

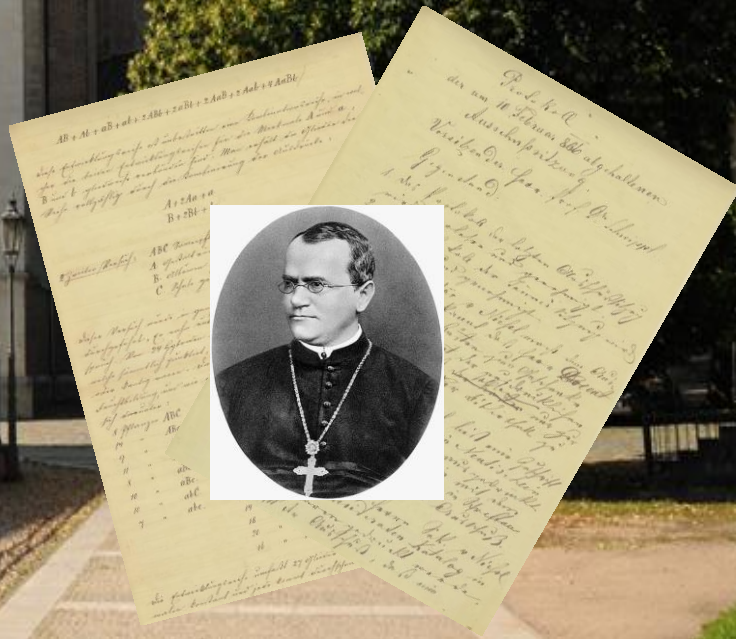


MASARYK UNIVERSITY

PhD training at Masaryk University

– national system and institutional progress

Tarragona, June 2016



Inspirations to my own students I will bring from Gregor Mendel, father of Genetics

- Struggled for funding, but had a good mentor and support of family, that recognized his gift for asking major, probing, fundamental scientific questions
- The questions have direct implications for human well-being
- The majority of his projects didn't work as desired, yet he persevered
- The understanding of Mendelian genetics arose because experiments were brilliantly designed, were designed to be statistically significant and included key controls
- Even in the age of Mendel, the interest in a paradigm (Mendelian basis of inheritance) to be general can lead to doubt when related systems are regulated in distinct ways (this underscores the need for meticulous experiments)



Gregor Mendel was a monk and a scientist. He was born in 1822 in a small village in the Czech Republic. He was a very intelligent man and he was very interested in science. He was a very good teacher and he was a very good scientist. He was a very good person and he was a very good man. He was a very good father and he was a very good husband. He was a very good friend and he was a very good neighbor. He was a very good citizen and he was a very good member of his community. He was a very good person and he was a very good man. He was a very good father and he was a very good husband. He was a very good friend and he was a very good neighbor. He was a very good citizen and he was a very good member of his community.

2% of GDP on R & D (=85 billions CZK/year)
50% from industry/50% from government and SF (infrastructures)

56% industry
26% (22 billions CZK/year) for universities

In total 65 000 research FTE
16 000 research FTE at universities

Top 1% - 1.7% (1.1%)

Top 10% - 11% (10%)

% of highly cited – 1.3 (0.7)

% of international collaboration – 40.3 (17.3)

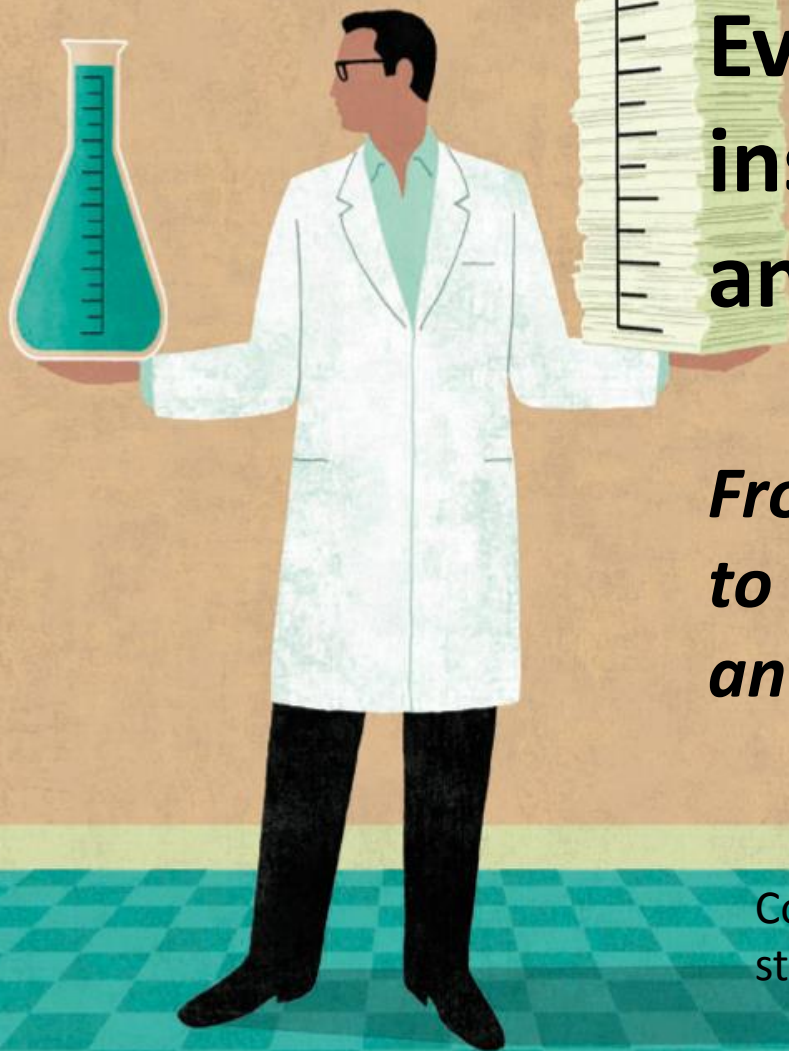
% of industrial collaboration – 0.7 (1.3)

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% of international collaboration – 40.3 (17.3)
% of industrial collaboration – 0.7 (1.3)



Evaluation methodology, institutional financing and SF

*From counting outputs
to international peer judgment
and performance contracts...*

Counting outputs (credits, papers, conferences...) still works for PhD candidates...

- ~1600 academic staff (FTE); ~250 international staff;
- >3000 PhD candidates (20% international)
- ~300 postdocs (50% international)
- Excellent state-of-the-art infrastructure (Central European Institute of Technology and other smaller infrastructural projects supported by SF)
- About 1000 - 1200 original research papers in WoS each year
- Increasing number of top 1 and 10% papers; recent papers (corresponding authors) in Nature, Science, Cell, NEJM, Lancet, EMBO J, etc.
- 3 ERC grants in the past 2 years/>50% of EMBO installation grantees in CR
- MU is strong contributor to national success in Nature Index 2016 (increase by 17.2%!)
- World competitive and robust research areas are biochemistry and molecular biology, cancer research, haematology, environmental sciences, plant sciences, ecology, analytical and physical chemistry, cell biology, and clinical neurology



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Social sciences are still less competitive !

Past situation

- **National level**
- Overwhelmed central accreditation committee
- Unclear relationship with the major research organization Czech Academy of Sciences
- The number of PhD candidates is (pre)determined by the Ministry through financial instruments

- **Masaryk university level**

- 122 accredited study fields (!)
- 122 highly independent PhD boards (!); partially excellent, partially weak...
- ~ 300 admitted and 300 graduates/year
- Diverse process for selecting and recruitment doctoral candidates
- Diverse system and quality of PhD training
- Low interdisciplinarity; limited exposure to industry
- Weak transferable skills training
- Absence of quality assurance system
- Limited (or none) care about next career of graduates
- Isolated examples of good practice somehow overlooked

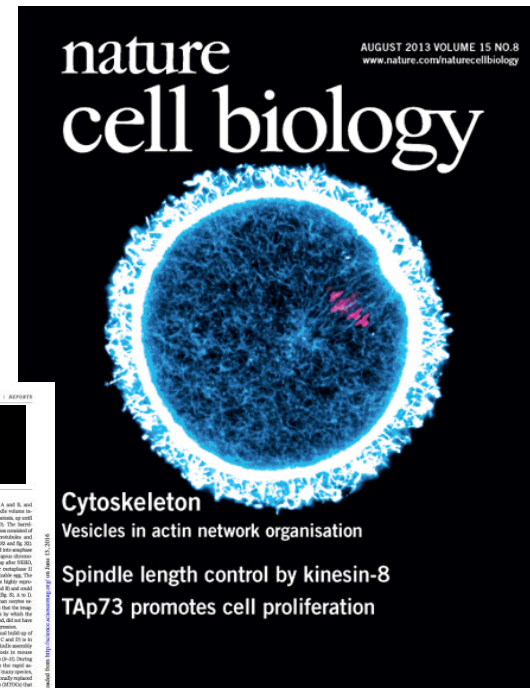


HUMAN OOCYTE

Error-prone chromosome-mediated spindle assembly favors chromosome segregation defects in human oocytes

Zuzana Hobubecová,¹ Martyn Hainey,² Kay Elder,² Melissa Schah

Aneuploidy in human eggs in the leading cause of pregnancy loss and several genetic disorders such as Down syndrome. Most aneuploidies result from chromosome segregation errors during the meiotic divisions of an oocyte, the egg's progenitor cell. The basis for particularly error-prone chromosome segregation in human oocytes is not known. We analyzed meiosis in more than 100 live human oocytes and identified an error-prone chromosome-mediated spindle assembly mechanism as a major contributor to chromosome segregation defects. In particular, it is the presence of a single chromosome, such as centromeres or other microtubule organizing centers. Instead, spindle assembly was mediated by chromosomes and the small G-protein Rho1 in a process requiring 16 hours. This unusually long spindle assembly period was marked by extensive spindle instability and several microtubule attachment defects. We conclude that chromosome segregation errors occur sometime after the formation of the oocyte, and that chromosome segregation errors occur sometime after the formation of the oocyte, and that chromosome segregation errors occur sometime after the formation of the oocyte.

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Current situation

- **National level**

- New higher education act in action since September 1, 2016
- National accreditation council as an independent supervisory body issuing institutional accreditation (applies largely for major universities)

- **Institutional level**

- Change from external accreditation of PhD programmes to institutional/internal quality assurance system
- High level committee for internal evaluation of study programmes including PhD fields (external members) until the end of 2016
- Soft standards and recommendations for PhD training
- Ongoing evaluation of PhD fields
- First industrial doctorates at Faculty of Informatics
- Interdisciplinary lecture series and high quality soft skills training
- Director of MU Umbrella PhD school after Tarragona




Hanka Sedlackova;
DNA damage and repair

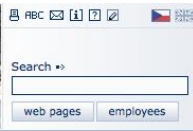
- **“Baby” umbrella PhD school at Masaryk University since January 1, 2016**

- Budget
- Leadership
- Lecture courses
- Soft skills
- Recruitment

- Central European Institute of Technology PhD school (Life Sciences) since 2013

New PhD website and information/recruitment brochure


MASARYK UNIVERSITY



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Masaryk University

Research and development


- Projects
- Development
- Project support at MU
- Popularization of research
- Academic qualifications
- Publications

Doctoral study


- Bachelor's and Master's study
- Master's study
- Doctoral study
- Lifelong learning




PhD Guide
Complete guide to programmes, doctoral boards, supervisors...



Seminars across the University
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/ Plasma physics
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Formal Modelling and Verification of Computer Systems
/ Modelling and verification of infinitestate stochastic systems
/ Verification and analysis of computer programs
/ Game theory and machine learning in security
/ Formal verification
/ Distributed and cloud computing in formal verification

Quantum Information Processing
/ Quantum information theory and quantum communication
/ Quantum cryptography protocols and security
/ Realworld randomness and random number generators

Combinatorial Algorithms and Complexity
/ Parameterized complexity, logic and algorithmic metaheuristics
/ Structural graph theory and width parameters
/ Computational geometry and graph crossing numbers

Computer Graphics and Visualization
/ Interaction in virtual environments
/ Analysis and visualization of protein structures
/ Data visualization

Biomedical Image Analysis
/ Development and study of image analysis methods for highly automated processing of multidimensional biomedical images
/ Segmentation, tracking, and simulation of microscopy images of cells

Computational Systems Biology
/ Scalable methods and tools for modelling complex biological systems
/ Automated parameter estimation in biological models

Data Intensive Systems and Applications
/ Semantic-based indexing and searching
/ Content-based multimedia processing
/ Distributed data organization

SELECTED RESULTS

- / ADAMEK, J.; ROSICKY, J.; VITALE, EM. *Algebraic Theories*. Cambridge University Press, 2011.
- / DANNER, A.; TYC, T.; LEONHARDT, U. *Controlling birefringence in dielectrics*. Nature Photonics, 2011, 5 (6): 397-399.
- / ANZENBACHER, JR. P.; LUBAL, P. et al. *A practical approach to optical cross-reactive sensor arrays*. Angewandte Chemie International Edition, Weinheim: Wiley-VCH Verlag GmbH & Co., 2010, 49 (13): 2378-2381.
- / KLAN, P.; SOLOMEK, T. et al. *Photoreversible Protecting Groups in Chemistry and Biology: Reaction Mechanisms and Efficacy*. Chemical Reviews, Baltimore: American Chemical Society, 2013, 113 (1): 119-191.
- / STEFL, R.; OBERSTRASS, F. et al. *The Solution Structure of the ADAR2 dsRNA-RNA Complex Reveals a Sequence-Specific Readout of the Minor Groove*. Cell, United States: Cell Press, 2010, 143 (2): 225-237.
- / KREJCI, L.; ALTMANNOVA, V.; SPIREK, M.; ZHAO, X. *Homologous recombination and its regulation*. Nuclear Acids Research, Oxford, UK: Oxford Press, 2012, 40 (13): 5795-5818.
- / SYKORA, J.; BREZOVSKY, J. et al. *Dynamics and hydration explain failed functional transformation in dehalogenase design*. Nat Chem Biol, 2014, 10 (6): 428-30.

The Faculty of Informatics was established in 1994.

Today, with more than 2 300 students offers study programmes at Bachelor's, Master's and Doctoral levels in various fields of studies such as computer science, informatics, Applied Informatics and Teaching for Secondary Schools, Computer Systems and Technologies,

FACULTY OF INFORMATICS

www.fil.muni.cz
admission@fil.muni.cz

Botanická 68a
602 00 Brno, Czech Republic

> 90
Ph.D. students

The Spectrum of Research: Get a Ph.D. at MU

Soft skills courses “PREFECT” and “Fundamentals of research work”

- Research ethics
- The research career: Opportunities and risks
- Shape your research career
- Scholarly publishing
- National funding opportunities
- International funding opportunities
- Practical course: Preparing international project I. and II.
- IP and patenting



Conducted jointly with Czech Academy of Sciences

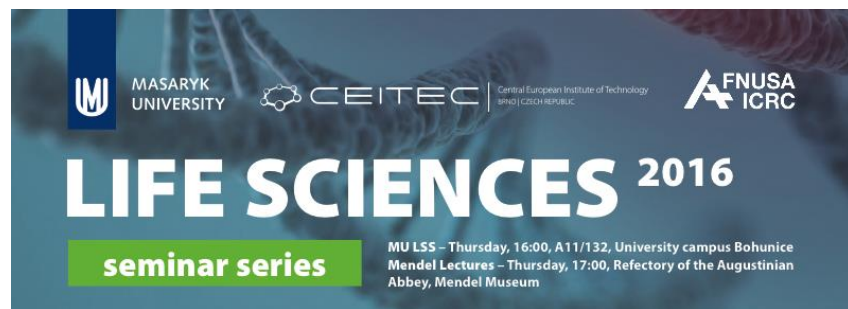
Soft skills course “Publish or perish”

- 12 weeks course Publish or perish: The art of research and scientific writing
- Combination of workshops and discussions, writing group meetings and lectures by experienced scholars
- Covers all steps from designing the manuscript to sending article to the journal and revision process



Led by CEITEC MU ERC grantee

Interdisciplinary Life Sciences and Humanities/Social Sciences lecture courses for PhD candidates



FEBRUARY

25/02/2016 **Vladimir Katanaev**
Faculty of Biology and Medicine, University of Lausanne, Switzerland
Wnt signaling: from fundamental studies of a signaling pathway to anti-cancer drug discovery

MARCH

03/03/2016 **Michael G. Rossmann**
Hockmeyer Hall of Structural Biology, Purdue University, West Lafayette, USA
A Personal History of Structural Virology

10/03/2016 **Janusz M. Bujnicki**
Laboratory of Bioinformatics and Protein Engineering, International Institute of Molecular and Cell Biology, Warsaw, and Institute of Molecular Biology and Biotechnology, Adam Mickiewicz University, Poznan, Poland
Modeling and design of RNA 3D structures and RNA-protein complexes: towards RNA nanotechnology

17/03/2016 **Bon-Kyoung Koo**
WT-MRC Cambridge Stem Cell Institute, University of Cambridge, UK
LGR5+ intestinal stem cells, RNF43 tumorigenesis, and CFTR gene correction in adult stem cells

24/03/2016 **Hashim M. Al-Hashimi**
Department of Biochemistry, Duke University, USA
Role of Dynamic Base Pair Polymorphism in the Central Dogma of Molecular Biology

31/03/2016 **George Weinstock**
The Jackson Laboratory for Genomic Medicine, Farmington, Connecticut, USA
The human microbiome: a new frontier that might just affect everything

APRIL

07/04/2016 **Steve Jackson**
Gurdon Institute, University of Cambridge, UK
Harnessing Genetic Principles to Treat Human Disease

14/04/2016 **Filippo Drago**
Department of Biomedical and Biotechnological Sciences, University of Catania and School of Medicine Catania, Italy
The role of dopamine D3 receptors in psychopathology

21/04/2016 **Jennifer Doudna**
Howard Hughes Medical Institute, University of California, Berkeley, USA
CRISPR-Cas Genome Surveillance: From Biology to Breakthrough Technology

28/04/2016 **Frank van Breusegem**
VIB Department of Plant Systems Biology, Gent, Belgium
Oxidative stress signalling in plants. Towards the proteome and beyond

MAY

05/05/2016 **Joan Steitz**
Howard Hughes Medical Institute, Yale University, New Haven, USA
Viral and Cellular Noncoding RNAs: Insight into Evolution

12/05/2016 **Stéphan Vagner**
Institut Curie, Orsay, France
Insights into RNA-mediated effectors of cancer hallmarks: focus on mRNA translation and polyadenylation

19/05/2016 **Stephen J. Benkovic**
Department of Chemistry, The Pennsylvania State University, USA
On De Novo Purine Biosynthesis: The Pseudosome



Social Sciences and Humanities Seminar Series

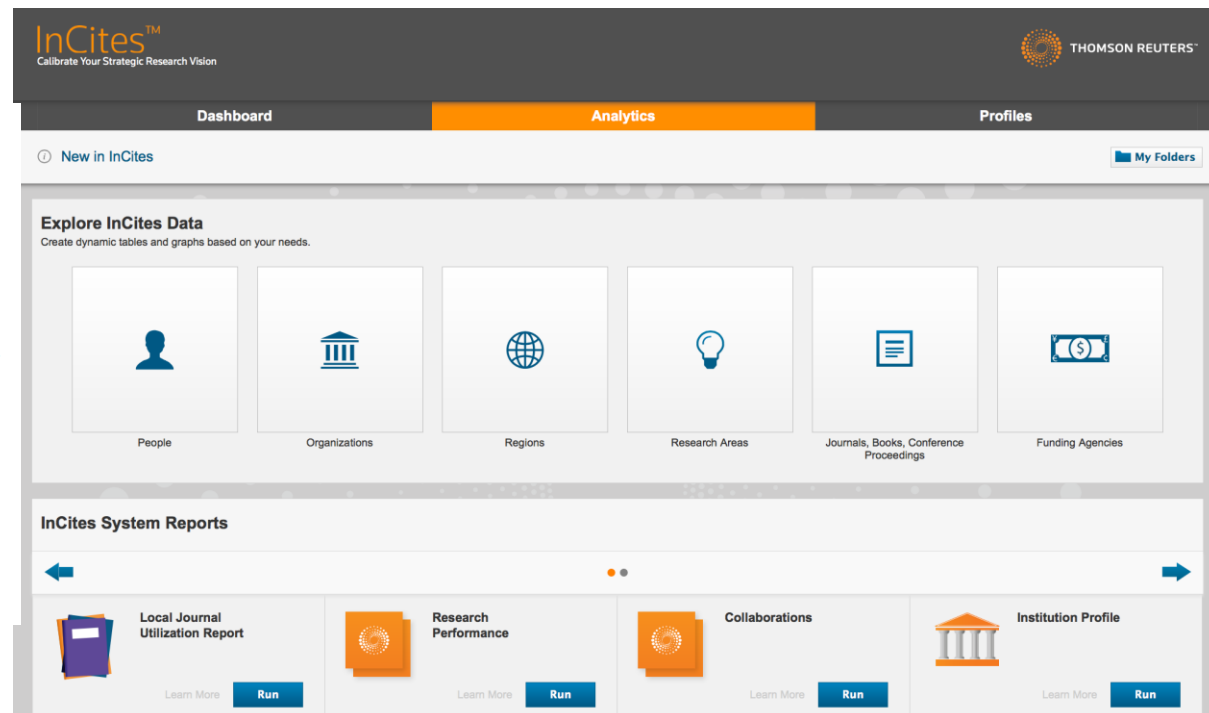
Autumn 2016

LECTURER	LECTURE
Prof. James Alm , Tulane University, New Orleans, LA	Behavioral Economy
Prof. Amy Goldrich , New York University, NY	Law and Art
Prof. Bradley A. Thayer , University of Iceland, Iceland	Darwin and International Relations: On the Evolutionary Origins of War and Ethnic Conflict
Prof. Mag. Dr. Eva Vetter , University of Vienna, Austria	Vize-Leiterin des Zentrums für LehrerInnenbildung, Vize-Leiterin der Sprachlehr- und -lernforschung
prof. Jaroslav Nešetřil , Charles University, CR	Mathematics and Art
PhDr. Marek Picha , Ph.D., Masaryk University, CR	Critical Thinking – Identification, Reconstruction and Argument Evaluation



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...and other activities aimed at improvement of PhD training

- Training for supervisors - joint activity with Center for Doctoral Studies, Vienna University planned for October 2016
- PhD candidate's conferences, workshops and summer schools
- Supervising + Mentoring in some PhD boards
- The PhD “viva voce” as an option





Good place to study and work!