

## EDITORIAL

The authors of this volume actively participated in the International Mendel Day 2019 at the Royal Institution in London, the centre of the British science engagement, where the Genetics Society also celebrates its 100<sup>th</sup> anniversary. It is thus not surprising that Mendel-Darwin discussion is still very alive, especially here. In the first contribution DANIEL J. FAIRBANKS and SCOTT ABBOTT provide an English translation of ALEXANDER MAKOWSKY's paper *On Darwin's Theory of Organic Creation* with comments. Makowsky published his lecture in the same 1866 volume in which famous Mendel's paper *Experiments on Plant Hybrids* was published and the copy of Makowsky's paper owned by Mendel contains his annotations. It therefore has a very close connection to Mendel's paper.

What would it have been like if Darwin had read Mendel or even if they communicated with each other? The above questions have been repeatedly asked since the beginning of genetics. Recently, similar speculation has been posited by Rama S. Singh. His main argument rests on the assumption that Mendel failed to see the importance of his discovery for Darwin's theory of evolution. JIŘÍ SEKERÁK in his contribution *At the Limits of (Our) Imagination* rejects such an assumption, because the study of the original historical sources implies something completely different. LAURENCE D. HURST in his article *A Celebration of a Century of the Genetics Society (Founded by Edith Rebecca Saunders Ably Abetted by William Bateson)* describes the history of the Genetic Society with an emphasis on the important role of women in this history. This volume of *Folia Mendeliana* is concluded with CHRISTINA M. LAUKAITIS's contribution *Mendel & Medical Genetics: Past, Present and Future* with an insight into modern genetics and its application potential. She is also this year's laureate of the Mendel Memorial Medal.

*Jiří Sekerák*

## ALEXANDER MAKOWSKY'S JANUARY 1865 LECTURE "ON DARWIN'S THEORY OF ORGANIC CREATION": AN ENGLISH TRANSLATION WITH COMMENTARY

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*ABSTRACT* – In February and March 1865, Gregor Mendel presented to the Natural Science Society in Brünn two lectures, which he later combined and published as his classic 1866 paper, "Experiments on Plant Hybrids." At the time, Darwin's *Origin of Species* was already well-known in German-speaking Europe. The first German translation of Darwin's book was published in 1860, and Mendel owned an 1863 translation from the third-edition English, which he annotated. There is strong evidence that it influenced Mendel's lectures and paper. In the January 1865 meeting, which immediately preceded the two meetings in which Mendel lectured, Alexandre Makowsky presented a lecture titled, "On Darwin's Theory of Organic Creation," highlighting several topics from *Origin of Species*, some of which Mendel also addressed in the following two months in his lectures, and annotated in his copy of *Origin of Species*. Makowsky published his lecture as a nine-page paper in the same 1866 volume in which Mendel's paper was published. The copy of Makowsky's paper owned by Mendel contains his annotations. It therefore has a close connection in both time and substance to Mendel's paper. Here we provide an English translation of Makowsky's paper with commentary.

### INTRODUCTORY REMARKS

Gregor Mendel presented his classic paper, "Versuche über Pflanzen-Hybriden" ("Experiments on Plant Hybrids") in the monthly February and March meetings in 1865 of the Naturforschender Verein in Brünn (Natural Science Society in Brünn).<sup>1</sup> At the time, Charles Darwin's *Origin of Species* had already been circulating for nearly five years in translation throughout German-speaking Europe. The first English edition had been published in 1859,<sup>2</sup> and the first German translation, by Heinrich Georg Bronn, was published in 1860.<sup>3</sup> Mendel owned a copy of the 1863 second-edition German translation (also by Bronn, from the third edition English), and it contains his handwritten annotations. Fairbanks and Rytting published those annotations in an online appendix to their paper "Mendelian Controversies."<sup>4</sup> Mendel probably read and annotated his copy of *Origin of Species* during the approximately year-and-a-half period between the time he completed his pea experiments and the presentations of his lectures on them. As part of an extensive review of Mendel's paper, Ronald Fisher in 1936 determined that Darwin's

## AT THE LIMITS OF (OUR) IMAGINATION: DID MENDEL REALLY FAIL TO SEE THE IMPORTANCE OF HIS DISCOVERY FOR DARWIN'S THEORY OF EVOLUTION?\*

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*ABSTRACT - In the history of science as well as in history in general, if we understand it as a scientific discipline, it is not possible to seriously ask and answer questions like: What would it be like if....? However, that doesn't seem to hold in one case: What would it have been like if Darwin had read Mendel? Or if they communicated with each other? It's really as if there is an exception in the history of science, because the above questions have been repeatedly asked since the beginning of genetics. There must be a reason, because everyone knows that even the best answer will always be mere speculation and therefore worthless in terms of historical research. But the real reason is probably that even such "worthless" speculation, just in the case of Mendel and Darwin, can tell us something important about how we understand and interpret the very foundations of scientific thought, what modern science is all about and what it stands for. Recently, similar speculation has been posited by Rama S. Singh in his article Limits of imagination. His main argument rests on the assumption that Mendel failed to see the importance of his discovery for Darwin's theory of evolution. We reject such an assumption, because the study of the original historical sources implies something completely different. Mendel was well aware of the importance of his discovery for Darwin's theory, and the real limits were not in his imagination, but entirely elsewhere.*

Undoubtedly, Mendel's work helped to lay the foundations on which today's life sciences stand. Nevertheless, there has never been any consensus on what this actually means to these sciences and what it really means for them. In the end, this led to the formulation of a question regarding whether Mendel was a Mendelist or not?<sup>1</sup> This question draws attention to a number of problems related to the interpretation of his discovery. In his case, we even encounter an obvious historical interpretative paradox described by Jan Sapp in an essay from 1990 with the apt title *The Nine Lives of Gregor Mendel*.<sup>2</sup>

Perhaps even better, Ronald A. Fisher put it well back in 1936, when he briefly stated that each generation would find in Mendel's work only what he expected to find. Therefore, each of these generations also ignores what does not confirm their own expectations.<sup>3</sup> This particular situation expresses well another important aspect of

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**A CELEBRATION OF A CENTURY OF THE GENETICS SOCIETY  
(FOUNDED BY EDITH REBECCA SAUNDERS ABLY ABETTED  
BY WILLIAM BATESON)**

LAURENCE D. HURST

President of the Genetics Society

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The study of inheritance didn't start with Mendel. Aside from the somewhat ambiguous story of the inheritance of the markings of Jacob's sheep in the appropriately named Old Testament book of Genesis (Chapter 30), the ancient Greek philosophers hotly debated the subject (LEROI 2014). Hippocrates espoused the theory of pangenesis, the notion that something travelled from every part of the male body to the storage organ, the testicles, and thence to the next generation (LEROI 2014). Aristotle however argued against this position noting that seedlings don't come ready pruned just because the parental tree had been cut back and observes that sons and daughters of handicapped parents aren't themselves disabled (LEROI 2014). Despite Aristotle's objections, pangenesis was endorsed by thinkers as temporally disparate as Galen (130–200 A.D), St Thomas Aquinas (1225–1274) and Herbert Spencer (1820–1903) (ZIRKLE 1935). While apparently unaware of Hippocrates contribution, Darwin certainly considered pangenesis seriously, presenting the argument that gemmules were particles sent by all parts of the body to the gonads (DARWIN 1868b). On being informed of Hippocrates ideas he comments (DARWIN 1868a):

*“I wish I had known of these views of Hippocrates, before I had published, for they seem almost identical with mine – merely a change of terms – & an application of them to classes of facts necessarily unknown to this old philosopher”*

Despite the entrenchment of pangenesis, we now know better in no small part because of a rather poorly understood, and commonly misunderstood, character, Gregor Mendel.

Shortly after the rediscovery of Mendelism, William Bateson, in 1905, in a letter to Adam Sedgwick, proposed the term “genetics”. Shortly after, the “gene” was suggested as a useful term by the Dane Wilhelm Johannsen (JOHANNSEN 1909). He commented that the term had the advantage of embracing the Greek origins (genesis, origins), while removing the “pan” component from pangene had the advantage of stripping away the hypothetical baggage associated with pangenesis (JOHANNSEN 1909). At the same time, he also bequeathed us the terms genotype and phenotype. Quite what it was about Scandinavians and genetics, but only one year after we had these terms that The Mendelian Society of Lund (in southern Sweden, a short boat ride away from Johannsen in Copenhagen) was founded in 1910 (HÖGLUND AND BENGTTSSON 2014). Just nine years later British supporters of Mendelism, notably William Bateson and Edith Saunders, set up the UK's Genetics Society. On 25<sup>th</sup> June 1919 Bateson and Saunders convened a meeting in the rooms of the Linnaean Society to propose the founding of a “Genetical Society”. Approved unanimously, the first meeting was held in Cambridge on 12<sup>th</sup> July that year. 2019 thus sees the centenary of the Genetics Society.

## MENDEL & MEDICAL GENETICS: PAST, PRESENT AND FUTURE

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*ABSTRACT - Within 40 years of Mendel's 1865 publication, physicians were beginning to recognize that some human diseases could be inherited. The 20<sup>th</sup> century saw the description of hundreds of human genetic diseases and the initiation of treatments for a few. In parallel with major technical advances, molecular testing for genetic diseases has become less expensive and more accessible and is a major focus of public health newborn screening efforts. Now in the 21<sup>st</sup> century, we are beginning to study the interaction of multiple genes and the environment in order to move beyond Mendelian traits to understand more common heritable diseases.*

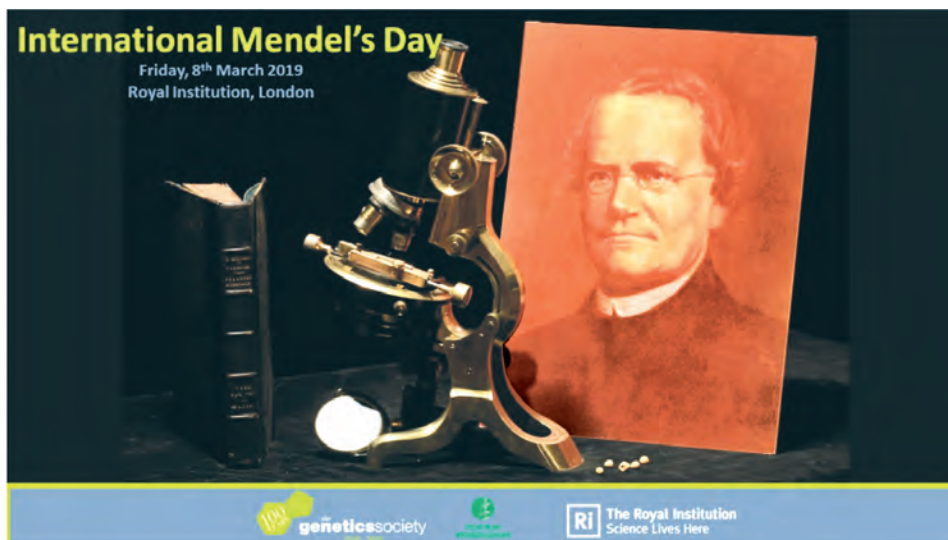
### INTRODUCTION

Mendel's insights into the principles of heredity did not immediately change medical practice, but within 40 years of his 1865 publication, physicians were beginning to recognize that some conditions could be inherited. In 1902, the theory of chromosomal inheritance was proposed. In the same year, the human condition alkaptonuria was recognized as being genetic. Later in the decade, population genetic theories were postulated and the genetically-controlled ABO blood types were described. In 1918, collinearity of genes was proposed. Another condition, phenylketonuria (PKU), was described in 1934 and it eventually triggered newborn screening and linked genetics to public health. In the 1940's, the one gene-one-enzyme hypothesis and discovery of DNA as the genetic material began to describe how conditions like PKU occurred. The double helix structure of DNA and its organization into 46 human chromosomes were described in the 1950's. Recognized human diseases with a genetic were cataloged into "Mendelian Inheritance in Man" in 1966 and this continues today as "Online Mendelian Inheritance in Man", with >23,000 entries. Major technological advances, including Sanger sequencing in 1977 and PCR in 1985, triggered an explosion in new gene discovery, allowing the completion of the first human genome in 2000. The field continues to grow as "next generation" massively parallel sequencing technology makes DNA sequencing even cheaper and faster.

### MILESTONES IN MENDELIAN MEDICAL GENETICS

Archibold Garrod published a description of alkaptonuria in 1902, which was the first attributing a human condition to a genetic cause<sup>1</sup>. He recognized that it occurred more frequently in consanguineous families, but understood that consanguinity alone could not explain the condition. Instead he recognized that some families had a latent explanation that reasserted itself when two members of that family reproduced together. He went on to explain that "the law of heredity discovered by Mendel offers a reasonable

## THE INTERNATIONAL MENDEL DAY 2019



The epicenter of this year's International Mendel Day was in London. The Genetics Society was celebrating its 100<sup>th</sup> anniversary since its foundation by William Bateson who originally came up with the term “genetics”. Bateson defended Mendel's work during the so-called rediscovery of Mendel's work in 1900. He supported the investigation of Hugo Iltis in the former monastery of Gregor Mendel in Old Brno and the construction of a marble monument to Mendel in Brno. Bateson attended the unveiling ceremony of the monument in 1910.

## MENDEL MEMORIAL MEDAL 2019

Two women, both active in the field of medical genetics, were awarded on Mendel's Day 2019. GREGOR MENDEL MEMORIAL MEDAL awarded by the Moravian Museum in Brno was received by Associate Professor Christina Marie Laukaitis from University of Arizona College of Medicine in Tucson. Mendel's Medal awarded by the Presidents of The Genetics Society was received by Professor Mary-Claire King.

Christina M. Laukaitis was awarded the MENDEL MEMORIAL MEDAL for her great contribution to starting and developing our mutual cooperation lasting more than 8 years and for her great contribution to promoting Mendel's scientific legacy. She is Ambassador to the International Mendel Day in the US - one of the accompanying programs she organizes at her workplace at the University of Arizona every year. Christina M. Laukaitis is currently Associate Professor of Medicine with Tenure at the University of Arizona, College of Medicine, Tucson, AZ. She is also Associate Professor (Joint Appointment) Department of Nutritional Sciences, University of Arizona, Tucson, the Director of Genetic Consultation and Counseling Services, the Director of Molecular Genetic Pathology Fellowship Program and Medical Education Director, Outreach Core, Partnership for Native American Cancer Prevention, University of Arizona Cancer Center, University of Arizona, Tucson, AZ.



At right, Dr. Laukaitis presented with the Mendel Memorial Medal from Dr. Jiří Mitáček, Director General of the Moravian Museum.

## Contents

### FOLIA MENDELIANA 55/1 2019

Jiří SEKERÁK: Editorial .....	3
Daniel J. FAIRBANKS, Scott ABBOTT: Alexander Makowsky's January 1865 Lecture "On Darwin's Theory of Organic Creation": An English Translation with Commentary .....	5
Jiří SEKERÁK: At The Limits of (Our) Imagination: Did Mendel Really Fail to See the Importance of his Discovery for Darwin's Theory of Evolution? .....	17
Laurence D. HURST: A Celebration of a Century of the Genetics Society (Founded by Edith Rebecca Saunders Ably Abetted by William Bateson) .....	23
Christina M. LAUKAITIS: Mendel & Medical Genetics: Past, Present and Future .....	29

### THE CHRONICLE

Eva MATALOVÁ: The International Mendel Day .....	37
Pavína PONČÍKOVÁ: Mendel Memorial Medal 2019 .....	47