EDITORIAL

The second issue of this year's Folia Mendeliana seamlessly follows the previous issue, which included contributions from the first two thematic parts of the historical-scientific session of the International Mendel Genetics Conference 2022, entitled History of Genetics: more than a century of international research into the life and legacy of Gregor Johann Mendel, the origin of genetics and its development.

After the topics 1. Anthropological and genomic analysis of Mendel's remains and 2. Mendel's history in the nineteenth century, including the introductory lecture by Daniel J. Fairbanks and the Mendel Lecture by Uwe Hoßfeld, we continue in this issue of our journal with papers presented in Section C of the conference under the themes 3. Mendel's legacy in the twentieth and twenty-first centuries, and 4. Mendel's theory and its implications. In addition, this issue also contains another introductory lecture, that by Nils Chr. Stenseth, which he delivered at the opening ceremony of the Mendel Genetics Conference in the Basilica of the Assumption of the Virgin Mary, as well as the most interesting contributions of the poster part of the historical-scientific section of the conference.

In THE CHRONICLE section there is a comprehensive summary by Pavlína Pončíková of the celebrations of the anniversary of Gregor Johann Mendel's birth which took place in Brno in the past. Also of note is a review of the new book by Daniel J. Fairbanks – Gregor Mendel: His Life and Legacy, which was published this year on the bicentenary of Mendel's birth.

Jiří Sekerák

SECTION C PROGRAMME

www.mendel22.cz/conference

Friday 22 July 2022, BRNO

HISTORY OF GENETICS: MORE THAN A CENTURY OF INTERNATIONAL RESEARCH INTO THE LIFE AND LEGACY OF GREGOR JOHANN MENDEL, THE ORIGIN OF GENETICS, AND ITS DEVELOPMENT

ANTHROPOLOGICAL AND GENOMIC ANALYSIS OF MENDEL'S REMAINS

9:00–10:30

Session chairs:	Daniel J. Fairbanks; Uwe Hoβfeld
9:00–9:20	Dana Fialová: Multidisciplinary Approach to Identification of Gregor Johann Mendel's Skeletal Remains
9:20–9:40	Eva Drozdová: Body Remains of the Founder of Genetics Gregor Johann Mendel – a Case Study
9:40–10:00	Filip Pardy: Reconstructing the genome of Gregor Johann Mendel using state-of-the-art molecular and bioinformatics tools
10:00–10:20	Eva Chocholová: Metagenomic and Proteomic Analysis of Dental Calculus of Abbot Gregor Johann Mendel
10:20–10:30	Discussion

MENDEL'S HISTORY IN THE NINETEENTH CENTURY

10:50–12:20

Session chairs:	Daniel J. Fairbanks; Uwe Hoβfeld
10:50–11:10	Sylvia Eckert-Wagner: Johann Gregor Mendel – His family and origin
11:10–11:30	Jiří Sekerák: Mendel's Date of Birth
11:30–11:50	Peter Van Dijk: A New Reconstruction of Mendel's 1865-lectures and a Content Comparison with the 1866 Paper
11:50–12:10	Johann Vollmann: Mendel's Contemporaries: Convergence and Strategies in 19th Century Plant Breeding
12:10–12:20	Discussion

MENDEL'S LEGACY IN THE TWENTIETH AND TWENTY-FIRST CENTURIES

13:20–14:50

Session chairs:	Daniel J. Fairbanks; Uwe Hoβfeld
13:20–13:40	Michael Mielewczik: New insights from a new critically commented edition of Mendel's classic article on plant-hybridization and its role in the transformation of science and agriculture
13:40–14:00	Gregory Radick: The Role of the Cold War in Transforming a Statistical Puzzle about Mendel's Pea Data into a Scientific Scandal
14:00–14:20	Toshiyuki Nagata: The Fate of Mendel's grapevine
14:20–14:40	Milan Macek sr.: Development of medical genetics in the Czech Republic
14:40–14:50	Discussion

MENDEL'S THEORY AND ITS IMPLICATIONS

15:10–16:40

Session chairs:	Daniel J. Fairbanks; Uwe Hoβfeld
15:10–15:30	Pablo Lorenzano: An Analysis of Mendel's Two Hybridist Theories and of Their Relationships
15:30–15:50	Jaroslav Nešetřil: Genius Loci: Mendel in Context of Central and Peripheral Categories
15:50–16:10	Hui Zhang: On the Bicentennial of Mendel's Birth, Attempting to Recover Mendel's Inheritance Principles with Mendel's Eyes
16:10–16:30	Petr Dostál: Genetic Algorithms Optimize Problems in Business and Economics
16:30–16:40	Discussion

POSTER SESSION Thursday 21 July 2022, 18:00–19:00

GREGOR MENDEL OUGHT TO BE BROUGHT OUT OF THE SHADOW OF CHARLES DARWIN: TOGETHER THEY ARE THE LOCK AND KEY IN EVOLUTIONARY BIOLOGY[1]

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ABSTRACT – For the opening of the conference celebrating the 200th anniversary of Gregor Johan Mendel's birth, I gave an introductory opening speech – a speech highlighting the fact the that Mendel rescued Darwin's theory of evolution through natural selection, thus making Darwin and Mendel equal giants. As part of the presentation, a Darwinian/Mendelian definition of life is given – namely entities (or individuals) which can evolve over time within a population.

INTRODUCTION

Over the last few years, I have been involved in preparing for the 200th anniversary of Gregor Johan Mendel. Besides giving several talks on Mendel and his influence on modern evolutionary biology, I took the initiative to produce a collection of articles on Mendel and modern evolutionary biology as a Special Feature in the *Proceedings of the National Academy of Sciences* (*PNAS*) – a Special Feature I edited together with Leif Andersson (Sweden) and Hopi Hoekstra (US). This Special Feature – with the overall title "Gregor Johann Mendel and Modern Evolutionary Biology"[2] – featuring nine newly written articles was publish on the 200th birth-day of Johan Mendel (20.07.22).

Over the last few years and in particular during the development of this Special Feature collection published in *PNAS*, I came to realize that Mendel has been too much in the shadow of Darwin: in fact, the contributions to evolutionary biology by Darwin and Mendel are like a lock and a key: Darwin understood that heredity needed to exist for his theory of evolution through natural selection to work, but he never understood what that mechanism was. Mendel provided that mechanism.

On July 20, 2022—200 years since Mendel was born—I delivered one of two scientific opening speeches[3] at the "Mendel Genetics Conference" (with the announced title: "Gregor Johann Mendel's Scientific and Cultural Impact"; see Figure 1) – the main content of my speech follows here (which again is primarily based upon the introductory paper to the Special Feature collection of paper in *PNAS*[4]).

EDITED TEXT OF THE SPEECH

It is indeed my great pleasure to address you on this great occasion of the 200th anniversary of Gregor Johann Mendel's birthday. During the next few minutes I'll be summarizing the scientific and cultural impact of Gregor Johann Mendel's scientific work.

A PREVIOUSLY UNKNOWN METEOROLOGICAL PUBLICATION OF GREGOR J. MENDEL FROM 1857

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ABSTRACT – Gregor J. Mendel is today best known for his discovery of the so-called Mendelian laws that he published in a long article in 1866. Most of his scientific papers however deal with meteorological topics. Of his overall 13 known articles written by him, 9 are devoted to meteorological or climatological observations. Since the first compilations of his work, this basically formed the core of his scientific publication work without any significant contributions extending the list. Here we report on an additional article that he published in 1857 reporting on a thunderstorm he observed in Brno on Friday, 7th August.

Gregor J. Mendel is today best known for his experimental work and his subsequent and now famous article in which he presented a statistical analysis on crossing of different pea varieties which differed in binary traits.[1] This publication eventually resulted in the formulation of the so-called Mendelian Laws and subsequently laid the foundation for the new discipline of Genetics. It is therefore easy to think of him as a hobbyist scientist who rarely published results of his scientific studies and who did not publish as intensely compared to other 19th century researchers.[2] This is however somehow misleading. Already his list of primary research so far contained several known articles[3] with additional research of him published as part of research articles by other scientists.[4] Furthermore, it is known that Mendel published under various author abbreviations a large number of minor reviews, which have been only rarely mentioned in the literature. However, the core list of Mendel's scientific publications has not seen any addition in at least half a century.[5]

It was therefore a surprise when we discovered an additional article by Gregor Mendel in an issue of the *Brünner Zeitung*.[6] Published on Tuesday, 18th August 1857, Mendel therein describes his observations of a thunderstorm in Brno (Brünn) that occurred on Friday, 7th August and had been accompanied by large torrents of rain.[7] In style and form the short articles shows large similarity with his later articles on observations of storms from the 1870s and 1880s.[8] Most famously among those articles is Mendel's detailed description of the occurrence of a tornado that caused considerable damage in his hometown Brno. Based on this the article itself on a first glance is only

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SOME ODDITIES ON THE EARLY ORIGINS AND INSPIRATIONS OF MENDEL'S EXPERIMENTS AND THE 'REDISCOVERY' OF THE MENDELIAN LAWS IN 1900

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ABSTRACT – Contemporary fragments from newspapers and books around the time of Gregor J. Mendel's famous experiments and lectures in Brno (Brünn) provide new evidence on the early beginnings of his experiments and experimental design. The fragments show that his early efforts were strongly focussed on plant breeding of varieties and at the time particularly discussed in the context of acclimatization experiments. Further newly found sources highlight that Mendel's 22 pea varieties might have been already presented to the public at exhibitions at the early beginning of his experiments in 1855. While Mendel was convinced that those experiments had economical relevance, contemporaries anonymously expressed doubts on this point. Criticism on his analysis in Brno also continued after the conclusion and presentation of his experiments. Johann Nepomuk Bayer (1802–1870), a railway expeditor and botanist for example doubted Mendel's concept of dominant and recessive traits and published a sharp comment in his final book on results of his own field trip. This previously unknown early citation of Mendel's article from 1866 is a particular oddity in the history of Genetics, because there is a huge likelihood that it might be a missing link in the early citation network of Mendel's work in the 19th century that eventually ensured that it could be rediscovered in 1900. The citation though also raises the question if this remark was only the tip of the iceberg in a longer and continuing discourse between the two researchers.

When we started to work on our upcoming new critically commented edition Mendel's scientific paper "*Versuche über Pflanzen-Hybriden*" we were confronted, as likely many editors before, with several open questions on the early origins of Gregor J. Mendel's experiments.[1] On these beginnings practically nothing is known with certainty beside the fact that already in the 1840s there was a small garden in the abbey that was maintained by the monks and later especially by Mendel's close friend František Matouš Klácel (1808–1882).[2] In 1848, during the revolution, Klácel had to leave Brno for longer periods

THE ROLE OF THE COLD WAR IN TRANSFORMING A STATISTICAL PUZZLE ABOUT MENDEL'S PEA DATA INTO A SCIENTIFIC SCANDAL

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ABSTRACT – The history of interest in the question of whether, statistically considered, Mendel's data from his hybrid-pea experiments are "too good to be true" has an intriguing structure. When the British mathematician and evolutionary theorist Ronald Fisher published his classic analysis in 1936, knowledge that Mendel's data conformed improbably closely to the predictions of his theory was long familiar among specialists. Furthermore, for decades after Fisher published, the issue largely remained a matter for specialists to puzzle over. There was no "Mendel-Fisher controversy," and no public hand-wringing about Mendel's truthfulness. (For Fisher, the improbable closeness was largely to Mendel's credit, since, in Fisher's view, it showed that Mendel was not merely a follower of data but a powerful thinker, who understood theoretically, in advance of data collection, how his data ought to look, and conceived his experiments not as a test of his theory but a demonstration of it.) What turned this long-running minor concern into a major scientific scandal, I suggested, was a particular 1960s/70s conjunction of historical developments, notably (i) the centennial celebrations of Mendel's 1865 lectures and 1866 paper; (ii) the changing cultural dynamics of the Cold War, on both sides of the Iron Curtain; and (iii) a new public mistrustfulness towards science, and scientists, in the West.

In my talk I dwelt especially on successive changes in Cold War culture. I argued that, from 1948 until the early 1960s, the crisis over Mendelian genetics brought on by the rise of Lysenkoism in the Communist sphere meant that whatever inclinations that geneticists might had had to discuss the data problem publicly – and they certainly discussed it privately – were not indulged. But with the shift from Stalin to Khrushchev, the sense of political emergency surrounding Mendel began to subside. At around this time, Western geneticists began to join in a more general trend in Western, and especially American, culture: the celebration of "no boundaries" intellectual, artistic, and political freedom, including the freedom to criticize, as characteristic of human minds at their best. Accordingly, whereas, at the 1950 jubilee celebrations of Mendel, the data problem was unmentioned, between 1963 and 1966 geneticists and other commentators talked about it constantly. In this sense, the new public openness about the data problem should be seen, I argued, as belonging to the same cultural moment as worldwide coverage of Civil Rights marches and CIA-funded exhibitions of abstract expressionism. Even so, at the centennial symposium held in Brno in 1965, in which a number of Western geneticists participated, once again, silence about the data problem reigned – now because, in the Czechoslovak context, the reconstruction of Mendel as a scientific hero fit for a socialist nation was a delicate business, as the foreign guests appreciated.

DEVELOPMENT OF MEDICAL GENETICS IN THE CZECH REPUBLIC

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ABSTRACT – In 1950 Lysenkoism was introduced but not accepted in medical genetics in the former Czechoslovakia. In 1962 Prof. Milan Hašek, M.D., DSc. on a plenary session of the Czech Academy of Sciences refuted it as a non-scientific theory. In 1961 he supported the creation of 1st department of medical genetics at the Faculty of Paediatrics of Charles University. In 1963 department of medical genetics was established at the Paediatric Research Institute in Brno. Lysenkoism was scientifically disproved in 1965 Brno at the international Mendel Memorial Conference, and officially eliminated de iure in 1966 in our country.
In 1966 the Czech Ministry of Health through the 1st Conception of Medical Genetics legalized medical genetics as medical specialty and fostered obligatory creation of departments of medical genetics at all medical schools and established postgraduate medical education.
In 1962 the Section of Medical Cytogenetics of the Biological Society was founded and in 1967 the Czech Society of Medical Genetics (and Genomics) of the Czech Medical Society of J. E. Purkyně was established.
By the end of 1969 four departments of medical genetics and three cytogenetic laboratories started their operation. In 1971 the first successful prenatal cytogenetic diagnosis was performed and since then prenatal prevention of chromosomal aberrations and of metabolic disorders was performed in close cooperation with Western European biochemical laboratories. Prior to 1979 all regional departments guaranteed complex genetic services, including prenatal diagnosis with ultrasound and obstetrical examination in at risk pregnancies.
In 1980 the new government Conception of Medical Genetics incorporated genetic services into the national health care system and funded their further development. First trimester prenatal diagnosis was introduced in 1985. Between 1990–2022 there has been a substantial progress in early diagnosis, prenatal screening, prevention, and treatment of genetic disorders, including development of private genetic centres. There has been extended international cooperation and support from national/European grants, broader molecular genetic examinations for individualized medical genetics diagnostics and care still fully reimbursed by the Czech health care system.

INTRODUCTION

The history of the critical years for the development of medical genetic in European countries was documented recently by Prof. Peter Harper's review (1), as well as for other European countries behind the "iron curtain" (2). The positive development after the end of the cold war and birth of European Union was reflected by the harmonisation of

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AN ANALYSIS OF MENDEL'S TWO HYBRIDIST THEORIES AND THEIR INTERTHEORETICAL RELATIONSHIPS*

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*ABSTRACT – Based on a statistical analysis of his experiments, which was a novelty for the tradition of "horticulturalists" (or "plant breeders") as well as for the tradition of "hybridists", and seeking a "generally applicable law governing the formation and development of hybrids" (Mendel 1865: 3), Mendel states "the law of development/evolution found for Pisum" (Mendel 1865: 32). When he tries to provide the "foundation and explanation" (Mendel 1865: 32) of the law of formation and development of hybrids, he does it in terms of the production and behavior of egg cells and pollen cells, and, ultimately, in terms of the nature and behavior of what he calls "elements" (Mendel 1865: 41) or "cell elements" (Mendel 1865: 42). Moreover, Mendel recognizes the existence not just of hybrids that behave like those of Pisum – i.e., of "variable hybrids" – but also of hybrids that "remain perfectly like the hybrid and continue constant in their offspring" (Mendel 1865: 38) and "acquire the status of new species" (Mendel 1865: 40) – i.e., of "constant hybrids" (Mendel 1869: 27–28, 31). The law that would govern the behavior of constant hybrids would also find its foundation and explanation in terms of the nature and behavior of elements (or cell elements). Mendel's hybridism consists of two theories: a theory that moves on a more "empirical" level, according to Schleiden's first "special guiding maxim", the "Maxim of the history of development/evolution" (Schleiden 1849: 141, 142, 146), which can be called "Mendel's theory of the development/evolution of hybrids" (**DEH**), and a theory that moves on a more "theoretical" level, according to Schleiden's second "special guiding maxim", the "Maxim of the autonomy of cells in plants" (Schleiden 1849: 146, 148), which can be called "Mendel's theory of the cellular foundation of the development/evolution of hybrids" (**CFH**).*
The paper aims to present an analysis of these two theories and their intertheoretical relationships, carried out within the framework of the so-called Metatheoretical Structuralism (Balzer, Moulines & Sneed 1987).

INTRODUCTION

According to the most popular version of the history of genetics (the so-called "traditional account", Olby 1979, "orthodox image", Bowler 1989, or "official story of genetics", Lorenzano 1995),[1] Johann (Gregor) Mendel (1822–1884) – in his "Versuche über Pflanzenhybriden" ["Experiments in Plant Hybridization"] read in 1865 at the

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GENIUS LOCI

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This became a cliché: *an isolated scientist at a remote place with a significant contribution to the great world science.* But closer look may display surprising details. Mendel´s story is often treated in this schema. In this brief paper we address/complement this popular story in a few new details, some of them, we believe, are new.

One of the common beliefs is that Brno was a remote provincial Austrian town. This simply is not true. Brno was the capital of Moravia and was the historical centre of this land (the other was Bohemia with Prague as its centre). Moravia was a highly cultural and prosperous land, rich in resources, fertile agriculture and rapid industrialization during the 19th century. Brno itself was sometimes called *Austrian Manchester* for its strong textile industry. Being in the vicinity of Vienna (and thus also called *suburb of Vienna*) could hardly be associated with provincialism.

The Augustinian monastery was founded in Brno in 1350 and in the 19th century were the Augustinians an elite group of scholars and teachers, even socially responsible. During the time of the abbot Cyril František Napp (1792–1867) this group consisted of several personalities whose importance reached well over the city borders: František Tomáš Bratránek (1815–1884, literary scholar and writer), František Matouš Klácel (1808–1882, poet, journalist philosopher, friend of Božena Němcová), Pavel Křížkovský (1820–1885, composer, musician and music teacher of young Leoš Janáček), and, of course, Gregor Johann Mendel (1822–1884), whose popularity as a teacher, learned man and scientist grew with time.

These facts are well known, still it seems that they should be emphasized again and again. The overall level of Augustinians is best illustrated by the fact that when the abbot Napp died in 1867, there were two candidates in the subsequent new abbot election: Bratránek and Mendel. The friars elected Mendel (as the story goes) as nationally more neutral or balanced candidate. And Bratránek? Tomáš Bratránek was an eminent scholar, philosopher and professor of German literature. He was the president (rector) of the Jagellonian University in Krakow. He returned to the monastery on 1881.

Yet Brno was not a site of vanguard science, it was a periphery. But in the 19th century the same can be said about Prague, Vienna (and many other places). And particularly, in mathematics the same is true even for whole countries such as England. The advanced mathematics was carried out almost exclusively in France and Germany where such stars as Gauss, Laplace, Galois, Cauchy, Fourier, Weierstrass, Klein and Riemann (to name just a few!) were establishing setting of today mathematics and science in general.

In this time the strongest mathematicians were lured naturally to these centres to learn and work on actual topics. And the 19th century was a *Gründerzeit* for major parts of modern mathematics.

But strong people are born everywhere. Lacking contacts and not being able to master depth and advances of their peers in the centre, being also left on their own they

ON THE BICENTENNIAL OF MENDEL'S BIRTH, ATTEMPTING TO RECOVER MENDEL'S INHERITANCE PRINCIPLES WITH MENDEL'S EYES

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ABSTRACT – The term "Mendel's laws" was first coined by Carl Correns, mainly referring to the law of segregation and of independent assortment in general. However, in Mendel's 1866 paper, once using Mendel's own symbol system to represent the selfing reproduction of F_1 hybrid, a sequential mathematical expression could be recovered here: $Aa \times Aa \rightarrow (A + a)(A + a) = A/A + a/a + A/a + a/A = A + 2Aa + a \rightarrow 3A + a$. Clearly, the perfect square formula together with both the upstream input and the downstream output could be figured out in the sequential expression, respectively corresponding to the principles of reproductive cells formation, of fertilization, and of seeds developments, all were lectured in his second speech in 1865. Then, the expression could be unambiguously resolved into more than ten items of inheritance laws. If it is acknowledged that Mendel utilized the perfect square formula to mimic the behavior of bisexual gametes in process of sexual reproduction, the pair of symbols, A, and a, can be seen having three different senses, gametes, factors, and traits. In fact, one factor carried by one gamete with capacity to transmit one trait to offspring was eventually exemplified in his later controlled pollination experiment in Mirabilis jalapa. At last, we proposed that Mendel's speculation of function of the factor in development process had both properties of holism and of reductionism, needing to be further studied in future.

KEY WORDS: Mendelism, Mendel's gamete theory of inheritance, the principles of reproductive cell formation, the principles of fertilization, the principles of seed development

INTRODUCTION

"Mendel's Law" was first coined as a term in 1900 by Car G. Correns, one of the three rediscoverers of Mendel's hybridization experiments in *Pisum*[1)]. In March 9, 1865, Mendel had given a special lecture to "speak about (reproductive) cell formation, fertilization, and seed production in general, and in the case of hybrids in particular ... *(spracher über Zellenbildung, Befruchtung und Samenbildung überhaupt und bei den Hybriden insbesondere...)*"[2)]. In light of the two separate reports in *Neuigkeiten*, it is believed that was a deliberate time made by Mendel himself for presenting his discovery of

MENDEL'S GENETIC ALGORITHMS OPTIMIZE PROBLEMS IN BUSINESS AND ECONOMICS

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ABSTRACT – Gregor Johan Mendel is the founder of genetics and is considered the discoverer of the basic laws of inheritance, which later became known as Mendel's laws of inheritance. His laws have affected many areas. In connection with the development of computers, the laws were used in the creation of so-called genetic algorithms. Especially, computer calculations are performed in binary form (0,1) and the fact of the successful development of mankind, was the inspiration for the application of the law of evolution in nature to the computer. Computer implementation of genetic algorithms began to appear in the 1970s and is associated with the names of J. Holland and D. E. Goldberg. Genetic terms were used: selection (selection of the strongest individual), crossover (creation of a new individual) and mutation (random change in an individual). This process forms one generation (iteration in the computer) and is repeated. A genetic algorithm is a heuristic procedure that seeks to apply the principles of evolutionary biology to find solutions to complex problems for which there is no applicable exact algorithm. The algorithm began to be used to optimize processes in the technical sciences, and its success spread to other fields, including economics and business. The reason is that optimizing the processes that the entrepreneur solves is maximizing profits and minimizing costs. Perhaps most famous problem is the Travel Salesman Problem. Various optimization tasks are solved e.g., minimization of material consumption, minimization of waste in cutting plans, minimization of distribution costs, waste collection costs, planning of optimal production etc. Various modifications of genetic algorithms have been created. But genetic algorithms based on Mendel's laws were among the first ones and still in use. Development has not stopped, new genetic algorithms are being applied to quantum computers, which significantly speed up calculations.

PRINCIPLES OF GENETIC ALGORITHMS

Gregor Johan Mendel is the founder of genetics and is considered the discoverer of the basic laws of inheritance, which later became known as Mendel's laws of inheritance. See fig. 1. His laws have affected many areas. In connection with the development of computers, the laws were used in the creation of so-called genetic algorithms. Genetic algorithms are used in studies where exact solution by systematic searching would be extremely slow. The genetic algorithm, which is well suited for solving complicated problems. The computer realization of genetic algorithms discovered in the 1970s, relates to the names of J. Holland and D. E. Goldberg. Recently there has been considerable expansion of genetic and evolutionary algorithms in the spheres of economic applications and the decision making of firms and companies.

BUILDING A BETTER HOP: HOW MENDELIAN HOP BREEDING HELPED TO CREATE THE CRAFT BEER INDUSTRY

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*ABSTRACT – Hops (*humulus lupulus*) have been a known plant variety for millennia. It is used almost entirely in making beer. Until the early 20th century, hops were used as a preservative. With the introduction of sanitary brewing, hops became a flavoring agent. Hop plants are dioecious: annual vines grow from perennial rhizomes. The female ultimately produces a hop cone; the male—a flower. Cones contain resins that provide flavor and aroma to beer. In the mid-20th century, the female cone was viewed as the sole contributor to a cultivar's characteristic, with the male flower simply germinating a cone. This was contrary to Mendel's theories of plant breeding. In 1961, U.S. Department of Agriculture (USDA) geneticist Dr. Stanley N. Brooks proved the male flower contributed half of the characteristics of a cone. Further work by Brooks and USDA's hops research team resulted in the first American hop cultivar—Cascade. In 1975, Anchor, a small brewery, was the first to use Cascade. Anchor chose Cascade to produce an 'all-American' beer for America's Bicentennial. In 1980, Sierra Nevada used Cascade in its 'Pale Ale'; its marketing highlighted Cascade's flavor. These first steps birthed the craft beer* industry. *Today, craft beer marketing often includes listing hop cultivars. But the journey began with Mendel and a research scientist who understood Mendelian inheritance—to build a better hop.*

HOP PLANTS (*humulus lupulus*)

The genus *humulus lupulus* belongs to the order *Cannabaceæ*, which includes hemp. Perhaps the first Western writer to address the cultivation and use of hops was Saint Hildegard Von Bingen,[1] a 12th century Benedictine abbess and polymath. In *Physica*, her guide for suitable plants for monastic gardens, she described the preservative qualities of hops for beer.[2]

Hops are dioecious, with its reproductive organs on separate plants differentiated by sex, female and male. Both types of plants have flowers: males have staminates which shed pollen, while female flowers contain a single ovary. Female flowers tend to grow together in structures, termed "strobiles" – which, during inflorescence, produce the hop cones. A cone's leaves are termed "bracts". They are triangular, thick, and shape the cone. The bracts contain lupulin glands, which, in turn, contain the (commercially important) resin.[3]

Hop seedlings grow from a root stock—a rhizome. A young plant will produce branches and secondary roots. Above ground, hop stems are termed "bines" and commercial growers position the rhizomes so the bines will grow upwards (climb) on wires.

SIXTEEN DECADES OF OCTOGENERIAN CHINESE GENETICISTS: FIRST MEETING OF C. C. LI AND C. C. TAN, FOUNDER OF HUMAN POPULATION GENETICS MEETS THE GUARDIAN OF CHINESE MENDELISM

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ABSTRACT – Two native Chinese geneticists, C. C. Li (1912–2003) and C. C. Tan (1909–2008), made huge contributions after earning American university PhDs in genetics and long careers that were bifurcated in 1949, by the Communist Revolution. Li founded human population genetics, but left China at age 38 years, to work for another 53 years at the University of Pittsburgh, U. S. A. Tan remained in China by appearing to modify his focus from pure genetics toward paleontology, and gained Mao Zedong's personal permission to teach Mendelism, but only at Fudan University, Shanghai, while the rest of China had to promulgate the Soviet Lysenkoism. Despite decades without contact and, at best, wariness, they first met in person in the mid-1990s in Pittsburgh, apparently with exuberant rapport as champions of Mendel.

PATH ANALYSIS

In their mid 80s, two China-born geneticists of great fame, Li Ching Chun and Tan Jiazhen (hereafter C. C. Li and C. C. Tan) met for the first time in Li's office in the Department of Human Genetics, University of Pittsburgh in 1995 or 1996. They shared many similarities, but had never met: Li was born in Tianjin, 140 kilometers southeast of Beijing in 1912; Tan was born in Ningbo, 220 kilometers southeast of Shanghai in 1909. Both got bachelor's degrees, 200 kilometers apart, Li at Nanking University in 1936, Tan at Soochow University in 1930. Both earned PhDs at famous departments of genetics in the US: Li, at Cornell University's College of Agronomy, Ithaca, New York, in Plant Breeding and Genetics; Tan at California Institute of Technology, Pasadena, California, where he was Theodosius G. Dobzhansky's first PhD student, describing the giant salivary gland chromosomes and genetic maps of *Drosophila pseudoobscura,* also under the guidance of Thomas Hunt Morgan and Alfred H. Sturtevant. Both had post-doctoral experience at Columbia University in New York City.

Back in China, they took prestigious faculty appointments and began their careers. The Communist Revolution of 1949 split their lives. Li had prepared a book on human population genetics and, at age 34 years, became chair of the Department of Agronomy at National Peking University. Soon, Communist leaders told him to stop all research on Mendelian genetics and adopt the "truth" of the false Lamarckian genetics advanced by Trofim D. Lysenko and embraced by Russian leaders. (The famed antagonist of Lysenko,

THE WAY TO G. MENDEL'S BICENTENARY CELEBRATIONS*

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ABSTRACT – The celebrations of the 200th anniversary of Gregor Johann Mendel's birth featured many events with differing focuses and qualities. The disproportionate production of articles, pamphlets, and scholarly publications, as well as works falling more into the realm of pop culture, are still awaiting evaluation. However, this year's celebrations also offer us the opportunity to compare this year's events with those of previous decades. It is 120 years since the first public celebrations of Mendel's birth in 1902, so they have a long tradition. The dozen stops that take us up to the present day offer a clear overview of the development of the perception of the famous naturalist not only among the scientific community but also among the public and political figures.

The celebrations of 1910, 1965, and 2015 were not celebrations of Mendel's birth and will not be given significant attention in this article, although they cannot be completely omitted either. The article focuses mainly on the course of the celebrations and the atmosphere of the time, or on something that can be characterized as a lasting memory or result of these celebrations. The result is a review of the situation in Brno regarding the preservation of the legacy of G. Mendel, which attempts to capture the more general trends of the time. Hugo Iltis, Jaroslav Kříženecký, and Vítězslav Orel discussed the course of earlier events in their essays. Since the 1970s, this information can be found in articles published in Folia Mendeliana.

This article does not aim at presenting a detailed and comprehensive account of the celebrations in honour of Gregor Mendel. The years of celebration themselves are probably rarely true milestones in the perception of Gregor Mendel's legacy, but they can very well express the changes and progress that research entails.

The grand celebrations that can be recorded in 1922, 1942 and 2022 mostly follow the own external goals of the main organizers of the event. Although it was not possible to find references to celebrations each year, the progress of research on Mendel and the progress in building his legacy in the public eye can be well documented in each decade. The preparation of grand celebrations often makes the realization of more comprehensive scientific publications impossible; these are then realized with delays. There is also a trend towards the organization of symposia, which is due to the increasing number of scientific institutions since the 1920s and, in particular, the establishment of a specialist department at the Moravian Museum in 1962.

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