1, 1867, he was elected among the first to become a full member of JAZU, where they also had the Carniolan experts Simon Šubic and Janez Bleiweis.

Krašan was among the early Darwinists at least in some semi-hidden form because he feared Unger's destiny in the hands of Catholic criticism. So, he published:

Beiträge zur Geschichte der Erde und ihrer Vegetation, 1881-1882, 1887, *Jahresberichte des K.K. Zweiten Staats-Gymnasiums in Graz* (today BG/BRG Lichtenfels), 1881-1882, 1887 (Contributions to the history of the earth and its vegetation, 1881-82, 1887, *Annual reports of Second State High School, Graz*).

In 1869, a school was opened on the premises in Griesgasse as the k. k. II. State High School in Graz, a decade before Krašan was hired. In 1889, twenty years after it was founded, the school moved to the premises on Lichtenfelsgasse in the 2nd district of St. Leonhard in Graz that are still in use today. A decade after Krašan's retirement, in 1909, it was converted into a secondary school, so that the school was then named k. k. Graz State Realgymnasium. In 1882/83 in Graz, Krašan taught mathematics in grades I, II and IV, as well as natural history in grades., II, III, V and VI. Altogether, he taught 19 hours per week. Dr. Ferdinand Mauer taught physics in grades IV and VII, and mathematics in grades III, V, VI and VIII, altogether 19 hours per week. In 1885 in Graz, Krašan taught mathematics in grades I, II and III, physics in grade III (second semester), as well as natural history in grades I, II, III (first semester), V, and VI. Altogether he again taught 19 hours per week (*14. Jahresberichte des K.K. Zweiten Staats-Gymnasiums in Graz*, 1882/83, 42; *16. Jahresberichte des K.K. Zweiten Staats-Gymnasiums in Graz*, 1885, 31; *18. Jahresberichte des K.K. Zweiten Staats-Gymnasiums in Graz*, 1887, 28; *19. Jahresberichte des K.K. Zweiten Staats-Gymnasiums in Graz*, 1888, 38). Krašan's three years older colleague, the Cistercian priest Ferdinand Maurer (1837 Vetrní (Wettern) in Bohemia - 1916 Vyšší Brod (Hohenfurth) in Bohemia) joined the Vyšší Brod Cistercian monastery in 1856 and was ordained a priest in 1860. He initially worked in pastoral care, then as a teacher candidate in Vienna and as a teacher of mathematics and physics at the high school in Budejovice (Budweis). In 1868, he obtained his PhD which, however, was apparently never materialized, as he was noted in Graz without that title. In 1872, Maurer became a professor at the state Grammar School in Celje (Cilli), three years after Krašan left that city. In 1874, Maurer became a professor and in 1884 a director at the II. Staatsgymnasium in Graz (Lichtenfelsg.), but in 1885 he was appointed director of the I. Staatsgymnasium (Academic Gymnasium) in Graz. In 1892, he became the state school inspector for Lower Austria. In 1902, he was retired: he lived in the Vyšší Brod (Hohenfurth) Abbey from 1915. During twelve years, he headed the Austrian group of the Society for educational and school history (Österr. Gruppe der Ges. für dt. Erziehungs- und Schulgeschichte). Despite being the leading Habsburgian botanist, Krašan was also obliged to teach mathematics and physics: without a PhD, he was unfit for the university job focused only on botany, but the lecturing on mathematics and physics helped the mathematizations and experimentations of his botanical research.

Krašan and Ettingshausen

In Graz, Krašan collaborated in the research of botanic atavism and deformations with the oldest child of Krašan's and Mendel's teacher Andreas, the botanist Constantin Baron Ettingshausen (* 16 June 1826 Vienna; † 1 February 1897 Graz). Together they published, inter alia:

Beiträge zur Erforschung der atavistischen Formen au lebenden Pflanzen und ihrer Beziehungen zu den Arten ihrer Gattung (Contributions to the research of atavistic forms in living plants and their relationships to the species of their genus), von Prof. Dr. Constantin, Freiherrn von Ettingshausen … und Prof. Franz Krašan, Wien: Aus der k. k. Hof- und Staatsdruckerei, 1888.

Untersuchungen über Deformationen im Pflanzenreiche von Constantin v. Ettingshausen und Franz Krasan: (Mit 2 Tafeln in Naturselbstdruck) (Investigations into deformations in the plant kingdom by Constantin von Ettingshausen and Franz Krašan (with 2 plates in natural printing) September Abdr. aus dem LVIII. Bande der *Denkschriften des Math. Naturw. Classe der K. Akad. d. Wiss*, Wien: K.K. Hof- und Staatsdruck, 1891.

After Constantin Baron Ettingshausen's death, Krašan continued with similar research:

Ansichten und Gespräche über die individuelle und spezifische Gestaltung in der Natur (Views and conversations about the individual and specific shapes in nature), Leipzig: Engelmann, 280 pages, 1903. Commented by J. A. T. on Books Received in *Nature* 10 March 1904, 69: 435). J. A. T. (probably the botanist–diplomat Hans Freiherr von Türckheim zu Altdorf (Johann, 1853 Karlsruhe - 1920 Karlsruhe)) jokingly stated that: "This quaint but very serious book is an expression of the author's attempts to reach some clearness in regard to the conceptions of species, variety, breed &c. which he has had to deal with in the course of his botanical studies. He discusses the profoundest questions of biology: How far is organic form a function of organic substance? What is the nature of reaction to surroundings? Can one distinguish between the original and the accessory characters of individuals? What is the real meaning of metamorphosis and substitution of organs? What is the evolutionary import of variation and mutation and modification? How are we to define species, variety, and breed? What is the scope of hybridisation and in-breeding, of isolation and selection? In short, Franz Krasan traverses the whole field of evolution-theory. And yet the result, to our mind at least, is deplorable-nothing short of a pathetic waste of careful and assiduous thinking, for he has cast his book in the form of dialogues between Arthur, Erwin, Fritz, Julius, Raimund, Walther, and possibly some others whose acquaintance we have not been able to make! … Krašan's characters reiterate their various convictions, while the reader undevoutly wishes that they would all die off and leave Franc Krašan to tell us in plain German what he really means." J. A. T. certainly wished to know some more about Krašan's Darwinism which was mainstreaming in Britain but not yet in Krašan's Graz! But, the clever Krašan was afraid to speak up in then Catholic Vienna because of Unger's Darwinist problems three decades earlier. He certainly had his reasons! Curiously, just next to Krašan's data, *Nature* published the famous article by Ernst Rutherford (1871-1937), certainly the most famous experimentalist of that era. The great Kiwi Rutherford discussed the radioactivity which was about to change sciences and the life in general, including Krašan's paleo-botany with incoming C^{14} dating of ancient fossils. This radiocarbon dating was developed by Willard Libby (1908-1980) at the University of Chicago in the late 1940s as the outcome of the Libby's bombing Manhattan WW2 project (Ernst Rutherford, Nature of the γ Rays from Radium, *Nature*, volume 69, pages 436–437, 10 March 1904). Other comments were more favourable, including K.K. who observed that Krašan successfully taught evolution at high schools even if the Anti-Darwinist promotor

of cell theory Rudolf Virchow (1821–1902) advised against it in 1877. With his new PhD, received at the University of Chicago, the plant physiologist Burton Edward Livingston (1875 Grand Rapids, Michigan–1948) praised Krašan as the Philosopher of Biology (K.K., 1903, 635-636; Livingston, 1903, 232-233).

Epilogue

Franc Krašan apparently never published his works in Slovenian language, although his colleagues Fran Erjavec, Anton Šantel, or Krašan's neighbour in Graz Simon Šibic earned some money with such publications. Franc Krašan and his wife Franziska (Frančiška) had a daughter the schoolteacher with a typical Slavic name Ludmila (Ludmilla) Krašan. Ludmila never married but helped Franc Krašan in the publishing of some of his works together with Bruno Kubart in Graz (Fridolin Krasser, *Mitteil. d. Naturwissenschaftl. Ver. f. Steiermark* 1907, 44: 166; Marko Krašan talk on 19. 11. 2023). The paleo-botanist professor at the University of Graz Bruno Kubart (13 September 1882 Libivá (Libein) in Moravia - 2 May 1959 near Bad Aussee) studied botany at the University of Vienna and received his doctorate in 1906. In 1907, he came to the Botanical Institute of the University of Graz as an assistant to Prof. Karl Fritsch (1864 Vienna - 1934 Graz), the son of a meteorologist who had the same name. In Graz, Kubart met Krašan and his family. Kubart completed his habilitation in 1912 and was appointed associate professor in phytopaleontology in 1920. In 1923, he became head of the Laboratory for Phytopaleontology. Despite a promising start, his career was rather lackluster: none of his appeals were successful, and his laboratory always remained underfunded. He constantly argued with his colleagues and the university management. A highlight of these disappointments was his early retirement in 1936. After the "Anschluss" he was put back into service, but he was still denied the professorship and academic recognition he had hoped for. Retired in 1936, Kubart returned to work after the annexation of Austria in 1938 and headed the phytopaleontological laboratory again. During the Nazi era, Kubart was president of the German Botanical Society (Deutschen Botanischen Gesellschaft). The paleobotanist Bruno Kubart was one of the most outspoken National Socialists at the University of Graz, which certainly annoyed the Nobel Prize winner Ernst Schrödinger who taught in Graz for a while as the outspoken enemy of Nazis. In May 1945, Kubart was arrested by the US Army. After his internment in "Glasenbach" near Salzburg, Kubart tried tirelessly and ultimately unsuccessfully to return to the University of Graz. Like many of his colleagues at the University of Graz, the paleobotanist Bruno Kubart was already National Socialist-minded before Austria's "annexation" to Germany. In Graz, Kubart remained a scientific "lone fighter" among many politically like-minded people. A paleobotanist Kubart fought boldly and ultimately unsuccessfully to have his achievements recognized.

Despite Kubart's sins, Krašan's star shines bright. Franz Krašan's portraits are today kept in the University of Padua. Five days after Franc's death, on 17 May 1907, his funeral in Graz was attended by many dignitaries including Ernst Mach's student, the physicist Anton Wasmuth (1844 Teplá Abbey (Klášter Teplá, Stift Tepl near Marienbad) in the Czech Karlovy Vary Region - 1927 Graz). From 1893 to 1914, Wassmuth served as chair of theoretical physics at the University of Graz. Wassmuth is best known for his research involving thermos-elasticity, electromagnetism, and statistical mechanics.

In, 2005, Tone Wraber demanded a street in Nova Gorica to be named Krašan Street (Wraber, 2005, 192), but it turned otherwise. In his native Šempas next to the old school not far from his domestic house Librščevi, the monument to F. Krašan was erected and the local square

was dedicated to Krašan. That celebration was promoted by the local branch of the former LDS Party headed by the Mayor of Gorizia Matej Arčon (* 1972 Šempeter near Gorizia) on 28 August 2014. In 2022, Arčon joined the party "Svoboda" led by his Gorizia neighbour Robert Golob. Franc Krašan is still praised by the great grandson of his nephew, the Ljubljana UKC computational economist Marko Krašan MSc (Marko Krašan notes from the bank of the Sava River in Ljubljana on 19 November 2023; Wraber, Tone. January 1989. Mendel's famous paper in the inheritance of Franc Krašan, *Proteus: ilustriran časopis za poljudno prirodoznanstvo*, 51/5 (1988/1989): 203-204; Wraber, Tone. 2005. Rastlinstvo Goriške okolice in njegovi raziskovalci, *Zbornik prispevkov v počastitev 75-letnice prof. Sergia Tavana,* Nova Gorica: Goriški muzej, *Goriški Letnik: zbornik Goriškega muzeja* no. 30/31, 2003-2004, pp. 171-192; Oset, Željko (ed.). 2018. *Goriški izobraženci skozi zgodovino,* Nova Gorica: Založba Univerze; Čuš, Jure. 2013. *Die Entwicklung der botanischen Fachsprache unter dem Einfluss der slowenisch-deutschen Sprachkontakte*: Diplomarbeit, University Maribor, Faculty of Arts, German studies department).

Rüdiger Felix Solla (Ruggerio Francesco, * 1859 Trieste) did not quote Krašan's papers, while Solla wrote on Gorizia plants in the same journal where Krašan also published his works(Solla, *Österreichische Botanische Zeitschrift*, 1878, 28: 264ff, 301ff, 331ff, 399ff). Solla made few botanic excursions to Mt Mangart with Krašan's younger Gorizia neighbour Julius Kugy (1858 Gorizia - 1944 Trieste) and frequently read papers to the Littoral branch of German Alpinverrein in Trieste, which was in odds with the Graz professor of mathematics and alpinist Johannes Frischauf (1837 Vienna - 1924 Graz). Frischauf supported Slovenian Alpinists, Ludwig Boltzmann's half Slovenian bride Jetti, and probably also Krašan who used Slovenian alphabet even for his family name. On the other hand, Edvard Scholz (Eduard Scholtz, 1860 Sibiu, Romania - 1932 Vienna) cited Krašan frequently in his key to identifying ferns (ein Schlüssel zur Identifizierung von Farnen) in 1896. In 1883/84 at the University Vienna, Scholz passed the teaching qualification in natural history for upper grades and mathematics and physics for lower grades. He taught from 1894 as a Grammar School in Gorizia, where he became a professor in 1897. From 1898, he taught at the Vienna VII State Higher Secondary School. Anton's son Saša Šantel remembered Scholz as a strict German albeit a great teacher of botany in natural environments. Otherwise, the Bohemian Edvard Ludvík Pospíchal (1838 Litomyšl, eastern Bohemia - 1905 Belluno in northern Italy) as a professor of classical philology at State Grammar School in Trieste in the 1875-1899 period published few texts on flora in the Littoral but without any citations. Pospíchal made botanical excursion to Karst with Henrik Tuma (1858 Ljubljana - 1935 Ljubljana) and Ferdo Siedl (1856 -1942). Pospíchal was criticized by the Trieste Museal custodian Carlo Marchesetti (1850 -1926). Günther Ritter Beck von Mannagetta und Lerchenau (1856 Bratislava - 1931 Prague) used Krašan's 40 years old data for his own geography of plants (Scholz, 1896, *Program of Gorizia Grammar School*, pp. 3-36; Saša Šantel, 2002; Pospíchal*, Flora des oesterreichischen Kuestenlandes*, 1897-1899, Leipzig/Wien; Wraber, 2005, 179-181; Mannagetta, *Wien. Ber.* 1907, 118: 1439-1534). Certainly, we could compare Krašan to the Odessa professor Smirnov (d. 1904 Tiflis) who botanically researched Krašan's favourite Mt Sabotin in 1890. Sabotin (Sabotino, Monte di San Valantino) is a 609 metres high hill above Nova Gorica and Solkan. All of them continued the research of the Gorizia physician Pietro Andrea Mattioli (1501 Siena - 1578 Trento) who guarded Gorizia against the pest in 1542/43 - February 1555. He was followed by the Belgrade born Jesuit F. Wulfen of Swedish origin, Julij Głowacki (Ivan, 1846 Idrija - 1915 Graz) and many others including Krašan (Tone Wraber's 26 February 2002 speech at Kromberg near Gorizia; Wraber, 2005, 171, 173, 180; Dakskobler, Igor. 2005. The flora and vegetation of Mt Sabotin: (western Slovenia)), *Goriški Letnik: zbornik Goriškega muzeja* no. 30/31, 2003-2004, pp. 193-208, here pp. 195, 204).

Povzetek

Krašan je vseskozi poučeval na gimnazijah, kjer si je pomagal s prvovrstno opremljenimi laboratoriji. Predvsem izjemno odmevne objave in vestno delo v Štajerskem naravoslovnem društvu so ga postavile v sam vrh slovenske botanike ob bok njegovemu dunajskemu učitelju Franzu Ungerju, ki je bil potomec mariborskega in višnjegorskega rodu. Tako Krašan kot Unger sta imela v lasti separat slovitega članka o hibridizaciji Gregorja Mendela iz leta 1866, čeravno se je le-teh ohranilo zgolj devet. Med devetimi kar dva Slovenca! Mendelova novotarska vpeljava matematike v botaniko, ki je marsikoga sprva zelo begala, je bila pisana na kožo prav Krašanu, saj je sam čislal podobne prijeme in je vseskozi predaval tudi matematiko. Krašan in njegov učitelj Unger sta se oprla na eksperimentalna in terenska raziskovanja, pri čemer se je Krašan osredotočil zlasti na primorsko in štajersko floro, medtem ko je bolj petični Unger potoval po vsem svetu. Oba sta razvijala Darwinovo evolucijsko teorijo na svojih poteh do sodobne epigeneze. Unger je kot mlad strokovnjak eksperimentiral z njega dni močno zagatnim Brownovim gibanjem, Krašan pa je objavil celo nekaj člankov osredotočenih na matematično in fizikalno pedagogiko ter mineralogijo, saj je o takšnih vsebinah redno predaval svojim dijakom. Profesor biologije, fizike in matematike Krašan je moral na svojih gimnazijah poleg njemu najbližje botanike vseskozi poučevati tudi matematiko, fiziko in kemijo, kar je vplivalo na njegov sodoben multidisciplinaren pristop k botaniki. Izučeni zdravnik Unger se je predavanjem zunaj botanike izognil najprej s svojim zasebnim poučevanjem otrok premožnih družin, nato z zdravniško službo in končno z univerzitetno profesuro. Kot zaprisežen darvinist in poljudni pisatelj je bil Unger deležen pristranskih kritik dunajskih duhovnikov. Prav zato sta se njegova učenca Mendel in Krašan obnašala previdneje izogibajoč se kakršni koli popularizaciji evolucijskih domnev, ki bi nepoznavalcem utegnile zveneti ateistično. V svojih strokovnih publikacijah je Krašan Darwina vseskozi citiral in je o njegovih novih na videz sprva kar prekucuških idejah redno predaval. V svojih poljudnih knjigah njega dni recenziranih v najodmevnejših revijah pa je svoj tedaj še marsikomu sporni darvinizem raje previdno skrival. Kot sin habsburškega Primorja stisnjenega pod nacionalističnimi grožnjami sosedov Krašan ni nikoli opustil slovenskega zapisa svojega imena in priimka: štajerski in koroški strokovnjaki Unger, Krašanov gimnazijski profesor Blaž Kocen in Jožef Stefan nikoli niso šli tako daleč, saj bi slovenjenje lahko ogrozilo njihov akademski prestiž v habsburški monarhiji pod občasno pristransko vladavino cesarja Franca Jožefa, ki se je nacionalizmom raje izogibal.

Reference / Sources and Bibliography

Czihak, Gerhard; Vítězslav Orel; Gregor Mendel. 1984. *Johann Gregor Mendel (1822-1884): dokumentierte Biographie und Katalog zur Gedächtnisausstellung anlässlich des hundertsten Todestages mit Facsimile seines Hauptwerkes, "Versuche über Pflanzenhybriden"*, Salzburg: Druckhaus Nonntal.

Čuš, Jure. 2013. *Die Entwicklung der botanischen Fachsprache unter dem Einfluss der slowenisch-deutschen Sprachkontakte: Diplomarbeit,* Univerza Maribor, Filozofska fakulteta, Oddelek za germanistiko.

Dakskobler, Igor. 2005. Floristična in vegetacijska oznaka Sabotina (zahodna Slovenija, The flora and vegetation of mount Sabotin: (western Slovenia)), *Goriški Letnik: zbornik Goriškega muzeja* št.30/31, 2003-2004, pp. 193-208.

Darwin, Charles. 1859. *The Origin of Species,* London: John Murray.

Darwin, Charles. 6. novembra 1880. *The Power of Movement in Plants,* London: John Murray.

Dassenbacher, Johann (ed.). 1868-1869. *Schematismus der Mittelschulen der im Reichsrate vertretenen Länder und der Militärgränze*. II. 1868 Znaim (SŠM-12134). Wien: Selbstverlage (NM-33472). (Volume 5, Nové Město (Neustadt) in Moravia: J. Dassenbacher, 1872).

Ettingshausen, Constantin baron. 1879. Beiträge zur Erforschung der Phylogenie der Pflanzen. *Denkschr. der k. Akad. der Wissensch, in Wien, mathem.- naturw. Klasse*, Bd. XXXVIII. und XLIII. (*Imperial Academy of Sciences in Vienna, Class of Mathematics and Natural Sciences, volumes XXXVIII and XLIII*); Vorläufige Mitteilungen über phyto-phylogenetische Untersuchungen, *Sitzungsber. der k. Akadem. der Wissensch, in Wien, mathem -naturw. Klasse (Preliminary communications on phyto-phylogenetic studies, meeting of k.k. Academy of Sciences in Vienna, class mathematics - natural sciences) 1879, year LXXX).*

Focke, Wilhelm Olbers. 1854. *Jenska revija* (*Jenaische gelehrte Zeitungen 1849-*, Jena: Cröcker & Melchior Cuno Strauß Cröcker & Gollner) V. letnik, št. 1).

Focke, Wilhelm Olbers. 1870. *Ueber rubus Leesii Babingt*, Bremen: Müller.

Jahresberichte (Program) Gimnazije Celje, 1879.

14. Jahresberichte des K.K. Zweiten Staats-Gymnasiums in Graz, 1882/83.

16. Jahresberichte des K.K. Zweiten Staats-Gymnasiums in Graz, 1885, 31;

18. Jahresberichte des K.K. Zweiten Staats-Gymnasiums in Graz (State Grammar School in Graz), 1887, 28;

19. Jahresberichte des K.K. Zweiten Staats-Gymnasiums in Graz, 1888, 38

Krasser, Fridolin. 1907. Franz Krašan, *Mitteil. d. Naturwissenschaftl. Ver. f. Steiermark* 1907, 44: 166, with a portrait after page 166.

Krašan, Franc. 1863. Die haupttypen der blüthenstände europ. Rubusarten und die entfaltungsfolge ihrer blüthen (*The main types of inflorescences of European rubus (bramble) and developmental sequence of their flowers*), 1863.

Krašan, Franc. 1863. Einiges zur Inflorescenz der Gageen *(A few observations about the inflorescence of Gagea) Oesterr. botanic. Zeitschrift,* junij 1863 15: 192–196 (1863). https://doi.org/10.1007/BF01892783

Krašan, Franc. 1866. *Bedeutung der Parabel für die Entwicklung des praktischen Begriffes eines bestimmten Integrals (The importance of the parable for the development of the practical concept of the definite integral),* 1866, Linz: J. Feichtingers Erben, 17 strani.

Krašan, Franc. 1 september 1867. Ueber Einige Kulturversuche (Culturversuche) mit Potentilla verna und cinerea, *Österreichische botanische Zeitschrift*, volume 17, pages 273–276.

Krašan, Franc. 1863, 1865. Beiträge zur Flora der Umgebung v. Görz, *Oesterr. bot. Zschr.*

Krašan, Franc. 1867. Eine Exkursion in das Gebirge von Tolmein (Tolmin) und Karfreit, *Oesterr. bot. Zschr.*

Krašan, Franc. 1868. Bericht über meine Exkursion in das Lascek-gebirge zwischen Canale u Chiapovano (Lašček, Kanal, Čepovan na Krasu), *Verhandl. d. zool.-bot. Gesellsch. in Wien*.

Krašan, Franc. 1868. Pflanzenphänologische Beobachtungen für Görz (*Program gimnazije Gorica (Grammar School Gorizia*).

Krašan, Franc. 1869. Bemerkungen über den Einfluss der Temperatur auf die Lebenserscheinungen der Pflanzen. (Aus der Flora von Görz) (*Comments on the influence of temperature on the life phenomena of plants (From Flora Gorizia))*, 1869, *Österreichische Botanische Zeitschrift*, 19, 18690101, 14.

Krašan, Franc. 1869. Über einige pflanzenphänologische Erscheinungen aus der Flora von Görz, *Oesterr. bot. Zschr.*

Krašan, Franc. 1870. Studien über die periodischen Lebenserscheinungen d. Pflanzen im Anschlusse an die Flora von Görz, *Verhandl. d. zool.-bot. Gesellsch.*

Krašan, Franc. 1873. Phänologisches aus der Flora von Görz u. Krainburg, *Zeitschr. d. österr: Gesellsch. für Meteorologie*.

Krašan, Franc. 1873. *Beiträge zur Kenntniss des Wachsthums der Pflanzen (Prispevki k poznavanju rasti rastlin)*, Wien.

Krašan, Franc. 1876. Generatio spontanea. *Programm des k.k. Staats-Gymnasiums in Celli*: Buchdr. v. Johann Rakusch, 1876, str. 3-34.

Krašan, Franc. 1879. Mineralogisch-geognostische Untersuchungen über die bei Cilli vorkommenden Eruptivgesteine *(Mineralogical-geognostic studies on igneos rocks occurring near Celje),* Celje (Cilli): Buchdr. von Johann Rakusch, *Program celjske gimnazije*.

Krašan, Franc. 1880. Vergleichende Übersicht d. Vegetationsverhältnisse Görz u. Gradisca, *Oesterr. bot. Zschr.*

Krašan, Franc. 1881-1882, 1887. Beiträge zur Geschichte der Erde und ihrer Vegetation, 1881-1882, 1887, *Jahresberichte des K.K. Zweiten Staats-Gymnasiums in Graz* (now BG/BRG Lichtenfels), 1881-1882, 1887 *(Contributions to the history of earth and its vegetation, 1881-82, 1887, Annual reports of the 2nd State Grammar School, Graz).*

Krašan, Franc. 1886. Bericht d. Kemmision für die Flora v. Deutschland, Steiermark, Kärnten u. Krain. *Ber. d. d. Bot. Ges*.

Krašan, Franc. 7 October 1886 in Graz written, in 1887 printed. Ueber der Ursache der Haarbildung in Pflanzenreiche *(On the cause of the hairiness in plants)*, *Oesterreichische botanische Zeitschrift,* letnik 37: 7-12, 47f, 93-97.

Krašan, Franc. 1887. Zur Geschichte der Formenenwicklung der der roburoiden Eichen *(On the history of the development of forms of roburoid oaks)*, *Botanische Jahrbücher Für Systematik, Pflanzengeschichte und Pflanzengeographie,* 1887, 8: pp. 165-202, with three tables of illustrations of his oak leaves at the end.

Krašan, Franc. January 1888. *Oesterr. botanic. Zeitschrift*, 38/1: 1-6.

Krašan, Franc; Ettingshausen, Constantin baron. 1888. *Beiträge zur Erforschung der atavistischen Formen au lebenden Pflanzen und ihrer Beziehungen zu den Arten ihrer Gattung (Contributions to the investigation of atavistic forms in living plants and their relations to the species of their genus), von Prof. Dr. Constantin, Freiherrn von Ettingshausen ... und prof. Franz Krašan*, Wien: Aus der k. k. Hof- und Staatsdruckerei.

Krašan, Franc; Ettingshausen, Constantin baron. 1891. Untersuchungen über Deformationen im Pflanzenreiche von Constantin v. Ettingshausen und Franz Krasan: (Mit 2 Tafeln in Naturselbstdruck) *Research of deformations in the plant kingdom by Constantin v.*

Ettingshausen and Franz Krašan (with two plates in natural size) September Abdr. aus dem LVIII. Bande der *Denkschriften des Math. Naturw. Classe der K. Akad. d. Wiss*, Wien: K.K. Hof- und Staatsdruck.

Krašan, Franc. 1894. Beiträge zur Flora von Untersteiermark (*Mitteilgn. d. Naturwissenschaftl. Ver. f. Steiermark*.

Krašan, Franc. 1900. Beiträge zur Flora v. Untersteiermark …, *Mitteilgn. d. Naturwissenschaftl. Ver. f. Steiermark*.

Krašan, Franc. 1902. Beitrag zur Charakteristik der Flora von Untersteiermark, *Mitteilgn. d. Naturwissenschaftl. Ver. f. Steiermark*.

Krašan, Franc. 1903. *Ansichten und Gespräche über die individuelle und spezifische Gestaltung in der Natur (Views and conversations about the individual and specific forms in nature). Leipzig: Engelmann, 280 pp. Reviews: K.K. 1 July. The Monist* (founded by Edward Carl Hegeler (1835–1910) in Chicago) 13/4: 635-636 https://doi.org/10.1093/monist/13.4.635; Burton Edward Livingston (1875 Grand Rapids, Michigan - 1948). September 1903. Biological Philosophy, *Botanical Gazette* (Chicago: University of Chicago), Volume 36, Number 3: 232-233; J. A. T. 1904. *Nature*, *Nature* 10 March 69/1793: 435.

Krašan, Franc. 2009/2011. *Botanik profesor Franc Krašan*, *illustrated folder, 6 pages*, Nova Gorica.

Krašan, Marko. 2023. *Notes along the Sava River by Ljubljana on 19 November 2003.*

Mannagetta, Günther Ritter Beck von Lerchenau. 1907. *Wien. Ber.* 1907, 118: 1439-1534

Meixner, 1815-1950, *ÖBL volume* 4 (Lfg. 18, 1968), pp. 211ff.

Mendel, Gregor. 1866. Versuche über Pflanzen-Hybriden, *Verhandlungen des naturforschenden Vereines in Brünn*, Brünn: Im Verlage des Vereines.

Nägeli, Carl von. 1865. *Entstehung und Begriff der naturhistorischen Art (Origin and concept of natural history art)*, München.

Oset, Željko (ur.). 2018. *Goriški izobraženci skozi zgodovino*, Nova Gorica: Založba Univerze.

Pospíchal, Edvard Ludvík. 1897-1899. *Flora*, Leipzig/Wien.

Rutherford, Ernst. 1904. *Nature of the γ Rays from Radium, Nature, Vol. 69, pp. 436-437, 10 March 1904.*

Scholz, Edvard. 1896. Ein Schlüssel zur Identifizierung von Farnen (Ključ za določanje praprotnic), *Program Goriške gimnazije*, str. 3-36;

Solla, Rüdiger Felix. 1878. *Österreichische Botanische Zeitschrift,* 28: 264ff, 301ff, 331ff, 399ff).

Steinbach, Richard. 1959. *Österreiche Botaniker des 19. Jh., die nicht an Hochschulen wirkten*, phil. Diss. Wien.

Šantel, Saša. 2002. Spomini, *Goriški spomini. Sodobniki o Gorici in Goriški v letih 1830–1918* (Uredil: Branko Marušič), Gorica: Goriška Mohorjeva družba/ Ljubljana: Založba ZRC SAZU.

T., J. A. 1904. On books received in situ, »Krašan, Franc. 1903. *Ansichten und Gespräche über die individuelle und spezifische Gestaltung in der Natur«, Nature*, *Nature* 10 March 1904, 69/1793: 435. https://doi.org/10.1038/069435a0).

Unger, Franz. 1850. Die fossile Flora von Sotzka. *Denkschriften K. K. Akad. Wiss., Math.-nat. Kl. 2* (1851), 131–197.

Vogt, Johann Gustav. 1878. *Die Kraft: Eine real-monistische Weltanschauung von Johann Gustav Vogt*. 1 Die Contraktionsenergie, die letztursächliche einheitliche mechanische Wirkungsform des Weltsubstrats, Leipzig: Haupt & Tischler.

Wraber, Tone. January 1989. Mendlov znameniti spis v zapuščini Franca Krašana, Proteus: ilustriran časopis za poljudno prirodoznanstvo, 51/5 (1988/1989): 203-204.

Wraber, Tone. 26 February 2002. invited talk, Kromberg by Gorizia,

Wraber, Tone. 2005. Rastlinstvo Goriške okolice in njegovi raziskovalci, *Zbornik prispevkov v počastitev 75-letnice prof. Sergia Tavana, Nova Gorica: Goriški muzej, Goriški Letnik: zbornik Goriškega muzeja* No. 30/31, 2003-2004, pp. 171-192.

Wretschko, Mathias. 1865/66. *Vorschule der Botanik für den Gebrauch an höheren Classen der Mittelschulen und verwandten Lehranstalten ... Mit ... Holzschnitten*, Vienna.

CIP - Kataložni zapis o publikaciji
Narodna in univerzitetna knjižnica, Ljubljana

58(497.4):929Krašan F.

JUŽNIČ, Stanislav, 1955-
Krašan as a leading Slovenian botanist / Stanislav Južnič. - Ljubljana : Prirodoslovni muzej Slovenije = Slovenian Museum of Natural History, 2024. - (Scopolia, ISSN 0351-0077 ; 107, 2024)

ISBN 978-961-6367-79-0
COBISS.SI-ID 211861507

107 2024

SOPOTA

Vsebina/*Contents*

9 789616 367790

Cena: 8,50 €