

# SZEGED SCIENTISTS ACADEMY

# YEARBOOK 2016/17



**SZEGEDI TUDÓS AKADÉMIA**  
**SZEGED SCIENTISTS ACADEMY**

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YEARBOOK 2016/17



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## **DR. LÁSZLÓ VÉCSEI**

Academician, former Dean of the Faculty of Medicine, University of Szeged, 2013–2016



# PROFESSIONAL MANAGEMENT



## DR. BERT SAKMANN

### DIRECTOR OF EDUCATION

Nobel Laureate cell physiologist, Max Planck Institute für Neurobiologie, Munich



## DR. PÉTER HEGYI

### PROGRAM DIRECTOR

Doctor of HAS, Professor of Faculties of Medicine,  
Universities of Szeged and Pécs



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### CHAIRMAN OF THE FOUNDATION'S BOARD OF TRUSTEES

Doctor of Hungarian Academy of Sciences (HAS), Professor and Head of  
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## SÁNDOR BÁN

### DEPUTY DIRECTOR (SECONDARY SCHOOL EDUCATION)

Leading biology teacher at Radnóti Miklós Experimental Grammar School, Szeged



## DR. ZOLTÁN RAKONCZAY

### DEPUTY DIRECTOR (UNIVERSITY EDUCATION)

Doctor of HAS, Professor of the Department of Pathophysiology at the  
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**ZSUZSANNA ADÉL PAPP**

ASSISTANT TO  
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**DEZSŐ ZSOLTNÉ HORVÁTH**

ASSISTANT TO  
DEPUTY DIRECTORS



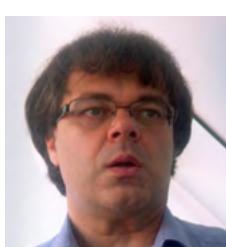
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PROGRAM ORGANIZER



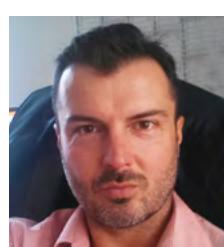
**LÁSZLÓ FRÖHLICH**

PROJECT MANAGER



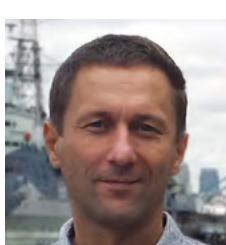
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LEGAL ADVISOR



**DR. TAMÁS NAGYMIHÁLY**

PUBLIC PROCUREMENT  
EXPERT



**DR. JÓZSEF TOLNAI**

WEBSITE DEVELOPER



**JÁNOS JÁNOSI**

WEBMASTER

# KLEBELSBERG SPONSORS

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## SCHOOL SUSTAINER:

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GOVERNMENT  
OF HUNGARY

## SPONSORS:

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## FINANCIAL DONORS:

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## EVENT SPONSORS:

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# SECONDARY SCHOOL PROGRAM

# NATIONAL BASE SCHOOLS

## RADNÓTI MIKLÓS EXPERIMENTAL GRAMMAR SCHOOL SZEGED

**HEADMASTER: BÉLA GÁL**

**DEPUTY LEADER OF THE LABORATORY: ANDREA BORBOLA** (*See page 14*)

The Radnóti Miklós Experimental Grammar School of Szeged saw many profile changes throughout its 120 year old history. Originally named after Gábor Klauzál, it served as a boys' real school for Szeged's middle class. After the second World War a mixed education was introduced, adding the training of skilled workmanship next to the real school. The current general gymnasial profile – aiming to achieve scientific excellence – was gradually built up starting from 1957. The school's building is as old as the institute itself, historically decorated yet equipped with state of the art laboratories and ICT appliances. At the moment six different departments are operated: Mathematics-Physics, Chemistry, Biology, Mathematics, General Studies (with increased English or Spanish classes), Humanities and a talent care division focusing on students with underprivileged backgrounds.



The students achieve the best results in Mathematics and Sciences. The average grades of the final examinations and the number of students accepted to universities both mark efficiency of the education and talent care. It is also known that not many schools can exceed the 'Radnóti' when it comes to results at national and international competitions. While the faculty is proud of the students' achievements, they consider these competitions as a means of education, not as a main goal. During the preparation the students can learn confidence, persistency, self-knowledge and cooperation next to the professional knowledge. Hence the school's motto: 'Sapere aude' – 'Dare to know'.

The construction of the Specialized Laboratory for Scientific Education (TERMOSZ Laboratory) was finished in 2015. The laboratory is located at the school's area yet plays a central part in the renewal of scientific education collaborating with 18 other schools in the Szeged school district. The associates also help with the preparations and executions of international competitions, in addition they play a key role in the national biological talent care.

# NÉMETH LÁSZLÓ SECONDARY AND GRAMMAR SCHOOL – HÓDMEZŐVÁSÁRHELY

HEADMASTER: **LÁSZLÓ ÁRVA**

LABORATORY LEADER: **EDIT CSALÁNÉ BÖNGYIK** (*See page 14*)

**Németh László Secondary and Grammar School** was established in the 1980s to serve the Hódtó district of Hódmezővásárhely. Originally it was a minor elementary school, however it launched its gymnasial classes in 1995 which quickly helped to raise its ranks amongst the other high schools of the town. Besides the general gymnasial educational structure, the school also emphasizes language and IT (Information Technology) studies along with natural science.

It is an absolute advantage that the students can carry out their studies in one institute – the talent care and education starting from early age until their final examination. This counts as a unique feature in Hungary and it helps to maintain a smooth cooperation between the elementary and high school educators, helping out the long-term correction and design of the training plan. The students have proven themselves at several competitions and perform well on their final examinations – marking the good student-teacher collaboration.

The school's modern building provides a luminous, well established location and atmosphere to carry out high standard education. In addition, a botanical garden is being built which will be a green spot in the neighborhood.

The József Gyulai Scientific Workshop (József Gyulai Laboratory) was established 3 years ago, offering quality training with modern equipment. All the neighboring elementary students can use the laboratory under the supervision of its trained attendants.



# REGIONAL BASE SCHOOLS



## TÓTH ÁRPÁD SECONDARY SCHOOL – DEBRECEN

Headmaster: Amália Fenyősné Kircsi  
Szent-Györgyi Senior Teacher: József Gőz (p. 23)



## NAGY LAJOS GRAMMAR SCHOOL OF THE CISTERCIAN ORDER – PÉCS

Headmaster: László Dobosi  
Szent-Györgyi Senior Teacher: Zsolt Nyisztor (p. 29)



## PREMONSTRATENSIAN ST. NORBERT SECONDARY SCHOOL – GÖDÖLLŐ

Headmaster: Borbála Takácsné Elek  
Szent-Györgyi Senior Teacher: Zoltán Kerényi (p. 25)



## CALVINIST GRAMMAR SCHOOL OF KECSKEMÉT

Headmaster: Anna Durucz  
Szent-Györgyi Senior Teacher:  
Adrien Vargáné Lengyel (p. 32)



## FÖLDÉS FERENC HIGH SCHOOL – MISKOLC

Headmaster: Pál Veres  
Szent-Györgyi Senior Teacher: Csilla Szentesi (p. 31)



## ELTE TREFORT ÁGOSTON SECONDARY GRAMMAR SCHOOL – BUDAPEST

Headmaster: Zoltán Csapodi  
Szent-Györgyi Senior Teachers: Norbert Faragó (p. 21),  
László Kutrovácz (p. 38)



### TÁNCSICS MIHÁLY SECONDARY GRAMMAR SCHOOL OF KAPOSVÁR

Headmaster: Ferenc Reőthy

Szent-Györgyi Senior Teachers:

Beatrix Bagi Kertész (p. 27), Róbert Kertész (p. 26)



### DEÁK TÉRI LUTHERAN GYMNASIUM - GÖDÖLLŐ

Headmaster: Edit Kézdy

Szent-Györgyi Senior Teacher: Andrea Fazakas (p. 22)



### LOVASSY LÁSZLÓ GRAMMAR SCHOOL - VESZPRÉM

Headmaster: Zoltán Schultz

Szent-Györgyi Senior Teacher: Tünde Tóth Szalainé (p. 30)



### FAZEKAS MIHALY PRIMARY AND SECONDARY GRAMMAR SCHOOL - BUDAPEST

Headmaster: Attila Pásztor

Szent-Györgyi Senior Teachers:

Julianna Erős-Honti (p. 19), Zsolt Erős-Honti (p. 20)



### ELTE BOLYAI JÁNOS PRACTICE PRIMARY AND SECONDARY GRAMMAR SCHOOL - SZOMBATHELY

Headmaster: Tibor Papp

Szent-Györgyi Senior Teacher: József Baranyai (p. 17)



### GÖDÖLLŐ REFORMED SECONDARY SCHOOL

Headmaster: Árpádné Bajusz

Szent-Györgyi Senior Teacher: Zsolt Horváth (p. 24)



### SZTE PRIMARY AND SECONDARY GRAMMAR SCHOOL - SZEGED

Headmaster: Dr. János Dobi

Szent-Györgyi Senior Teacher: István Csigér (p. 18)

# LABORATORY LEADER TEACHERS



## ANDREA BORBOLA

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## PUBLICATIONS

Kiss E, Olah B, Kalo P, Morales M, Heckmann AB, **Borbola A**, Lozsa A, Kontar K, Middleton P, Downie JA, Oldroyd GED, Endre G: (2009) Lin, a novel type of u-box/wd40 protein, controls early infection by rhizobia in legumes. *PLANT PHYSIOLOGY* 151:1239-1249

**Borbola A:** (2004) Construction of a linkage map for *Medicago truncatula* RIL population and its comparative analysis with other *Medicago* genetic maps. *ACTA BIOLOGICA SZEGEDIENSIS* 48:51

Kedves M, Párdutz Á and **Borbola A:** (1998) Transmission electron microscopy of X-ray irradiated teliospores of *Ustilago maydis*. *GRANA* 37:29-34

## TEACHING CAREER IN BRIEF

I've been an associate at the TERMOSZ Laboratory since 2014, I consider it as a prime element in my life. During my high school years I had the opportunity of assisting at the Cell Biology and Evolutional Micropaleontology Laboratory of the University of Szeged, which helped me start my scientific work. Throughout my university studies I was co-authoring several English publications, participated in an Indian-Hungarian joint research and for years I was the technical editor of the Plant Cell Biology and Development (Szeged) issue. In addition I also acquired some successful applications (pro Renovada Cultura Hungariae Fund – 'Students for Science' foundation).

My interests shifted towards molecular biology - starting from 2001, I carried out my PhD studies at the Genetic Institute of the Biological Research Center (Hungarian Academy of Sciences); later on I worked there as a science assistant. Next to learning the basic molecular biology techniques and elaborating new methods I also participated in several conferences. At the moment I'm teaching Biology at the Randóti Miklós Grammar School and tending to the TERMOSZ Laboratory.



## EDIT CSALÁNÉ BÖNGYIK

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## TEACHING CAREER IN BRIEF

I began teaching in the Commercial and hospitality secondary school of Hódmezővásárhely in 1998, parallel with my university studies and I have been working in the Németh László Grammar School for a year. I have been teaching biology and chemistry and during my years in the commercial secondary school my students performed well at professional competitions. I have always felt lucky to be a teacher, I am one of the few persons whose job is their hobby. I regularly attended professional trainings and always supported varied pedagogical methods and educational

forms, recently I have been committed to digital pedagogy. I was teaching complex nature for a long time, I also prepared a workbook for internal use with my colleague. Thanks to this I became closer to the activities of the Öveges labs and also had the opportunity to participate in the elaboration of complex book labs. I was also engaged in scientific thinking renewing teacher training for two years. I gladly contribute to project writing, I am proud of my two successful National Talent Projects. At present, I teach students committed to natural sciences at each grade above 8th and also the ones who wish to perform advanced level biology final exam.

# SZENT-GYÖRGYI SENIOR TEACHERS



"Those who affect children's imagination essentially influence their future existence as well."

*József Eötvös*

**Szent-Györgyi Senior Teachers** are the secondary school teachers who constantly recognise young talents and provide them with additional, extensive knowledge of biology and chemistry. Their students also actively participate in the national and international natural sciences competitions.

**Szent-Györgyi Senior Teachers** select youths who have the opportunity to get more acquainted with the scientific activities of the Faculty of Medicine at the University of Szeged and the Biological Research Center of the Hungarian Academy of Sciences. The most important tasks of **Szent-Györgyi Senior Teachers** are to introduce the selected youths to the Szeged Scientists Academy's program, to encourage them to inquire into areas of research supervised by mentors of the Academy, and to emphasize all the potentials to reach the top of their profession with the help of the Academy's scholarships.

With the assistance of **Szent-Györgyi Senior Teachers**, it is possible to achieve an interconnection between secondary schools and higher education, which then facilitates the development of young talents to become creative, successful scientists.

Currently there are 17 **Szent-Györgyi Senior Teachers** in the program representing a number of schools in different cities all over the country, and their mutual goal is to develop young talents into prominent researchers of Hungarian science.

# SÁNDOR BÁN

PROFESSIONAL LEADER OF THE SECONDARY SCHOOL PROGRAM



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## TEACHING CAREER IN BRIEF

I started my career in 1993 at the Dugonics András Piarist Grammar School, Szeged, where I taught chemistry and biology, both as part of the regular curriculum and in advanced elective courses as well as special after-school lessons. In 1998–99, I played a leading role in designing and equipping the science section of the school's new building. I was also the head of the department of biology and chemistry for four years. Since 2002, I have taught in the special biology, chemistry and mathematics programs at the Radnóti Miklós Grammar School in Szeged, mostly in small groups. Between 2005 and 2012, I headed the biology department, which developed into the most successful high school biology workshop in the country during that period, based on advanced Matura examination and competition results. My colleagues and I have also established a state-of-the-art high school molecular biology laboratory. This facility has been made available to biology teachers from other schools for in-service trainings as well as to students for selection tests for international biology competitions. My colleagues and I have attended in-service trainings in molecular biology at the EMBL laboratories in Cambridge, Heidelberg and Monterotondo on a number of occasions. Since 2009, I have been the team leader of the Hungarian national teams at the International Biology Olympiad (IBO) and mentor to our national teams at the European Union Science Olympiad (EUSO). In 2010, I won the Rátz Lifetime Achievement Award. I am currently head of the EU-funded high school science laboratory.

## PUBLICATIONS

Bán S. (1998). Gondolkodás a bizonytalanról: a valószínűségi és korrelatív gondolkodás fejlődése. [Thinking about the uncertain: developing probabilistic and correlative thinking]. In Csapó B. (Ed.): Az iskolai tudás. Budapest: Osiris Kiadó.

Bán S. (2010). A tanulás természetes jellemzőinek érvényesülése az iskolai biológiaoktatásban [Implementing natural features of learning in biology instruction]. Mester és Tanítvány 28: 48–56.

Bán S et al. (Eds.). (2003). From Vandal to Voter: Active Citizenship in Europe - Analysis and Methods. Szeged-Paris: KIFE.

## SUCCESSFUL STUDENTS

### Márton Szentirmai

Faculty of Medicine  
University of Szeged, Szeged

- IBO 2011, silver medal
- EUSO 2010, gold medal
- IBO 2010, bronze medal

### Petra Varga

Faculty of Medicine  
University of Szeged, Szeged

- IBO 2016, silver medal
- EUSO 2015, gold medal
- iGEM 2014, Best Experimental Measurement Prize

### Márk Harangozó

Faculty of Medicine  
University of Szeged, Szeged

- EUSO 2015, silver medal
- iGEM 2014, Best Experimental Measurement Prize

### Fatime Hawchar

Faculty of Medicine  
University of Szeged, Szeged

- IBO 2011, bronze medal
- National Secondary School Competition (OKTV) Biology 4<sup>th</sup> place

### Dr. Márton Pipicz

Faculty of Medicine  
University of Szeged, Szeged

- Student research:  
*Department of Anatomy,  
Faculty of Medicine,  
University of Szeged, Szeged*
- 2011. Pro Scientia gold medal

# JÓZSEF BARANYAI



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### TEACHING CAREER IN BRIEF

I completed my biology degree at the József Attila University (University of Szeged) in 1994. During my university years, I was a demonstrator at the Department of Zoology, and I stayed on as an assistant lecturer after receiving my degree. I have much to thank the excellent staff at the department (Drs. Róbert Gábel, Éva Fekete and Katalin Halasi) for my professional development. They inspired me to become an outstanding student and assistant lecturer. Soon afterward, I was invited by Dr. János Iker to the newly established Bolyai Grammar School in Szombathely and have been teaching there since then for over 20 years. I am an advocate of problem-/inquiry-based learning, but also believe that there is not one single right method: one must always dynamically adjust to the problem at hand and tailor the methods accordingly. I have worked on a number of professional boards (Hungarian National Institute for Educational Research and Development (OKI/OFI) in curriculum development, dealing with the National Curriculum etc.). I am the head of our talent center, and I am proud of all the results of all my students. In 2011, I received the Rátz Lifetime Achievement Award, and in 2013 the Bonis Bona National Talent Award.

### PUBLICATIONS

**Baranyai J, Szűcsné Kerti A.** (2006). Biológia középszintű érettségi feladatgyűjtemény 10. [Intermediate biology Matura examination papers 10]. Budapest: Nemzeti Tankönyvkiadó.

**Baranyai J, Szűcsné Kerti A.** (2006). Biológia középszintű érettségi feladatgyűjtemény 11. [Intermediate biology Matura examination papers 11]. Budapest: Nemzeti Tankönyvkiadó.

**Baranyai J, Szűcsné Kerti A.** (2006). Biológia középszintű érettségi feladatgyűjtemény 12. [Intermediate biology Matura examination papers 12]. Budapest: Nemzeti Tankönyvkiadó.

### SUCCESSFUL STUDENTS

#### Ramón Hegedüs

biophysics researcher – Barcelona established own firm

- Intel International Science and Engineering Fair 2001, 1<sup>st</sup> prize

#### Péter Korcsmár

practising physician – Germany

- Bolyai Prize for Youth 2001

#### Krisztina Berek

intern – Second Department of Medicine and Cardiology Center, Szeged

- National Scientific and Innovation Contest for Youth 2004, 1<sup>st</sup> place

#### Péter Novinszky

physician – Szombathely

- IBO 2011, silver medal

#### Bence Hajnal

medical student

Semmelweis Medical University, Budapest

- IBO 2013, silver medal

# ISTVÁN CSIGÉR



## SZTE Primary and Secondary Grammar School

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## TEACHING CAREER IN BRIEF

I earned my degree at the József Attila University (University of Szeged) in 1985, which qualified me to teach biology and chemistry in secondary school. Right after I completed my studies, I started my career at the Vocational School for Forestry and Water Resources Engineering and Management in Barcs, where I spent six years. I taught biology and chemistry to students in the forestry stream and chemistry and lab practice to students in the water resources engineering and management stream. In acknowledgement of my work, I received a Ministerial Commendation in 1989. In 1991, I came to my current workplace, the University of Szeged Grammar School and Primary School (previously the University of Szeged Ságvári Endre Grammar School) as a mentor teacher in biology. My basic job has been to teach biology and to train university students studying to become biology teachers (supervising student teaching and administering examinations to student teachers). I also work as the lead teacher for biology in the Szeged Regional Student Science Laboratory, established by our high school and by the University of Szeged, which supports it financially. Within the limits of reason, I endeavour to develop relationships with my high school and university students based on collegiality and respect, never compromising on quality work standards or the requirements of consistent and rigorous assessment. In acknowledgement of my teaching activities, I received the Golden Rostrum Commemorative Plaque in 2001. I first became involved in the Szeged Scientists Academy in 2012, which honored me with the title of Szent-Györgyi Teacher and then in 2016 with that of Szent-Györgyi Senior Teacher. I have endeavoured to aid the academy from the beginning to discover and cultivate young talent.

## PUBLICATIONS

**Csigér I, Juhász K, Vargáné Lengyel A.** (2011). Biológia 11 [Biology 11]. Szeged: Maxim Könyvkiadó.

**Csigér I, Juhász K, Vargáné Lengyel A.** (2012). Biológia 12 [Biology 12]. Szeged: Maxim Könyvkiadó.

**Csigér I, Németh E.** (2005). Néhány szakmai észrevétel dr. Lénárd Gábor Biológiá II. és Biológia III. Tankönyvről [Some observations on Dr. Gábor Lénárd's Biology II and Biology III coursebooks]. A biológia tanítása 2. szám: 7-19

## SUCCESSFUL STUDENTS

### Tamás Kovács

forest engineer

- *Kitaibel Pál Competition 1988, 4<sup>th</sup> place*

### Magdolna Gaál

dermatologist, associate professor Dermatology Clinic,  
 Faculty of Medicine,  
 University of Szeged, Szeged

### Attila Vass

ophthalmologist

Eye Clinic, Faculty of Medicine,  
 University of Szeged, Szeged

### László Pecze

biologist

University of Fribourg, Switzerland

- *National Secondary School Competition (OKTV) 1997, 17<sup>th</sup> place*

# JULIANNA ERÓS-HONTI



## Fazekas Mihaly Primary and Secondary Grammar School

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## TEACHING CAREER IN BRIEF

I completed my studies as a research biologist at Eötvös Loránd University, Budapest, with a concentration in evolutionary biology, systematics and ecology. Later, at the same institution, I studied in the Theoretical Ecology Program within the Doctoral School for Biology. In the meanwhile, I also earned a teaching degree. I conducted my research in the field of plant ecology, examining the distribution of grass species in the Dolomites. In my research work, I gained experience in planning research. I can thus assist students in carrying out independent research and writing articles. I teach biology at Fazekas Mihály Primary and Grammar School. A great emphasis is placed on academic competitions at our school, for which we continuously prepare our students. As a mentor teacher, my tasks include holding demonstration lessons and workshops, organising competitions and editing the biology website. I consider my most significant tasks to be the special after-school lessons for nurturing excellence and the summer biology camps that I organise, in which our students can become acquainted with the mentality of the researcher and the diversity of the academic field. In addition to teaching, I have worked as an educational developer for the Hungarian National Institute for Educational Research and Development (OFL), and I also contribute to the work of the Matura examination, as assigned by the Office of Education.

## SUCCESSFUL STUDENTS

### Csaba Szilágyi

university student  
 Semmelweis Medical University, Budapest  
 • *National Secondary School Competition (OKTV) biology, category II, 2<sup>nd</sup> place*

### Eszter Székely

university student – chemistry  
 Faculty of Sciences,  
 Eötvös Loránd University, Budapest  
 • *OKTV biology, category I, 2012, 6<sup>th</sup> place*

### Dániel Zahemszky

university student – biology  
 University of York  
 • *Dr. Árokszállásy Zoltán National Biology and Environmental Protection Competition 2013, 5<sup>th</sup>–7<sup>th</sup> place*

## PUBLICATIONS

Mihók B, Erős-Honti Zs, Gálhidyi L, Bela Gy, Illyés E, Tinya F, **Erős-Honti J**, Molnár Á, Szabó R. (2006). A Borsodi-ártér természeti állapota a helyben élők és az ökológusok szemével - interdiszciplináris kutatás a hagyományos ökológiai tudásról [The natural state of the Borsod flood plain through the eyes of locals and ecologists: interdisciplinary research on traditional ecological knowledge]. TERM. VÉD. KÖZL. 12: 79-103.

Dobolyi K, **Erős-Honti J**, Botta-Dukát Z. (2008). Habitat preference of Linum dolomiticum (Linaceae) STUDIA. BOT. HUNG. 39: 135–144.

Dobolyi K, **Erős-Honti J**, Rédei T. (2010). Az Odvas-hegy flórája és vegetációja [The flora and vegetation of the Odvas Mountain]. In Molnár Cs, Molnár Zs, Varga A. (Eds.): „Hol az a táj szab az életnek teret, Mit az Isten csak jókedvében teremt.” Válogatás az első tizenhárom MÉTA-túrafüzetből MTA-ÖBKI, Vácrátót, 2003-2009. pp. 191-199.

# DR. ZSOLT ERŐS-HONTI



## Fazekas Mihaly Primary and Secondary Grammar School

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## TEACHING CAREER IN BRIEF

I am a research biologist with a PhD as well as having been trained as a specialized translator and secondary school biology teacher. I hold the post of associate professor at the Faculty of Horticultural Science, Szent István University. Ever since I received my teaching degree, I have been teaching biology to secondary school students (both in Hungarian and English), currently part-time at the Fazekas Mihály Primary and Grammar School in Budapest. I participate in the nurturing excellence program at the school, preparing students for both domestic and international competitions, including the International Biology Olympiad. I also organise camps and prepare students for the Matura examination. I have developed teaching materials for public education, edited and published educational methodology coursebooks, and provided professional editing for materials used in public education. I participated in a Social Renewal Operational Program (TÁMOP) project dealing with the implementation of the framework curriculum in the Hungarian National Institute for Educational Research and Development (OFL), and I was also a member of a working group that harmonised the requirements of the Matura examinations with those of the framework curriculum. Since 2012, I have regularly completed assignments for the Office of Education. As someone involved in higher education, it is my conviction that development and nurturing excellence should not be a process tied to particular educational phases. It should be an overarching effort. I am also convinced that success in the education system depends on effective communication between public and higher education.

## PUBLICATIONS

**Erős-Honti Zs.** (2011). A kertészeti növények alaktana [Morphology of horticultural plants]. Egyetemi jegyzet. Budapest: BCE-KeTK.

**Erős-Honti Zs.** (2015). Az info-kommunikációs technológiák (IKT) alkalmazásának lehetőségei a kertészeti oktatás szakmódszertanában [Options for using Information and Communications Technology (ICT) in teaching horticulture]. In Szakmódszertani jegyzet az agrár-mérnöktanárok és -hallgatók számára (mezőgazdasági gépészet, mezőgazdaság, kertészet és parképítés) (Erős-Honti Zs, Nagy J). Budapest: BCE.

Jakucs E, **Erős-Honti Z**, Seress D, Kovács G M. (2015). Enhancing our understanding of anatomical diversity in *Tomentella ectomycorrhizas*: characterization of six new morphotypes. *MYCORRHIZA* 25(6): 419-429

# NORBERT FARAGÓ



## ELTE Trefort Ágoston Secondary Grammar School

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## TEACHING CAREER IN BRIEF

I began my teaching career at the Terézváros Bilingual Primary and Grammar School in Budapest in 2001. I also taught biology and chemistry at a private grammar school concurrently. Since 2005, I have taught at the Trefort Ágoston School in Budapest, mostly biology. I have been a mentor teacher since 2006. In 2010, I received a certificate in mentoring candidate teachers. At school, I teach seventh- to twelfth-grade students as well as preparing the eleventh- and twelfth-grade students in advanced elective courses. Our students have achieved strong results at the Herman and Kitaibel competitions as well as at the National Secondary School Competition (OKTV) and the Árokszállásy biology and environmental protection competition. I regularly prepare students in groups for the advanced Matura examination. Since 2013, I have been head of the school's TÁMOP-funded science laboratory.

## PUBLICATIONS

**Faragó N., Szászné H J.** (2013). Biológia lépésről lépéstre [Biology step by step]. Budapest: Bölcselet Egyesület.

Czédulás K, **Faragó N**, Solymoss M, Szászné H J. (2013). Még egy lépés a biológia érettségihez [One more step toward the biology Matura examination]. Budapest: Bölcselet Egyesület.

## SUCCESSFUL STUDENTS

### Eszter Tóth

university student

Semmelweis Medical University, Budapest

- *National Secondary School Competition (OKTV) biology 2010, 2<sup>nd</sup> prize*

### György Varga

university student

Faculty of Sciences,

Eötvös Loránd University, Budapest

- *Herman Competition 2010, 2<sup>nd</sup> prize - Árokszállásy Competition 2011, 1<sup>st</sup> prize EUSO XI, 2012, silver*

### Anna Uzonyi

university student

Technische Universität München

- *Árokszállásy Competition 2014, 1<sup>st</sup> prize OKTV 2014, 1<sup>st</sup> prize*

- *IBO 2013, silver*

- *IBO 2014, silver*

# ANDREA FAZAKAS



## Deák Téri Lutheran Gymnasium

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## TEACHING CAREER IN BRIEF

I graduated with a secondary school teaching degree in biology and chemistry at József Attila University (University of Szeged) in 1988. I began teaching at the Deák Tér Lutheran Grammar School in Budapest in 1993. I quickly learned the importance of an encouraging school atmosphere in nurturing talented students. I developed Matura examinations for the Hungarian National Institute for Educational Research and Development (OFI) between 2003 and 2006. In 2004, I attended a Training for Trainers program to implement the two-tier Matura examination, and in 2004–05, I held talks on this new system for my colleagues. I have also participated in administering the advanced Matura examination since 2005. Meanwhile, in 2005, I passed a qualifying examination to become a mentor teacher at the Faculty of Sciences, Eötvös Loránd University, Budapest. I have always been happy to mentor future teachers. I have seen five of my candidates complete their teacher training. I received the BONIS BONA for the Nation's Talent Award in 2013 in acknowledgement of my efforts in preparing students for the National Secondary School Competition (OKTV). In 2015, I applied for the master teacher rank and received it the following year. I consider it important during my work to instil a passion for biology in my students and introduce them to the logic of the natural sciences. Various extracurricular events offer excellent opportunities in that regard. During the academic year, we usually take hiking trips, mainly in the Danube–Ipoly National Park (DINP). In addition, we also visit laboratories and attend lectures organised for students by the Hungarian Academy of Sciences. During the summer holidays, I take my students to one-week ecocamps. We have already visited the Kis-Balaton, Szatmár, Őrség and Lake Velence regions in and around Hungary as well as the North Hungarian Mountains.

## PUBLICATIONS

Dr. Kisfaludy A, Dombovári L, **Fazakas A**, Dr. Lóczy D. (2008). Természettudományi Enciklopédia [Encyclopaedia of science]. Budapest: Nemzeti Tankönyvkiadó.

## SUCCESSFUL STUDENTS

### Dr. Katalin Czöndör

researcher – assistant lecturer

Department of Physiology and Neurobiology,

Eötvös Loránd University, Budapest;  
postdoc, University of Bordeaux

- *L'Oréal-UNESCO for Women in Science International Prize 2014*

### Dóra Pálva

university student

Faculty of Medicine, Semmelweis University, Budapest

- *National Secondary School Competition (OKTV) Biology 2015, 1<sup>st</sup> prize*
- *Curie Environmental Protection Competition 2014, 8<sup>th</sup> place*
- *Szentágothai Competition 2016, 1<sup>st</sup> prize*

### Dr. Orsolya Gresits

physician

Orthopedic Clinic,

Semmelweis University, Budapest

- *OKTV Biology 2008, 11<sup>th</sup> place*

### Huba Szabolcs

university student – biology

Eötvös Loránd University, Budapest

- *OKTV Biology 2013, 9<sup>th</sup> place*
- *OKTV Biology 2014, 31<sup>st</sup> place*
- *IBO national selection finals 2014*

### Bence Domokos

university student

Faculty of Medicine,

Semmelweis University, Budapest

- *OKTV biology 2015, 11<sup>th</sup> place*
- *OKTV Biology 2016, 28<sup>th</sup> place*
- *Szentágothai Competition 2016, 5<sup>th</sup> place*

# JÓZSEF GŐZ



## Tóth Árpád Secondary School

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## TEACHING CAREER IN BRIEF

I have been teaching biology and chemistry at the Tóth Árpád Grammar School in Debrecen since 2000. During my career, I have earned a qualification in specialized Hungarian–English translation as well as passing a mentor teaching examination and receiving the title of master teacher. At my job, in addition to teaching in the specialized biology program, I also joined the Arany János Nurturing Excellence Program, the International Baccalaureate Program and the Öveges Scientific Laboratory Program, as well as being involved in grant projects and in mentoring candidate teachers. I am the head of the department of biology and chemistry at my school, where we are engaged in a specialized high school program that enjoys the longest history in the country. An integral part of this is nurturing excellence, developing projects, and preparing students for competitions and the Matura examinations. As a Matura examiner, I operate an online database which aids in the students' preparations for the examination with items on the written part presented in a system. My main area of interest and research is the methodology of teaching biology and, within that, digital innovation. In my work, I do my utmost to combine the options offered by technology and the international environment with the traditional values embodied by my workplace and the domestic professional community.

## SUCCESSFUL STUDENTS

### Hédi Árva

university student

University of Szeged, Szeged

- Szent-Györgyi Competition 2012, 1<sup>st</sup> prize
- Bugát Pál Competition 2014, 1<sup>st</sup> prize
- Georgikon Competition 2014, 4<sup>th</sup> place

### Anna Erdei

PhD student

Eötvös Loránd University, Budapest

- National Secondary School Competition (OKTV) Biology 2008, 21<sup>st</sup> place
- Árokszállásy Competition 2008, 7<sup>th</sup> place

### Tamás Kun

pharmacist

Faculty of Pharmacy,

University of Debrecen

- National Secondary School Competition (OKTV) Biology 2010, 30<sup>th</sup> place
- Árokszállásy Competition 2009, 19<sup>th</sup> place

## PUBLICATIONS

Dobróné Tóth M, Futóné Monori E, **Gőz J**, Revákné Markóczi I. (2015). Biológia tanítás az IKT és IBL világában [Biology teaching in a world of ICT and IBL]. Debrecen: Debreceni Egyetemi Kiadó

# ZSOLT HORVÁTH



## Gödöllő Reformed Secondary School

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## TEACHING CAREER IN BRIEF

I received my teaching degree in biology and chemistry from the Kossuth Lajos University (University of Debrecen) in 1995 and have been working since then at the Reformed Church Grammar School in Gödöllő. During the first years of my career, I learned about the BISEL biological water quality assessment method, and in 2000 I participated in the Bioindication and Internet 2000 EU Leonardo in-service training for teachers in Belgium. Then in summer 2002, I organised the BISEL bioindication water quality assessment method 2 accredited in-service training. Between 2006 and 2008, I was asked to update high school biology coursebooks written by Gábor Lénárd and published by Nemzeti Tankönyvkiadó publishers. My tasks included editing (the Prizma series written by Mrs József Berger), preparing digital teaching materials (a CD-ROM with images, figures and experiments for the Lénárd biology coursebook series) and holding lectures (at the start-of-the-year Nemzeti Tankönyvkiadó conference). I have participated in designing biology competition items since 2008. Between 2011 and 2012, I edited digital teaching materials for chemistry and biology called Yenka and Sunflower, and I prepared a series of histological images for Mozaik Publishers. In 2015, I edited digital teaching materials entitled "The molecular cell biology of autolysis, apoptosis and cell regeneration", created by the Department of Anatomical, Cell and Developmental Biology, Eötvös Loránd University, and took part in a training for trainers on the advanced Matura examination in biology. As of 2016, my school (along with three other Hungarian high schools) has participated in a health protection program based on the TANTUDSZT contemporary teaching project, which won a teaching methodology competition announced by the Hungarian Academy of Sciences. In 2016, I had three articles published in the Eduvital column of Élet és Tudomány (Life and Science), a popular science weekly.

## SUCCESSFUL STUDENTS

### Éva Hamar

PhD student

Vegetable Crop Research Department,  
 National Agricultural Research and  
 Innovation Center

- *National Secondary School Competition (OKTV) 2011, 7<sup>th</sup> place*
- *TUDOK National Finals:  
 Medicine-biology section:  
 special prize for best presentation*

## PUBLICATIONS

**Horváth Zs.** (2008). Képek, ábrák és kísérletgyűjtemény a Lénárd-féle biológia-tankönyvcsaládhoz [Images, figures and experiments for the Lénárd biology coursebook series]. Budapest: Nemzeti Tankönyvkiadó Zrt.

**Horváth Zs.** (2016). Fehérjebontás a sejtekben [Proteolysis in cells]. ÉLET ÉS TUDOMÁNY 71: 140-142.

Papp T, Szekeres Zs, Huoranszki Cs, **Horváth Zs.** (2016). Mindennapi kenyérünk 1-2 [Our daily bread 1-2]. ÉLET ÉS TUDOMÁNY 71: 468-470.

# ZOLTÁN JÁNOS KERÉNYI



## Premonstratensian St. Norbert Secondary School, Technical School for Church Music and Dormitory

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## TEACHING CAREER IN BRIEF

I earned a degree from the József Attila University (University of Szeged) as both a biology teacher and a biologist with a specialization in ecology. I began my teaching career as a part-time biology teacher at the Dugonics András Piarist Grammar School in Gödöllő, moving on to the Premonstratensian (Norbertine) Grammar School in the same town in 1998. I taught biology to students within the regular curriculum and advanced elective courses in biology for those preparing to study the subject at university as well as other enthusiasts. We launched a specialized program in biology and chemistry in 2014–15, and, as department head, I played an active role in developing its content and structure. Since our school boasts a great many outstanding students, my teaching activity has become focused on engaging with young people with particular talent. In order to carry out the work in a truly professional manner, I also completed a course to become a talent development teacher at the University of Debrecen and attended the Geniuszin-service training ("Nurturing excellence among talented biology students"). One regular, favourite form of dealing with talented young people is the Path to Science program, through which research teams of five students are formed to learn and improve thinking through joint research activity on a particular topic area. At the end of the project, the research teams share their results in a presentation every year at the TUDOK regional and national conferences. For my work in nurturing excellence, I have so far received the Kontra György Award (2010), Bonis Bona Award (2013) and a Ministerial Certificate of Recognition (2016).

## PUBLICATIONS

Kerényi Z. (2004). Pilisjászfalu madárvilága [The bird world of Pilisjászfalu]. In Pilisjászfalu I. Pilisjászfaluért Közalapítvány.

Kerényi Z. (2011). A Gödöllői-dombság állatvilága [The animal world of the Gödöllő Hills]. In Szabó L. (Ed.): A Gödöllői-dombság természeti- és gazdaság-földrajzi viszonyai. Budapest: Agroinform Kiadó.

Kerényi Z, Ivók E. (2013). Nestsite characteristics of the European Bee-eater (*Merops apiaster* L.) in the Gödöllő Hills. ORNIS HUNGARICA 21(2): 23-32.

## SUCCESSFUL STUDENTS

### Bence Prehoda

university student  
 Faculty of Medicine,  
 Semmelweis Medical University, Budapest  
 • *National Secondary School Competition (OKTV) Biology 2012, 4<sup>th</sup> place*  
 • *OKTV Biology 2013, 12<sup>th</sup> place*  
 • *IBO national selection, 3<sup>rd</sup> place*

### Flóra Takács

university student  
 University College London  
 • *OKTV Biology 2014, 8<sup>th</sup> place*  
 • *IBO 2015, silver medal*  
 • *ICYS 2015, silver medal*

### Márton Csaba

university student  
 Faculty of Medicine,  
 Semmelweis Medical University, Budapest  
 • *OKTV Biology 2015, 12<sup>th</sup> place*  
 • *TUDOK national finals 2015, grand prize*  
 • *KutDiák essay-writing competition 2014, 1<sup>st</sup> prize*

### István Krisztofer Tóth

Bartók Conservatory, Liszt Academy  
 • *Hlavay József National Environmental Science Students Conference 2014, 1<sup>st</sup> prize*

### János Farkas

university student  
 Faculty of Chemical Technology and Biotechnology, Budapest University of Technology and Economics  
 • *TUDOK national finals 2015, grand prize*  
 • *KutDiák essay-writing competition 2014, 1<sup>st</sup> prize*  
 • *Avram Hershko Science Competition 2014 and 2015, 1<sup>st</sup> prize*

# RÓBERT KERTÉSZ



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### TEACHING CAREER IN BRIEF

I earned my secondary school teaching degree in biology and chemistry at the József Attila University (University of Szeged) in 1993. I started working at the Department of Botany there and then moved to Kaposvár in 1997. Since then, I have been teaching biology and chemistry in the regular and specialized curricular programs at my alma mater there, Táncsics Mihály Grammar School. Since the Research area of the two-tier Matura examinations, I have participated in the work of the advanced Matura examination boards, I have corrected advanced written Matura examinations and was even requested to oversee examination marking. I passed two specialized examinations (at the University of Szeged and the Budapest University of Technology and Economics) and have incorporated the knowledge I have thus acquired into my everyday practice. In 2014, I received the rank of master teacher, so I am now also called on to provide consultations, through which I endeavour to improve the position of my scientific subjects, which are continually being pushed into the background. During my work in secondary school, I have always laid great stress on nurturing excellence – I have prepared my students for various competitions in both of my subjects. I consider it important to aid my students in strengthening their own innate interest and developing their own high professional standards.

### PUBLICATIONS

### SUCCESSFUL STUDENTS

#### Ábel Perjés

research fellow

National Institute for Sports Medicine

- *National Secondary School Competition (OKTV) Biology 2009, 9<sup>th</sup> place*

#### András Horváth

research fellow

Institute of Enzymology, Hungarian Academy of Sciences, Budapest

- *OKTV Biology 2002*

#### Szabolcs József Vigvári

physician

Department of Emergency Medicine, University of Pécs, Pécs

- *OKTV Biology 2002*

#### Szilveszter Ziegenheim

PhD student

University of Szeged, Szeged

- *OKTV Biology 2010*

# BEATRIX CSILLA BAGI KERTÉSZ



## Táncsics Mihály Secondary Grammar School of Kaposvár

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## TEACHING CAREER IN BRIEF

I earned my teaching degree in biology and chemistry at the József Attila University (University of Szeged) in 1993. I rounded out my degree with a postgraduate qualification in environmental protection in 1995. I taught at the Corvin Mátyás Vocational School in Hódmezővásárhely for four years, and I have been teaching in my current workplace at the Táncsics Mihály Grammar School in Kaposvár since 2001. Throughout my career, I have placed a major emphasis on nurturing excellence in my professional work. My students have achieved success at various competitions in chemistry, biology and environmental protection, many of them having gone on to study medicine, pharmacy, biology and chemistry. I teach advanced elective courses in both my subject areas, and I was the form teacher for three of the groups in the school specializing in biology and chemistry as well as their teacher in those subjects. I have aided my students with a great deal of useful experience by regularly participating in the advanced Matura examinations in both of my subjects. I have always considered it important to learn about and apply an objective measurement of knowledge. I therefore did a specialized examination in teaching with a specialization in educational assessment at the University of Pécs in 2011. I feel responsible for the future of my academic subjects. My aim is for us to engage in a truly appealing science education in our schools at a high standard, an effort I strive to support as a consultant with a master teacher qualification. Finally, I think one needs sufficient professional humility and endurance to be successful in one's work, not only talent.

## PUBLICATIONS

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## SUCCESSFUL STUDENTS

### Csilla Varju

pharmacist – Faculty of Pharmacy,  
 Semmelweis University, Budapest  
 • Árokszállásy 2007, 11<sup>th</sup> place  
     2008, 6<sup>th</sup> place  
     2009, 4<sup>th</sup> place

### Sára Vasana Morapitiye

physician  
 Faculty of Medicine, Semmelweis University, Budapest  
 • National Secondary School Competition (OKTV) Biology 2008, 7<sup>th</sup> place

### Nóra Koch

pharmacy student – Faculty of Pharmacy,  
 Semmelweis University, Budapest  
 • Árokszállásy 2010, 16<sup>th</sup> place  
     2011, 3<sup>rd</sup> prize  
     2012, 7<sup>th</sup> place  
 • OKTV Biology 2012, 11<sup>th</sup> place  
     2013, 14<sup>th</sup> place  
 • Fodor 2013, 1<sup>st</sup> prize  
 • 2013 Richter Gedeon Talentum Foundation Grant

### Bence Bajzik

medical student – Faculty of Medicine,  
 University of Pécs, Pécs  
 • Árokszállásy 2011, 5<sup>th</sup> place  
 • OKTV Biology 2013, 34<sup>th</sup> place  
 • Fodor 2013, 2<sup>nd</sup> prize

### Adél Kiss

medical student – Faculty of Medicine,  
 University of Pécs, Pécs  
 • Irinyi 2010, 44<sup>th</sup> place  
     2011, 44<sup>th</sup> place  
 • Fodor 2013, 3<sup>rd</sup> prize

# LÁSZLÓ KUTROVÁCZ



## ELTE Trefort Ágoston Secondary Grammar School

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## TEACHING CAREER IN BRIEF

I started my teaching career in autumn 2002 at the Eötvös Loránd University Trefort Ágoston School in Budapest, where I have worked ever since. I have trained candidate teachers as a mentor teacher in chemistry there for nine years, and I have been department head since 2011. As a form teacher, I will see my second group of students complete their Matura examinations. In 2010, I received the Trefort Ágoston Certificate of Recognition from the Eötvös Loránd University Senate. In the same year, I was certified as a mentor teacher with a specialization in nurturing excellence. My goal is to shed light on the beauty and importance of scientific connections and their close ties to our everyday lives. I lay a great deal of emphasis on mentoring talented students in special after-school lessons. Two of my students have reached the National Secondary School Competition (OKTV) finals in biology and two have done so in chemistry. One of my students became a member of the national team for the International Mendeleev Chemistry Olympiad.

## PUBLICATIONS

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## SUCCESSFUL STUDENTS

### Borbála Bognár

psychologist

- *National Secondary School Competition (OKTV) biology 2007, 13<sup>th</sup> place*

### Susanne Prokop

medical researcher - KatonaLab - Momentum Laboratory of Molecular Neurobiology

- *Irinyi János National Chemistry Competition 2008, 25<sup>th</sup> place*
- *National Secondary School Competition (OKTV) chemistry 2010, 30<sup>th</sup> place (could not participate in the finals)*

### Eszter Tóth

doctor

- *National Secondary School Competition (OKTV) biology 2010, 2<sup>nd</sup> place*

### Anna Baumann

student

- *National Secondary School Competition (OKTV) chemistry 2017, 25<sup>th</sup> place*
- *Dürer Chemistry Competition 2017, 1<sup>st</sup> place*

### Péter Kalapos

student

- *Irinyi János National Chemistry Competition 2015, 10<sup>th</sup> place*
- *Oláh György National Chemistry Competition 2015, 2<sup>nd</sup> place*
- *National Secondary School Competition (OKTV) chemistry 2016, 13<sup>th</sup> place*
- *National Secondary School Competition (OKTV) chemistry 2017, 7<sup>th</sup> place*
- *Dürer Chemistry Competition 2017, 1<sup>st</sup> place*
- *Baltic Chemistry Competition, 8<sup>th</sup> place*
- *Member of the Mengyelejv International Students Olympics Team*

# ZSOLT NYISZTOR



## Nagy Lajos Grammar School of the Cistercian Order

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## TEACHING CAREER IN BRIEF

I received my teaching degree in biology and chemistry at the University of Pécs. During my studies, I was engaged in an ecological study of barn owls, among other topics, as well as a molecular biology project involving the processing of samples collected in the field for taxonomic purposes. During this time, I also spent half a year in Italy as an ERASMUS student at the University of L'Aquila. In 2001, I began teaching at the Nagy Lajos Cistercian Grammar School in Pécs, where I have been a teacher ever since. Since 2012, I have been a correspondence student at the Doctoral School for Biology and Sports Biology, University of Pécs, where I am engaged in mammalian retina research at the Department of Experimental Zoology and Neurobiology. I would like to pass on to my students my enthusiasm for the sciences and the ability to wonder at the myriad beauty of the created world. I believe that Hungary should be represented among the scientific elite of the world through diligence and endurance. I consider it important for my students to leave high school not only strengthened in knowledge, but also in moral and spiritual values.

## PUBLICATIONS

**Nyisztor Zs.** (2015). Biológia munkafüzet 11-12. osztály [Biology workbook grades 11–12]. Pécs: Ciszterci Rend Nagy Lajos Gimnáziuma és Kollégiuma.

**Nyisztor Zs.** (2015). Biológia szaktanári segédlet 11. osztály [Biology teacher's guide grade 11]. Pécs: Ciszterci Rend Nagy Lajos Gimnáziuma és Kollégiuma.

**Nyisztor Zs.** (2015). Biológia szaktanári segédlet 12. osztály [Biology teacher's guide grade 12]. Pécs: Ciszterci Rend Nagy Lajos Gimnáziuma és Kollégiuma.

## SUCCESSFUL STUDENTS

### Dr. Eszter Mária Végh

resident

Semmelweis University Heart Center,  
Budapest

- *National Secondary School Competition (OKTV) biology, 12<sup>th</sup> place*

### Sándor Szabó

medical student

Faculty of Medicine, Semmelweis Medical University, Budapest

- *OKTV Biology 2010, 14<sup>th</sup> place*
- *Árokszállásy Zoltán Biology Competition 2010, 20<sup>th</sup> place*

### Viktória Kornélia Takács

biologist

Department of Pathology, University of Pécs, Pécs

- *Kitabel Pál Biology Competition 2008, 23<sup>rd</sup> place*
- *OKTV biology 2010, 9<sup>th</sup> place*
- *TUDOK national finals 2010, grand prize*

### Dóra Kinga Kevey

medical student

Faculty of Medicine, University of Pécs,  
Pécs

- *TUDOK national finals 2013, grand prize*
- *OKTV biology 2013, 12<sup>th</sup> place*
- *Árokszállásy Zoltán Biology Competition 2014 national finals, 21<sup>st</sup> place*

### Bence Szélíg

medical student

Faculty of Medicine, University of Pécs,  
Pécs

- *OKTV biology 2015, 11<sup>th</sup> place*
- *Árokszállásy Zoltán Biology Competition 2016, 7<sup>th</sup> place*

# TÜNDE SZALAINÉ TÓTH



## Lovassy László Grammar School

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## TEACHING CAREER IN BRIEF

I have been an educator since 1982 and continue to derive great joy from my work to the present day. In addition to my daily teaching responsibilities, I have endeavoured to use and pass on my knowledge and experience at the school, municipal, county and national levels. I consider it a priority to nurture excellence: so far, 34 of my students have reached the final round of Hungary's highly respected National Secondary School Competition (OKTV) in biology, two of them won first place, one of them won second place, and 12 of them finished in the top ten. My students have achieved great success in numerous other prominent competitions for young scholars. As an acknowledgement of my work in nurturing excellence, I received the Rátz Life Achievement Award as well as a Ministerial Certificate of Recognition. I have also been awarded the Ranolder Prize from the City of Veszprém and the Pro Talento Prize from the Veszprém County Institute of Education. I take part in organising county and national competitions as well as school events. I am a master teacher, consultant, board chair for the Matura examination and multiplier as well as participating in bringing grant projects to fruition. I was a form teacher for 19 years. I enjoy professional challenges, and I have worked as an educational developer in several projects for the Hungarian National Institute for Educational Research and Development (OFI). I have often published in Élet és Tudomány (Life and Science), a popular science weekly, in which studies by my students are also occasionally published. I have also created the Lovassy Health website, which is edited exclusively by my students, who write articles on health and health education. At the request of Maxim Publishers, I have prepared a Matura preparation book with a colleague from Debrecen. Since 2014, I have participated in the work of the National Teachers Chamber (NPK) as a national delegate, and I have been the national chair of the Man and Nature section of the Chamber since 2015.

## PUBLICATIONS

Feith H, Melicher D, Máthé G, Gradvohl E, Füzi R, Darvay S, Hajdú Zs, Nagyné Horváth E, Soósné Kiss Zs, Bihariné Krekó I, Földvári-Nagy Lászlóné, Molnár E, **Szalainé Tóth T**, Urbán V, Kassay A, Falus A. (2016). Tapasztalok és motiváltság: magyar középiskolások véleménye az egészségnélő programokról [Experience and motivation: Hungarian high school students' views on health education programs]. ORVOSI HETILAP 2: 65-69.

**Szalainé Tóth T.** (2015). Megváltoztatható-e, ami géneinkben meg van írva? [Can we change what is written in our genes?] ÉLET ÉS TUDOMÁNY 48: 1526-1528.

**Szalainé Tóth T**, Dr. Szűcsné Kerti A. (2017). Érettségi mintafeladatsorok biológiából (10 írásbeli emelt szintű feladatsor) [Sample Matura examinations in biology (10 advanced written examination papers)]. Szeged: Maxim Kiadó.

## SUCCESSFUL STUDENTS

### Dr. Lilla Képes

physician, anaesthesiology resident  
St. Anna-Virngrund-Klinik, Ellwangen, Germany

- *National Secondary School Competition (OKTV) biology 2006, 1<sup>st</sup> place*
- *Kitaibel Pál Biology and Environmental Protection Competition 2003, 7<sup>th</sup> place*
- *Kitaibel Pál Biology and Environmental Protection Competition 2004, 4<sup>th</sup> place*

### Dr. Bence Szalai

postdoctoral medical researcher  
Joint Research Center for Computational Biomedicine, RWTH Aachen Uniklinik, Germany

- *OKTV biology 2001, 6<sup>th</sup> place*
- *OKTV biology 2000, 12<sup>th</sup> place*
- *Kitaibel Pál Biology and Environmental Protection Competition 1999, 3<sup>rd</sup> place*

### Dr. Tamás Radovits

internist, lecturer – Semmelweis University Heart Center, Budapest

- *OKTV biology 1998, 4<sup>th</sup> place*
- *Kitaibel Pál Biology and Environmental Protection Competition 1995 and 1996, national finals*

### Norbert Hőgye

university student – Faculty of Medicine, Semmelweis University, Budapest

- *OKTV biology 2012, 2<sup>nd</sup> place*
- *OKTV biology 2011, 17<sup>th</sup> place*

### Krisztina Molnár

university student – Faculty of Medicine, Semmelweis University, Budapest

- *OKTV biology 2011, 6<sup>th</sup> place*
- *OKTV biology 2010, 19<sup>th</sup> place*
- *Kitaibel Pál competition 2008, 14<sup>th</sup> place*

# CSILLA SZENTESI



## Földes Ferenc High School

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## TEACHING CAREER IN BRIEF

I completed my studies in biology and geography at the Kossuth Lajos University (University of Debrecen) in 1998. To this day, I have taught in my former high school, Földes Ferenc Grammar School in Miskolc. In 1998, I also completed a teaching degree in the field of environmental protection at the Eszterházy Károly College in Eger. In 2005, I passed an examination in public school management and teaching. In 1996, I joined the County Institute of Education, and I was appointed a municipal consultant in biology and environmental protection between 1998 and 2011. Since 2005, I have been a board chair for the advanced Matura examination in my subject areas and am also engaged in coordinating the corrections for the advanced written Matura examination. During my career, I have organised lectures and held practical in-service training for my colleagues in the county. I have participated in testing digital teaching materials, preparing task sheets and editing geography coursebooks as well as serving as a mentor teacher for a number of student teachers from the University of Debrecen. As of 2015, I have also worked as a master teacher and an educational inspection and teacher certification expert. In 1997, my colleagues and I launched the Árokszállásy Biology and Environmental Protection Competition, of which I am the main organiser. My school has had a great natural sciences tradition. My work in preparing my students for the advanced Matura examination and in my capacity as a form teacher is a top priority for me. I prepare my students continuously, hold special after-school lessons, and organise fieldwork and lectures. I have received a number of certificates at national competitions through my students as well as a certificate of appreciation from the city. My greatest source of pride is my students' success and the happy smiles on their faces when they achieve their goals.

## SUCCESSFUL STUDENTS

### Dóra Zwillinger

veterinarian

Szent István University, Budapest

- Kitaibel Pál Competition 2007, 6<sup>th</sup> place

### Bálint Lakatos

PhD student

Semmelweis Medical University, Budapest

- National Secondary School Competition (OKTV) Biology 2010, 45<sup>th</sup> place

### Lukács Lesinszki

demonstrator

Semmelweis Medical University, Budapest

- OKTV Biology 2014, 5<sup>th</sup> place
- Árokszállásy Competition 2014, 2<sup>nd</sup> prize

### Ferenc Fónagy

Corvinus University, Budapest

- Lóczy Geography Competition 2009, 13<sup>th</sup> place
- Less Geography Competition 2010, 8<sup>th</sup> place
- OKTV Geography 2011, 35<sup>th</sup> place  
2012, 12<sup>th</sup> place

## PUBLICATIONS

**Szentesi Csilla.** (2014). Biológia munkafüzet és tanári segédlet 7.8.10. évfolyam [Biology workbook and teacher's guide for grades 7, 8 and 10]. Miskolc: Miskolc Megyei Jogú Város Önkormányzat

# ADRIEN VARGÁNÉ LENGYEL



## Calvinist Grammar School of Kecskemét

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## TEACHING CAREER IN BRIEF

Being a student at the József Attila University of Szeged, I concluded my studies as a Biology and Chemistry teacher. My first employment was at the Katona Secondary School at Kecskemét, then I changed to the Calvinistic Secondary School where I'm working up to this day. Upon launching the six-grade education program, my task was to develop the Chemistry curriculum, later I became the head of the teacher's team. We are frequent participants of the TUDOK (Annual Conference of National Scientific Students' Associations) with remarkable success. The achieved results truly enhanced my personal development. Along with a colleague, I'm organizing the Biology field trips which are quite popular amongst our students. I'm also an evaluating teacher at the advanced level final examinations. Throughout the years my main focus has been to modernize Biology education; especially reaching out for students who show interest in this field - for this achievement I received an award. Other significant professional steps were publishing textbooks and books assisting the preparation for final examinations (MAXIM publishing). These activities demand great devotion, lots of reading, consulting and many working hours, yet offer the best way for self-improvement in the dynamically changing subject of Biology. In addition, I handled full readership of a laboratory project and held advanced education to my colleagues. I find these activities both challenging and exciting.

## SUCCESSFUL STUDENTS

### Andor Kenyerés

medical student at SZOTE  
 • OKTV Biology 2010. 35<sup>th</sup> place

### Emese Klément

medical student at Semmelweis University  
 • OKTV Biology 2012. 30<sup>th</sup> place

### Márk Svévis

doctor at the Honvéd Hospital Budapest  
 • ORKV Chemistry 2001. 1<sup>st</sup> place

## PUBLICATIONS

Juhász K., **Vargáné L.A.** Theme Outlines for Biology Final Examination, Maxim Publishing, Szeged, 2017.

Juhász K., **Vargáné L.A.** 130 themes of Biology, Maxim Publishing, Szeged, 2017.

Juhász K., **Vargáné L.A.** Colourful thesmes of Biology, Maxim Publishing, Szeged, 2017.



# UNIVERSITY PROGRAM

# RESEARCH CENTERS

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## UNIVERSITY OF SZEGED

The University of Szeged is one of the leading universities of Hungary, committed to maintaining quality higher education.

The University was established by the integration of Attila József University, Albert Szent-Györgyi Medical University, Szeged College of Food Industry, Gyula Juhász Teacher Training College and the College of Agriculture in Hódmezővásárhely. The University of Szeged offers a wide range of educational opportunities for the students: hundreds of basic, master, doctoral and higher educational professional training programs, just like adult training and postgraduate specialist training courses. With its nearly 25,000 students and 7,000 employees (out of which 2,400 are academic researchers and teachers), the University of Szeged is one of the largest institutions of the Southern Great Plain region. Teaching and research are performed by the 12 Faculties while medical health care is the task of the Albert Szent-Györgyi Health Center. The mission and aim of the University is to cultivate science and internationally competitive research work and to advance its research university nature.



## BIOLOGICAL RESEARCH CENTER

The Biological Research Center (BRC) is an outstanding institution of the internationally acknowledged Hungarian biological research. It was founded in 1973. The 4 institutes of BRC - the Institutes of Biophysics, Biochemistry, Genetics and Plant Biology - employ about 260 scientists whose work is hall-marked by highly appreciated international scientific publications and patents. The research topics include several fields of molecular and cell biology from the industrial utilization of bacteria through controlled improvement of cultivated plants to the problems of human health and environmental protection. BRC is mainly a scientific basic research center, but scientists of BRC play an initiative role in the foundation and promotion of biotechnological companies, as well as in educational duties. The successful activity and high-level scientific research pursued in BRC were also acknowledged by the European Molecular Biological Organization (EMBO) and in 2000 the European Union awarded the title of "Center of Excellence" to BRC.

([http://www.brc.hu/about\\_brc.php](http://www.brc.hu/about_brc.php))



# SZENT-GYÖRGYI MENTORS



"If I go out into nature, into the unknown, to the fringes of knowledge, everything seems mixed up and contradictory, illogical, and incoherent. This is what research does; it smooths out contradictions and makes things simple, logical, and coherent."

*Albert Szent-Györgyi*

**Szent-Györgyi Mentors** of the Szeged Scientists Academy are researchers, who engage in internationally highly reputable scientific activities, supervise their own research groups, and whose works are published in prestigious scientific journals.

**Szent-Györgyi Mentors** are committed to participate in the education of the **Szent-Györgyi Students**, offering them the opportunity to join their research groups that provide the required conditions for research. **Szent-Györgyi Mentors** also personally assist in training and developing the young talents, primarily focusing on the importance of nurturing talent.

**Szent-Györgyi Mentors** also undertake to involve other mentors from among his or her foreign partners in the activities of the Szeged Scientists Academy as **Szent-Györgyi International Mentors** so as to provide **Szent-Györgyi Students** with the ability to participate in the projects of foreign laboratories as well.

Currently, there are 42 **Szent-Györgyi Mentors** supporting the **Szent-Györgyi Students** of the Szeged Scientists Academy. They are renowned and recognised scientists of the University of Szeged and the Biological Research Center of the Hungarian Academy of Sciences, and they are all part of a widespread international network of scientists and researchers. They engage in internationally admired microbiological, genetic and biomedical research.

# ZOLTÁN RAKONCZAY

PROFESSIONAL LEADER OF  
THE UNIVERSITY PROGRAM



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### RESEARCH AREA

Acute pancreatitis is a sudden inflammation of the pancreas which can have mild or severe course. Unfortunately, the latter form still has an unacceptably high mortality. The reason for this is, at least in part, due to the facts that the pathomechanism of acute pancreatitis is unclear and we have no specific treatment of the disease. The main aims of our group are to investigate the roles of various inflammatory factors, mitochondria and the recently identified pancreatic ductal cells in the development of acute pancreatitis. Our hope is to eventually open up new therapeutic possibilities in acute pancreatitis.

### TECHNIQUES AVAILABLE IN THE LAB

Induction of acute pancreatitis in animals, isolation of pancreatic acinar and ductal cells, measurement of enzyme (amylase, trypsin, myeloperoxidase, lactate dehydrogenase) activities, confocal microscopy, histological analysis, ELISA, microspectrofluorimetry (intracellular H<sup>+</sup>, Ca<sup>2+</sup> concentration), microperfusion of pancreatic ducts, measurement of pancreatic ductal fluid secretion, Western blot analysis, RT-PCR.

### SELECTED PUBLICATIONS

Pallagi, P., Balla, Z., Singh, A.K., Dósa, S., Iványi, B., Kukor, Z., Tóth, A., Riederer, B., Liu, Y.J., Engelhardt, R., Jármay, K., Szabó, A., Janovszky, Á., Perides, G., Venglovecz, V., Maléth, J., Wittmann, T., Takács, T., Gray, M.A., Gácser, A., Hegyi, P., Seidler, U., **Rakonczay Jr., Z.** (2014) The role of pancreatic ductal secretion in protection against acute pancreatitis in mice. *Crit Care Med* **42**: e177-88.

Biczó, G., Hegyi, P., Dósa, S., Shalbulyeva, N., Berczi, S., Sinervirta, R., Hracsikó, Z., Siska, A., Kukor, Z., Jármay, K., Venglovecz, V., Varga, I.S., Iványi, B., Alhonen, L., Wittmann, T., Gukovskaya, A., Takács, T., **Rakonczay Jr., Z.** (2011) The crucial role of early mitochondrial injury in L-lysine-induced acute pancreatitis. *Antioxid Redox Signal* **15**: 2669-81.

**Rakonczay Jr., Z.**, Hegyi, P., Dósa, S., Iványi, B., Jármay, K., Biczó, G., Hracsikó, Z., Varga, I.S., Karg, E., Kaszaki, J., Varró, A., Lonovics, J., Boros, I., Gukovsky, I., Gukovskaya, A.S., Pandol, S.J., Takács, T. (2008) A new severe acute necrotizing pancreatitis model induced by L-ornithine in rats. *Crit Care Med* **36**: 2117-27.

**Rakonczay Jr., Z.**, Hegyi P., Takács T., McCarroll J., Saluja A.K. (2008) The role of NF-κB activation in the pathogenesis of acute pancreatitis. *Gut* **57**: 259-267.

**Rakonczay Jr., Z.**, Jármay, K., Kaszaki, J., Mándi, Y., Duda, E., Hegyi, P., Boros, I., Lonovics, J., Takács, T. (2003) NF-κB activation is detrimental in arginine-induced acute pancreatitis. *Free Radic Biol Med* **34**: 696-709.

# ISTVÁN ANDÓ



**Laboratory of Immunology,  
Institute of Genetics,  
Biological Research Center of the  
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## RESEARCH AREA

The development of blood cells and the immune response are regulated by a complex gene regulatory network that connects their transcriptional and epigenetic machinery to the microenvironment. This enables the cells to respond immediately to any stress, including the attacks of microorganisms and parasites. The characterization of these regulatory networks is essential for the understanding of immunity and the implementation of specific immunotherapy.

The research interests in my laboratory focus on the basic phenomena of immunity using the model organism *Drosophila melanogaster*, with a prototype of immunity. We pursue this project with the aim to understand blood cell development and the innate immune response.

## TECHNIQUES AVAILABLE IN THE LAB

Combination of methods in basic biology, immunology, cell biology, and molecular genetics.

## SELECTED PUBLICATIONS

Honti, V., Csordas, G., Kurucz, E., Markus, R., **Ando, I.** (2013) The cell-mediated immunity of *Drosophila melanogaster*: Hemocyte lineages, immune compartments, microanatomy and regulation. *Dev Comp Immunol* **42**: 47-56.

Honti, V., Csordas, G., Markus, R., Kurucz, E., Jankovics, F., **Ando, I.** (2010) Cell lineage tracing reveals the plasticity of the hemocyte lineages and of the hematopoietic compartments in *drosophila melanogaster*. *Mol Immunol* **47**: 1997-2004.

Markus, R., Laurinyecz, B., Kurucz, E., Honti, V., Bajusz, I., Sipos, B., Somogyi, K., Kronhamn, J., Hultmark, D., **Ando, I.** (2009) Sessile hemocytes as a hematopoietic compartment in *Drosophila melanogaster*. *Proc Natl Acad Sci USA* **106**: 4805-4809.

Kurucz, E., Markus, R., Zsamboki, J., Folkl Medzihradszky, K., Darula, Z., Vilmos, P., Udvardy, A., Krausz, I., Lukacsovich, T., Gateff, E., Zettervall, C.J., Hultmark, D., **Ando, I.** (2007) Nimrod, a Putative Phagocytosis Receptor With Egf Repeats in *Drosophila* Plasmatocytes. *Curr Biol* **17**: 649-654.

Kurucz, E., Zettervall, C.J., Sinka, R., Vilmos, P., Pivarcsi, A., Ekengren, S., Hegedus, Z., **Ando, I.**, Hultmark, D. (2003) Hemese, a hemocyte-specific transmembrane protein, affects the cellular immune response in *Drosophila*. *Proc Natl Acad Sci USA* **100**: 2622-2627.

# FERENC BARI



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University of Szeged**

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## RESEARCH AREA

Adequate and continuous blood supply of the brain requires a very precise regulatory mechanism. Investigating the properties of the cerebral microcirculation opens a unique way for understanding the details (components, dynamics) of blood flow regulation in both the healthy and the injured brain. We have been studying the major characteristics of the neurovascular coupling (enhanced neuronal activity is followed by changes in the local blood perfusion) for more than 20 years. We have obtained considerable knowledge on the nature of excitatory amino acid release and the concomitant changes in local microcirculation. We have intensively studied the vascular consequences of hypoxic-ischemic injuries and tested various, potentially neuroprotective strategies. We study cerebral microcirculation in various animal models. Our major approach is using optical methods (intravital microscopy, laser Doppler flowmetry, laser speckle contrast analysis [LASCA]). In addition, we perform *ex vivo* studies in order to characterize morphological alterations and changes in protein expression in the injured brain. Recently, we have been working on new neuroprotective approaches.

During the last years our research interest involves the question how medical informatics could help in stroke prevention and treatment of stroke victims.

## TECHNIQUES AVAILABLE IN THE LAB

Intravital microscopy, laser Doppler flowmetry, laser speckle contrast image analysis, brain electrophysiology, monitoring of vital functions of anesthetized animals, data evaluation and analysis.

## SELECTED PUBLICATIONS

Clark, D., Tuor, U.I., Thompson, R., Institoris, A., Kulynych, A., Zhang, X., Kinniburgh, D.W., **Bari, F.**, Busija, D.W., Barber, P.A. (2012) Protection against recurrent stroke with resveratrol: endothelial protection. **PLOS One** **7**: e47792.

Domoki, F., Zölei, D., Oláh, O., Tóth-Szűki, V., Hopp, B., **Bari, F.**, Smausz, T. (2012) Evaluation of Laser-speckle contrast image analysis techniques in the cortical microcirculation of piglets. **Microvasc Res** **83**: 311-7.

Hugyecz, M., Mracskó, E., Hertelendy, P., Farkas, E., Domoki, F., **Bari, F.** (2011) Hydrogen supplemented air inhalation reduces changes of prooxidant enzyme and gap junction protein levels after transient global cerebral ischemia in the rat hippocampus. **Brain Res** **1404**: 31-8.

Mracsko, E., Hugyecz, M., Institoris, A., Farkas, E., **Bari, F.** (2010) Changes in prooxidant and antioxidant enzyme levels during cerebral hypoperfusion in rats. **Brain Res** **1321**: 13-9.

Lenti, L., Domoki, F., Gáspár, T., Snipes, J.A., **Bari, F.**, Busija, D.W. (2009) N-methyl-D-aspartate induces cortical hyperemia through cortical spreading depression-dependent and independent mechanisms in rats. **Microcirculation** **16**: 629-39.

# ZSUZSANNA BATA-CSÖRGŐ



## Department of Dermatology and Allergology, University of Szeged

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## RESEARCH AREA

Psoriasis is the most common inflammatory skin disease among Caucasians. Our research focus is on the pathomechanism of this disease. The disease is polygenic with complex pathology therefore our work has different aspects: immunology, epidermal and dermal biology, regulation of cell proliferation and differentiation and extracellular matrix biology. We are engaged in classical theory driven research, but also use large scale studies. The research group is closely related to the clinic that makes it possible to use human tissues and cells for some of our work, which enhances the clinical relevance of our results. Some of our work is more basic research, we investigate normal and pathological functions of keratinocytes, fibroblasts and melanocytes.

## TECHNIQUES AVAILABLE IN THE LAB

Separation and culture of various cells, immunostaining techniques on tissues and on cells, flow cytometry methods, cell cycle analysis, Western blot, RT-PCR, proteomic techniques.

## SELECTED PUBLICATIONS

- Gál, B., Dulic, S., Kiss, M., Groma, G., Kovács, L., Kemény, L., **Bata-Csörgő, Z.** (2017) Increased circulating anti-α6-integrin autoantibodies in psoriasis and psoriatic arthritis but not in rheumatoid arthritis. *J Dermatol* 44: 370-374.
- Göblös, A., Danis, J., Vas, K., **Bata-Csörgő, Z.**, Kemény, L., Széll, M. (2016) Keratinocytes express functional CARD18, a negative regulator of inflammasome activation, and its altered expression in psoriasis may contribute to disease pathogenesis. *Mol Immunol* 73: 10-8.
- Gubán, B., Vas, K., Balog, Z., Manczinger, M., Bebes, A., Groma, G., Széll, M., Kemény, L., **Bata-Csörgő, Z.** (2016) Abnormal regulation of fibronectin production by fibroblasts in psoriasis. *Br J Dermatol* 174: 533-41.
- Belső, N., Széll, M., Pivarcsi, A., Kis, K., Kormos, B., Kenderessy, A.S., Dobozy, A., Kemény, L., **Bata-Csörgő, Z.** (2008) Differential expression of D-type cyclins in HaCaT keratinocytes and in psoriasis. *J Invest Dermatol* 128: 634-42.
- Bata-Csorgo, Z.**, Hammerberg, C., Voorhees, J.J., Cooper, K.D. (1995) Kinetics and regulation of human keratinocyte stem cell growth in short-term primary *ex vivo* culture. Cooperative growth factors from psoriatic lesional T lymphocytes stimulate proliferation among psoriatic uninvolved, but not normal, stem keratinocytes. *J Clin Invest* 95: 317-27.
- Bata-Csorgo, Z.**, Hammerberg, C., Voorhees, J.J., Cooper, K.D. (1993) Flow cytometric identification of proliferative subpopulations within normal human epidermis and the localization of the primary hyperproliferative population in psoriasis. *J Exp Med* 178: 1271-81.

# ANTAL BERÉNYI



## MTA-SZTE 'Lendület' Oscillatory Neuronal Networks Research Group

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## RESEARCH AREA

Recent technical development gave a new momentum to experiments studying the brain, although the extremely complex structure of the nervous system still supplies the researchers with an endless inventory of open questions.

In our research we investigate the possible therapeutic effects of Transcranial Electrical Stimulation (TES) on epileptic seizures. Particularly, we plan to develop a focused stimulation protocol both in time and space to interact only with the desired brain areas within an appropriate time-frame. To determine the appropriate focal points of stimulation, we investigate the internal dynamics of neural networks involved in seizure generation. We do this by performing a throughout analysis of networks on microscopic and mesoscopic scale with extremely high spatial and temporal resolution. The same approach is used to focus on the role of hippocampus and related circuitries in memory formation and spatial navigation. We pay special interest to the role of sensory information in this field.

Our long-term vision is to develop a closed-loop, implantable seizure suppressor device that continuously monitors the patterns of brain activity, and delivers electrical pulses in order to terminate any occurring seizures. We are hoping to translate our laboratory-stage experimental results into clinical trials within a few years.

## TECHNIQUES AVAILABLE IN THE LAB

Extra- and juxtacellular recording techniques, transcranial electrical stimulation, freely moving animal models to study the correlation of behavior and neuronal activity patterns, basic histology and immunohistochemistry, double transgenic animal models for optogenetical research, analog and digital electronics development, microcontroller programming, signal processing algorithms, advanced data mining techniques, Matlab and Labview programming languages, non-supervised pattern recognition algorithms.

## SELECTED PUBLICATIONS

Oliva, A., Fernández-Ruiz, A., Buzsáki, G., **Berényi, A.** (2016) Role of Hippocampal CA2 Region in Triggering Sharp-Wave Ripples. *Neuron* **91**: 1342-55.

Agarwal, G., Stevenson, I.H., **Berényi, A.**, Mizuseki, K., Buzsáki, G., Sommer FT. (2014) Spatially distributed local fields in the hippocampus encode rat position. *Science* **344**: 626-30.

**Berényi, A.**, Somogyvári, Z., Nagy, A.J., Roux, L., Long, J.D., Fujisawa, S., Stark, E., Leonardo, A., Harris, T.D., Buzsáki, G. (2014) Large-scale, high-density (up to 512 channels) recording of local circuits in behaving animals. *J Neurophysiol.* **111**: 1132-49.

**Berényi, A.**, Belluscio, M., Mao, D., Buzsaki, G. (2012) Closed-loop control of epilepsy by transcranial electrical stimulation. *Science* **337**: 735-737.

Madisen, L., Mao, T., Koch, H., Zhuo, J.M., **Berényi, A.**, Fujisawa, S., Hsu, Y.W., Garcia, A.J. 3rd., Gu, X., Zanella, S., Kidney, J., Gu, H., Mao, Y., Hooks, B.M., Boyden, E.S., Buzsáki, G., Ramirez, J.M., Jones, A.R., Svoboda, K., Han, X., Turner, E.E., Zeng, H.A. (2012) Toolbox of Cre-dependent optogenetic transgenic mice for light-induced activation and silencing. *Nat Neurosci* **15**: 793-802.

# IMRE MIKLÓS BOROS



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## RESEARCH AREA

Technical development during the last decade resulted in the arrival of a post-genomic area of modern biology. Thanks to the rapid advance in nucleic acid sequencing and related technologies the scientific focus related to structure and function of individual genes has shifted to studies concerning organization and interactions of complex gene networks and the whole genome. The laws of epigenetics, which govern inheritance not fixed in the DNA sequence, are being recognized nowadays. There are realistic hopes that the new data on functioning of the genome will improve our life directly by providing grounds for life style recommendations and personalized medical treatments, just to mention a few aspects.

We study gene regulation in different models with the aim of understanding the role of proteins involved in the packaging of DNA into chromosomes. The action of these proteins determines whether a particular gene can manifest its action or not. Consequently, by changing the activity of these chromatin modifier proteins, specific gene functions can be altered intentionally.

## TECHNIQUES AVAILABLE IN THE LAB

The techniques we use for studying gene regulation are among the most advanced ones available in the field. These include techniques of gene engineering, culturing of different cell types and measuring gene activity by various means. Ongoing development further supports our work by applying the most advanced next-generation sequencing in our studies.

## SELECTED PUBLICATIONS

Borsos, B.N., Huliák I., Majoros, H., Ujfaludi, Z., Gyenis, Á., Pukler, P., **Boros, I.M.**, Pankotai, T. (2017) Human p53 interacts with elongating RNAPII complex and is required for the release of actinomycin D induced transcription blockade. *Sci Rep* 7: 40960.

Vedelek, B., Blastyak, A., **Boros, I.M.** (2015) Cross-Species Interaction between Rapidly Evolving Telomere-Specific Drosophila Proteins. *PLOS One* 10: e0142771.

Borsos, B.N., Pankotai, T., Kovacs, D., Popescu, C., Pahi, Z., **Boros, IM.** (2015) Acetylations of Ftz-F1 and histone H4K5 are required for the fine-tuning of ecdysone biosynthesis during Drosophila metamorphosis. *Dev Biol* 404: 80-87.

Villanyi, Z., Ribaud, V., Kassem, S., Panasenko, O.O., Pahi, Z., Gupta, I., Steinmetz, L., **Boros, I.**, Collart, M.A. (2014) The not5 subunit of the ccr4-not complex connects transcription and translation. *PLOS Genet* 10: e1004569.

Sike, A., Nagy, E., Vedelek, B., Pusztai, D., Szerémy, P., Venetianer, A., **Boros, I.M.** (2014) mRNA Levels of Related Abcb Genes Change Opposite to Each Other upon Histone Deacetylase Inhibition in Drug-Resistant Rat Hepatoma Cells. *PLOS One* 9: e84915.

Gyenis, A., Umlauf, D., Ujfaludi, Z., **Boros, I.M.**, Tora, L. (2014) UVB Induces a Genome-Wide Acting Negative Regulatory Mechanism That Operates at the Level of Transcription Initiation in Human Cells. *PLOS Genet* 10: e1004483.

**Boros, I.M.** (2012) Histone modification in Drosophila. *Brief Funct Genomics* 11: 319-331.

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## RESEARCH AREA

Surgical research can bring together many clinical disciplines and interests, ranging from cardiovascular biology to gastroenterology. The ischemia-reperfusion (I/R)-induced cellular hypoxia - reoxygenation, and subcellular oxido-reductive stress are major determinants of mortality and morbidity in many areas of clinical practice, such as sepsis or shock situations, and investigations targeting the I/R-caused microcirculatory dysfunction are essential for development of treatment strategies for several clinical pathologies. From a general perspective, it is worth pointing out that any intervention protecting microcirculation is likely to result in protection of tissue function and structure. In this scheme we have characterized the anti-inflammatory potential of membrane-forming phospholipids in I/R-induced antigen-independent inflammation, and the observation that methane formation from phosphatidylcholine metabolites occurs in ischemic systems opened up new avenues for future research. Currently we examine the possible biological roles of endogenous methane formation and whether methane - or potentially methane-releasing agents influence I/R-induced microcirculatory dysfunctions and modulate the outcome of inflammation.

## TECHNIQUES AVAILABLE IN THE LAB

Fundamental surgical techniques with complete hemodynamic monitoring and distinct imaging possibilities, such as intravital fluorescence microscopy and orthogonal polarization spectral imaging for *in vivo* microcirculatory analysis. Confocal laser scanning endomicroscopy for *in vivo* gastrointestinal histology. Detection of whole body methane emission by photoacoustic spectroscopy. High-resolution respirometry for mitochondrial studies.

## SELECTED PUBLICATIONS

Strifler, G., Tuboly, E., Szél, E., Kaszonyi, E., Cao, C., Kaszaki, J., Mészáros, A., **Boros, M.**, Hartmann, P. (2016) Inhaled Methane limits the mitochondrial electron transport chain dysfunction during experimental liver ischemia-reperfusion injury. *Plos One* **11**: Paper e0146363. 15 p.

**Boros, M.**, Tuboly, E., Meszaros, A., Amann, A. (2015) The role of methane in mammalian physiology-is it a gaso-transmitter? *J Breath Res* **9**: 014001.

Tuboly, E., Szabó, A., Garab, D., Bartha, G., Janovszky, Á., Erős, G., Szabó, A., Mohácsi, Á., Szabó, G., Kaszaki, J., Ghyczy, M., **Boros, M.** (2013) Methane biogenesis during sodium azide-induced chemical hypoxia in rats. *Am J Physiol Cell Physiol* **304**: C207-214.

**Boros, M.**, Ghyczy, M., Érces, D., Varga, G., Tókés, T., Kupai, K., Torday, C., Kaszaki, J. (2012) The anti-inflammatory effects of methane. *Crit Care Med* **40**: 1269-1278.

Ghyczy, M., Torday, C., **Boros, M.** (2003) Simultaneous generation of methane, carbon dioxide, and carbon monoxide from choline and ascorbic acid: a defensive mechanism against reductive stress? *FASEB J* **17**: 1124-1126.

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## RESEARCH AREA

Cardiovascular diseases and especially acute myocardial infarction are among the leading causes of death worldwide. Although prevention and the therapy of myocardial infarction have been significantly improved in the last decades, mortality is still unacceptably high. Therefore, development of new therapies aiming to attenuate infarct size is very relevant. Thus, our research group investigates the molecular mechanisms of infarction as well as the adaptive responses of the myocardium to ischemic stress (pre- and postconditioning) to develop novel potential therapies for the treatment of myocardial infarction. Since the risk of myocardial infarction is increased by the presence of several co-morbidities and risk factors including high cholesterol level, diabetes, obesity, hypertension, smoking, lack of exercise, kidney failure, etc., we also look at the effects of certain risk factors on the myocardium as well as on adaptive mechanisms of the heart.

## TECHNIQUES AVAILABLE IN THE LAB

Induction and treatment of disease models (e.g. diabetes, hypercholesterolemia) in experimental animals, echocardiographic assessment of cardiac morphology and function, surgical interventions to induce disease models (myocardial infarction, heart failure, kidney failure, etc.), isolated heart perfusion, determination of infarct size, induction and maintenance of cell culture, viability assays, transfection, general biochemical methods to determine metabolites, proteins and nucleic acids (spectroscopy, western blot, ELISA, flow cytometry, histochemistry, PCR, etc.).

## SELECTED PUBLICATIONS

Sárközy, M., Szűcs, G., Fekete, V., Pipicz, M., Éder, K., Gáspár, R., Sója, A., Pipis, J., Ferdinandy, P., Csonka, C., **Csont, T.** (2016) Transcriptomic alterations in the heart of non-obese type 2 diabetic Goto-Kakizaki rats. *Cardiovasc Diabetol* **15**: 110.

Pipicz, M., Varga, Z.V., Kupai, K., Gáspár, R., Kocsis, G.F., Csonka, C., **Csont, T.** (2015) Rapid ventricular pacing-induced postconditioning attenuates reperfusion injury: effects on peroxynitrite, RISK and SAFE pathways. *Br J Pharmacol* **172**: 3472-83.

Varga, Z.V., Kupai, K., Szűcs, G., Gáspár, R., Pálóczi, J., Faragó, N., Zvara, A., Puskás, L.G., Rázga, Z., Tiszlavicz, L., Bencsik, P., Görbe, A., Csonka, C., Ferdinandy, P., **Csont, T.** (2013) MicroRNA-25-dependent up-regulation of NADPH oxidase 4 (NOX4) mediates hypercholesterolemia-induced oxidative/nitrative stress and subsequent dysfunction in the heart. *J Mol Cell Cardiol* **62**: 111-21.

Kocsis, G.F., Sárközy, M., Bencsik, P., Pipicz, M., Varga, Z.V., Pálóczi, J., Csonka, C., Ferdinandy, P., **Csont, T.** (2012) Pre-conditioning protects the heart in a prolonged uremic condition. *Am J Physiol Heart Circ Physiol* **303**: H1229-36.

**Csont, T.**, Görbe, A., Bereczki, E., Szunyog, A., Aypar, E., Tóth, M.E., Varga, Z.V., Csonka, C., Fülöp, F., Sántha, M., Ferdinandy, P. (2010) Biglycan protects cardiomyocytes against hypoxia/reoxygenation injury: role of nitric oxide. *J Mol Cell Cardiol* **48**: 649-52.

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## RESEARCH AREA

Organisms are protected by biological barriers from harmful effects. These barriers also impede drug penetration. Our lab investigates methods to increase drug delivery on culture models of the blood-brain, nasal, lung and intestinal barriers. The pathways examined are (I.) reversible opening of tight intercellular junctions by peptides or small molecules; (II.) targeting solute carriers at barriers for drug delivery by nanoparticles. Cellular toxicity of active ingredients and pharmaceutical excipients are measured by a real-time impedance-based method. Double and triple co-culture models are used for experiments, and a microfluidic integrated chip has been developed in a collaborative project. Our other major research interest is the examination of blood-brain barrier injury and dysfunctions in different diseases, like Alzheimer's disease, brain tumors, diabetes or acute pancreatitis. The goal of these experiments is to reveal the effect of disease pathogenic factors on blood-brain barrier functions and to identify protective molecules. The protection of brain endothelial cells and the improvement of BBB functions in pathological conditions, the exploration of new approaches for drug transport/targeting to brain may have therapeutic potential in the treatment of central nervous system diseases.

## TECHNIQUES AVAILABLE IN THE LAB

Mammalian cell culture; primary cultures from brain and brain microvessels; models of biological barriers by double and triple co-cultures; cell culture models in microfluidic chips; electric resistance measurements of cell layers; permeability of drugs across culture models; immunohistochemistry; phase contrast, fluorescent and confocal microscopy; ELISA; measurement of nitric oxide and reactive oxygen species production in cells; colorimetric and impedance-based toxicity tests.

## SELECTED PUBLICATIONS

Walter, F.R., Valkai, S., Kincses, A., Petneházi, A., Czeller, T., Veszelka, S., Ormos, P., **Deli, M.A.**, Dér, A. (2016) Versatile lab-on-a-chip tool for modeling biological barriers. **Sens Actuators B Chem** **222**: 1209-1219.

Bocsik, A., Walter, F.R., Gyebrovszki, A., Fülöp, L., Blasig, I., Dabrowski, S., Ötvös, F., Tóth, A., Rákely, G., Veszelka, S., Vastag, M., Szabó-Révész, P., **Deli, M.A.** (2016) Reversible opening of intercellular junctions of intestinal epithelial and brain endothelial cells with tight junction modulator peptides. **J Pharm Sci** **105**: 754-765.

Veszelka, S., Tóth, A.E., Walter, F.R., Datki, Z., Mózes, E., Fülöp, L., Bozsó, Z., Hellinger, E., Vastag, M., Orsolits, B., Környei, Z., Penke, B., **Deli, M.A.** (2013) Docosahexaenoic acid reduces amyloid- $\beta$  induced toxicity in cells of the neurovascular unit. **J Alzheimers Dis** **36**: 487-501.

Hüller, P., Veszelka, S., Walter, F.R., Wolburg, H., Fallier-Becker, P., Piontek, J., Blasig, I.E., Lakomek, M., Kugler, W., **Deli, M.A.** (2013) Acute effects of short-chain alkylglycerols on blood-brain barrier properties of cultured brain endothelial cells. **Br J Pharmacol** **169**: 1561-1573.

Nakagawa, S., **Deli, M.A.**, Kawaguchi, H., Shimizudani, T., Shimono, T., Kittel, A., Tanaka, K., Niwa, M. (2009). A new blood-brain barrier model using brain endothelial cells, pericytes and astrocytes. **Neurochem Int** **54**: 253-263.

# ANDRÁS DÉR



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## RESEARCH AREA

Bioelectronics has a double meaning in scientific literature. On the one hand, as a branch of basic biophysical sciences, it deals with electric phenomena appearing on any organization level of living systems. On the other hand, as a recently developed discipline of information technological science, it explores the potential of biological materials for application in molecular electronics. These two areas of research are in close interaction not only with each other, but also with other disciplines of basic applied sciences.

Our main goal is to develop novel methods on integrated micro- and nanotechnological platforms for the investigation of light-induced processes in biological membranes, and utilize them in both branches of bioelectronic science. The most important scientific problems to be solved are, on the one hand, concerned with the investigation of electric properties of single cells and cellular interfaces, while on the other hand with the application of photochromic proteins in optoelectronics and photonics. Besides its impact on basic biophysical science, our research is expected to have utilizations in various branches of applied bioelectronics.

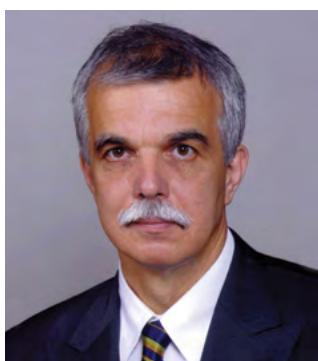
## TECHNIQUES AVAILABLE IN THE LAB

Photoelectric measuring techniques, absorption kinetics, polarisation methods, electro-optics, photolithography, laser-assisted microstructure building, surface coating techniques, TIRF-microscopy, MATLAB programing, LabVIEW programing.

## SELECTED PUBLICATIONS

- Dér, A., Kelemen, L., Fábián, L., Taneva, S.G., Fodor, E., Páli, T., Cupane, A., Cacace, M.G., Ramsden, J.J. (2007) Interfacial Water Structure Controls Protein Conformation. *J Phys Chem B* **111**: 5344-5350.
- Ormos, P., Fábián L., Oroszi L., Ramsden, J.J., Wolff, E.K., Dér, A. (2002) Protein-based integrated optical switching and modulation. *Appl Phys Lett* **80**: 4060-4062.
- Dér, A., Keszthelyi, L. (eds.) (2001) Bioelectronic Applications of Photochromic Pigments, IOS Press **NATO Science Series**, Vol. 335.
- Dér, A., Keszthelyi, L. (2001) Charge motion during the photocycle of bacteriorhodopsin. (Review) *Biochemistry (M)* **66**: 1234-1248.
- Dér, A., Oroszi, L., Kulcsár, Á., Zimányi, L., Tóth-Boconádi, R., Keszthelyi, L., Stoeckenius, W., Ormos, P. (1999) Interpretation of spatial charge displacements in bacteriorhodopsin in terms of structural changes during the photocycle. *Proc Natl Acad Sci USA* **96**: 2776-2781.

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## RESEARCH AREA

The Biochemitsry Department follows the traditions of the school of Albert Szent-Györgyi in muscle research. Former achievements in the area, as the discovery of actin, the characterization of actin-miosin-ATP involvement in muscle contraction, crystallization of the calcium pump enzyme in muscle paved the way until now. Recent research interest is focused on the development, differentiation and regeneration of muscle tissues at the molecular level. Neural and humoral factors, as well as extracellular matrix components involved in these processes are under study.

Another main field our of research and development activities is the standardization, quality assurance of diagnostic methods in clinical biochemistry and molecular biology. The development and application of reference materials for the area.

## TECHNIQUES AVAILABLE IN THE LAB

Qualitative and quantitave protein and nucleic acid analytical methods, cell and tissue culture, histochemistry and immunohistochemistry, morphometry, flow cytometry, characterization of molecular regulatory systems.

## SELECTED PUBLICATIONS

Kocsis, T., Trencsényi, Gy., Szabó, K., Baán, J.A., Müller, G., Mendler, L., Garai, I., Reinauer, H., Deák, F., **Dux, L.**, Keller-Pintér, A. (2017) Myostatin propeptide mutation of the hypermuscular Compact mice decreases the formation of myostatin and improves insulin sensitivity. **Am J Physiol Endocrinol Metab** **8**: 744-785.

Kocsis, T., Trencsényi, Gy., Szabó, K., Baán, J. A., Müller, G., Mendler, L., Garai, I., Reinauer, H., Deák, F., **Dux, L.**, Keller-Pintér, A. (2017) Myostatin propeptide mutation of the hypermuscular Compact mice decreases the formation of myostatin and improves insulin sensitivity. **Am J Physiol Endocrinol Metab** **312**: E150-E160.

Csonka, Cs., Sárközy, M., Pipicz, M., **Dux, L.**, Csont, T. (2016) Modulation of hypercholesterolemia-induced oxidative/nitrative stress in the Heart. **Oxid Med Cell Longev** **2016**: Paper 3863726. 23 p.

Baán, J.A., Varga, Z.V., Leszek, P., Kusmierczyk, M., Baranyai, T., **Dux, L.**, Ferdinandy, P., Braun, T., Mendler, L. (2015) Myostatin and IGF-I signaling in end-stage human heart failure: a qRT-PCR study. **J Transl Med** **13**: Paper 1. 9 p.

Deak F., Mates, L., Korpos, E., Zvara, A., Szenasi, T., Kiricsi, M., Mendler, L., Keller-Pinter, A., Ozsvári, B., Juhasz, H., Sorokin, L., **Dux, L.**, Mermod, N., Puskas, LG., Kiss, I. (2014) Extracellular deposition of matrilin-2 controls the timing of the myogenic program during muscle regeneration. **J Cell Sci** **127**: 3240-3256.

Kocsis, T., Baán, J.A., Müller, G., Mendler, L., **Dux, L.**, Keller-Pintér, A. (2014) Skeletal muscle cellularity and glycogen distribution in the hypermuscular Compact mice. **Eur J Histochem** **58**: 169-175.

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## RESEARCH AREA

Constant, undisturbed blood supply is critical for the optimal function of the brain, the organ that regulates our body. The brain accounts for only 2% of the entire body weight, yet it receives 15% of the cardiac output and consumes 20% of available oxygen. Accordingly, any disruption or limitation of cerebral blood supply has major consequences on the integrity of the nervous tissue. Our research activities focus on various aspects of the pathophysiology of cerebrovascular diseases in experimental models.

Ischemic injury to the brain favors the occurrence of spreading depolarization. Spreading depolarization is a self-propagating, transient disruption of cellular ionic homeostasis in the cerebral gray matter, which is potentially harmful to the nervous tissue. We have developed a sophisticated, live, multi-modal imaging technology, which enables us to study the evolution of spreading depolarization under experimental conditions. Our current goal is to determine how the typical features of ischemia-induced spreading depolarization are altered in old age. This is a highly relevant question, taken that cerebrovascular diseases predominantly occur in the aging population.

## TECHNIQUES AVAILABLE IN THE LAB

Application of the Biopac<sup>©</sup> system for data acquisition and analysis, basic experimental surgical techniques, electrophysiology (DC potential and EEG recording, measurement of pH and extracellular potassium concentration in the nervous tissue), experimental microsurgery, image analysis, *in vitro* brain slice preparation, intrinsic optical signal analysis, laser Doppler flowmetry, laser-speckle contrast imaging of local cerebral blood flow, pharmacology, statistical methods, voltage-sensitive and pH-sensitive dye imaging of cellular trans-membrane potential.

## SELECTED PUBLICATIONS

Hertelendy, P., Menyhárt, Á., Makra, P., Süle, Z., Kiss, T., Tóth, G., Ivánkovits-Kiss, O., Bari, F., **Farkas, E.** (2017) Advancing age and ischemia elevate the electric threshold to elicit spreading depolarization in the cerebral cortex of young adult rats. **J Cereb Blood Flow Metab** **37**: 1763-1775

Varga, D.P., Puskás, T., Menyhárt, Á., Hertelendy, P., Zölei-Szénási, D., Tóth, R., Ivánkovits-Kiss, O., Bari, F., **Farkas, E.** (2016) Contribution of prostanoid signaling to the evolution of spreading depolarization and the associated cerebral blood flow response. **Sci Rep** **6**: 31402.

Menyhárt, Á., Makra, P., Szepes, B.É., M. Tóth, O., Hertelendy, P., Bari, F., **Farkas, E.** (2015) High incidence of adverse cerebral blood flow responses to spreading depolarization in the aged ischemic rat brain. **Neurobiol Aging** **36**: 3269-3277.

Bere, Z., Obrenovitch, T.P., Kozák, G., Bari, F., **Farkas, E.** (2014) Imaging reveals the focal area of spreading depolarizations and a variety of hemodynamic responses in a rat microembolic stroke model. **J Cereb Blood Flow Metab** **34**: 1695-705.

**Farkas, E.**, Pratt, R., Sengpiel, F., Obrenovitch, T.P. (2008) Direct, live imaging of cortical spreading depression and anoxic depolarisation using a fluorescent, voltage-sensitive dye. **J Cereb Blood Flow Metab** **28**: 251-262.

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## RESEARCH AREA

Infectious diseases are one the leading causes of mortality worldwide, killing millions of people every year. While bacteria and viruses cause the majority of deadly infections, notably the number of fungal diseases is increasing at an alarming rate. In fact, it is estimated that nearly as many people die annually from invasive fungal infections as from the greatly feared tuberculosis (1.4 million) or malaria (1.2 million). Our research program focuses on the most common human fungal pathogens, the opportunistic *Candida* species with special focus on *C. parapsilosis*. We investigate the basic mechanisms of fungal pathogenesis and host immunity, and we aim to improve diagnosis and identify novel biomarkers of infection. Recently, we also investigate the role of the human “mycobiome” in health and disease development and progression.

## TECHNIQUES AVAILABLE IN THE LAB

*In vitro* infection models using phagocytes (murine and human cell lines, primary immune cells). Measurement of fungal cell phagocytosis with Flow Cytometry or microscopy, cytokines-chemokines with ELISA, host damage with LDH-assay. Quantitative imaging using FlowSight. *In vivo* infection models using wild type and transgenic mice. Colony forming unit measurements from different organs, histological analysis, immune cell preparation from infected animals. Basic and advanced molecular techniques, qRT-PCR, Western blot, Southern blot, CRISPR/Cas9 technology, GATEWAY-cloning system.

## SELECTED PUBLICATIONS

Tóth, A., Zajta, E., Csonka, K., Vágvölgyi, C., Netea, M.G., **Gácsér, A.** (2017) Specific pathways mediating inflammasome activation by *Candida parapsilosis*. **Sci Rep** 7: 43129.

Pryszcz, L.P., Nemeth, T., Saus, E., Ksieziopolska, E., Hegedusova, E., Nosek, J., Wolfe, K.H., **Gácsér, A.**, ¶ Gabaldon, T. ¶ (2015) The Genomic Aftermath of Hybridization in the Opportunistic Pathogen *Candida metapsilosis*. **PLOS Genetics** 11: e1005626. 29 p. ¶ joint senior authors

Tóth, R., Alonso, M.F., Bain, J.M., Vágvölgyi, C., Erwig, L-P., **Gácsér, A.** (2015) Different *Candida parapsilosis* clinical isolates and lipase deficient strain trigger an altered cellular immune response. **Front Microbiol** 6: 1102. 11 p.

Toth, A., Csonka, K., Jacobs, C., Vagvolgyi, C., Nosanchuk, J.D., Netea, M.G., **Gácsér, A.** (2013) *Candida albicans* and *Candida parapsilosis* Induce Different T-Cell Responses in Human Peripheral Blood Mononuclear Cells. **J Infect Dis** 208: 690-698.

Lázár-Molnár, E., ¶ **Gácsér, A.**, ¶ Freeman, G.J., Almo, S.C., Nathenson, S.G., Nosanchuk, J.D. (2008) The PD-1/PD-L costimulatory pathway critically affects host resistance to the pathogenic fungus *Histoplasma capsulatum*. **Proc Natl Acad Sci USA** 105: 2658-2663. ¶ joint first authors

# LAJOS HARACSKA



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## RESEARCH AREA

Stalling of the DNA replication machinery, which occurs as a consequence of encountering unrepaired DNA damage, is a challenge for cells. To rescue the stalled replication fork, different DNA damage bypass mechanisms have evolved that promote replication through DNA lesions. In humans, increased error-prone bypass of DNA lesions causes increased mutagenesis and, as a consequence, a rise in the incidence of cancers. Error-free bypass processes, by contrast, keep mutagenesis low and reduce the frequency of cancers. Our research laboratory is interested in the driving forces and molecular mechanisms of mutagenesis and carcinogenesis. In particular, we investigate the following questions: What are the common roots of evolution and carcinogenesis? What are the molecular mechanisms of chromosomal rearrangements and the formation of point mutations? Why do we observe increased genome instability during carcinogenesis? What is the role of the recently described DNA repair genes in cancer suppression? Why do mutations in certain genes predispose to cancer? Which genes are commonly mutated in cancer, and how do these mutations contribute to tumour development and drug resistance? We investigate these challenging problems using human tissue culture-based reporter systems, next-generation DNA sequencing and purified proteins in reconstituted reaction pathways. Our research provides more insight into the molecular events of genome instability, carcinogenesis and has the potential to identify new tumour markers and drug targets as well as to improve personal cancer treatment.

## TECHNIQUES AVAILABLE IN THE LAB

Next-generation DNA sequencing, PCR, qPCR, protein microarray, human tissue culture-based reporter assays such as cell survival, mutagenesis, homologous recombination and various tests, confocal microscopy-based techniques such as protein localization, DNA replication and chromosomal rearrangements, protein overexpression and purification, immunological assays, biochemical enzyme assays, and yeast genetic methods.

## SELECTED PUBLICATIONS

- Mórocz, M., Zsigmond, E., Tóth, R., Enyedi, M.Z., Pintér, L., **Haracska, L.** (2017) DNA-dependent protease activity of human Spartan facilitates replication of DNA-protein cross-link-containing DNA. *Nucleic Acids Res* **45**: 3172-3188.
- Chen, J., Ai, Y., Wang, J., **Haracska, L.**, Zhuang, Z. (2010) Chemically ubiquitylated PCNA as a probe for eukaryotic translesion DNA synthesis. *Nature Chem Biol* **6**: 270-2.
- Blastyák, A., Pintér, L., Unk, I., Prakash, L., Prakash, S., **Haracska, L.** (2007). Yeast Rad5 protein required for postreplication repair has a DNA helicase activity specific for replication fork regression. *Molecular Cell* **28**: 167-75.
- Johnson, R.E., Washington, M.T., **Haracska, L.**, Prakash, S., Prakash, L. (2000) Eukaryotic polymerases  $\delta$  and  $\zeta$  act sequentially to bypass DNA lesions. *Nature* **406**: 1015-1019.
- Haracska, L.**, Yu, S.L., Johnson, R.E., Prakash, L., Prakash, S. (2000) Efficient and accurate replication in the presence of 7,8-dihydro-8-oxoguanine by DNA polymerase  $\eta$ . *Nat Gen* **25**: 458-461.

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### RESEARCH AREA

Epithelial cells form a sheet-like contiguous layer that covers both the external and internal free surfaces of the body, e.g. the surface of skin or inner surface of hollow organs such as in the gastrointestinal tract (GIT). The epithelial cells in the GIT secrete over 10 liters of digestive fluid daily into the lumen - and after digestion - absorb the fluid and nutrients from the lumen. Derangement of this secretory process can lead to severe disorders such as cystic fibrosis or secretory diarrhoea. One of our main research interests is to understand the physiology and pathophysiology of secretory mechanisms.

Most recently we have shown that epithelial fluid and ion secretion plays a crucial role in acute pancreatitis which is one of the most severe inflammatory diseases of the GI tract. Therefore, repairing the damaged secretion may lead to a new specific therapeutic way in acute pancreatitis. Besides our interest in the pancreas we work on understanding the oesophageal, gastric and colonic fluid and ion transport mechanisms.

### TECHNIQUES AVAILABLE IN THE LAB

Isolation of epithelial cells from human and animal, culturing of cells, measurement of fluid secretion using video-technique, measurement of intracellular ion ( $H^+$ ,  $Ca^{2+}$ ) concentrations using fluorescence imaging microscopy, western blotting, working with DNA and RNA, measurement of mitochondrial damage using confocal microscopy, *in vivo* experimental animal models.

### SELECTED PUBLICATIONS

Maléth, J., Balázs, A., Pallagi, P., Balla, Z., Kui, B., Katona, M., Judák, L., Németh, I., Kemény, L.V., Rakonczay Jr., Z., Venglovecz, V., Földesi, I., Pető, Z., Somorácz, Á., Borka, K., Perdomo, D., Lukacs, G.L., Gray, M.A., Monterisi, S., Zaccolo, M., Sendler, M., Mayerle, J., Kühn, J.P., Lerch, M.M., Sahin-Tóth, M., **Hegyi, P.** (2015) Alcohol disrupts levels and function of the cystic fibrosis transmembrane conductance regulator to promote development of pancreatitis. *Gastroenterology* **148**: 427-39.

Pallagi, P., Venglovecz, V., Rakonczay, Z., Borka, K., Korompay, A., Ozsvári, B., Judák, L., Sahin-Tóth, M., Geisz, A., Schnúr, A., Maléth, J., Takács, T., Gray, M.A., Argent, B.E., Mayerle, J., Lerch, M.M., Wittmann, T., **Hegyi, P.** (2011) Trypsin reduces pancreatic ductal bicarbonate secretion by inhibiting CFTR  $Cl^-$  channels and luminal anion exchangers. *Gastroenterology* **141**: 2228-2239.

**Hegyi, P.**, Pandol, S., Venglovecz, V., Rakonczay, Z. (2011) The acinar-ductal tango in the pathogenesis of acute pancreatitis. *Gut* **60**: 544-52.

Maléth, J., Venglovecz, V., Rázga, Z., Tiszlavicz, L., Rakonczay, Z., **Hegyi, P.** (2011) Non-conjugated chenodeoxycholate induces severe mitochondrial damage and inhibits bicarbonate transport in pancreatic duct cells. *Gut* **60**: 136-8.

Venglovecz, V., Rakonczay, Z., Ozsvári, B., Takács, T., Lonovics, J., Varró, A., Gray, M.A., Argent, B.E., **Hegyi, P.** (2008) Effects of bile acids on pancreatic ductal bicarbonate secretion in guinea pig. *Gut* **57**: 1102-12.

# JUDIT HOHMANN



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### RESEARCH AREA

Natural products play an important role in drug discovery because of their unmatched structural diversity, amazing, and often complex structures. The aim of our group is to perform purposeful research by rational selection of plant extracts and compounds to be isolated, in order to obtain efficiently new secondary plant metabolites, which are perspective for drug discovery. Literature data, ethnomedicinal knowledge, results of screen investigations and metabolomic approaches are considered for selection of plant species. Compounds are isolated from the very complex multi-component extracts exhibiting efficacy in the used tests, with the aid of different chromatographic methods by guidance of bioassay. The structures of the purified compounds are determined by means of spectroscopic methods (NMR and MS). The biological activity is usually investigated in collaborations.

### TECHNIQUES AVAILABLE IN THE LAB

Solid-solid and solid-liquid extraction techniques, evaporators; chromatographic techniques (OCC, GC, VLC, CPC, Flash, SE, SFC, MPLC, HPLC) coupled with UV-Vis, PDA, light scattering and MS detectors; ESIMS, HRMS, 1D and 2D NMR for structure elucidation; microplate reader, bioassays for antimicrobial, antitumor, ion channel activity in collaboration.

### SELECTED PUBLICATIONS

- Ványolós, A., Dékány, M., Kovács, B.t, Krámos, B., Bérdi, P., Zupkó, I., **Hohmann, J.**, Béni Z. (2016) Gymnopeptides A and B, cyclic octadecapeptides from the mushroom *Gymnopus fusipes*. *Org Lett* **18**: 2688-2691.
- Vasas, A., Forgo, P., Orvos, P., Tálosi, L., Csorba, A., Pinke, G., **Hohmann, J.** (2016) Myrsinane, premyrsinane, and cyclomyrsinane diterpenes from *Euphorbia falcata* as potassium ion channel inhibitors with selective G protein-activated inwardly rectifying ion channel (GIRK) blocking effects. *J Nat Prod* **79**: 1990-2004.
- Hajdu, Z., Nicolussi, S., Rau, M., Lorantfy, L., Forgo, P., **Hohmann, J.**, Csupor, D., Gertsch, J. (2014) Identification of endocannabinoid system-modulating N-alkylamides from *Helianthus annuus* var. scabra and *Lepidium meyenii*. *J Nat Prod* **77**: 1663-1669.
- Vasas, A., Rédei, D., Csupor, D., Molnar, J., **Hohmann, J.** (2012) Diterpenes from European *Euphorbia* species serving as prototypes for natural-product-based drug discovery. *Eur J Org Chem* **2012**: 5115-5130.
- Hohmann, J.**, Molnár, J., Rédei, D., Evanics, F., Forgo, P., Kálmán, A., Argay, G., Szabó, P. (2002) Discovery and biological evaluation of a new family of potent modulators of multidrug resistance: reversal of multidrug resistance of mouse lymphoma cells by new natural jatrophane diterpenoids isolated from *Euphorbia* species. *J Med Chem* **45**: 2425-2431.

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## RESEARCH AREA

Recent advances in light microscopy have changed the way biological research is conducted. The ability to acquire massive amounts of image data has given rise to new fields such as high content screening (HCS) or 3D imaging, which promise to open new doors both for basic research and drug discovery. However, with such massive amounts of data comes a need for automatic analysis tools. Our research concentrates on how human knowledge can be best integrated into intelligent computer algorithms for automated microscopy. To reach this goal, we have interest in image processing that is concerned with extracting biologically relevant quantitative information in 3-4-5D imaging and multi-parametric machine learning analysis that is necessary to make sense of this information. Recently, machine learning algorithms have become a popular solution for analyzing large single cell-based imaging scenarios. We concentrate on improving the state-of-the-art by detecting unusual patterns corresponding to unknown phenotypes.

## TECHNIQUES AVAILABLE IN THE LAB

Various microscopy and computational techniques are available in the BIOMAG laboratory. These include high-content screening, confocal, laser microdissection, light-sheet, point scanning confocal microscopy; and various image analysis and machine learning approaches and software and hardware infrastructure.

## SELECTED PUBLICATIONS

- Pfisterer, S., Gateva, G., **Horvath, P.**, Pirhonen, J., Salo, V., Karhinan, L., Varjosalo, M., Ryhänen, S., Lappalainen, P., Ikonen, E. (2017) Role for formin-like 1-dependent acto-myosin assembly in lipid droplet dynamics and lipid storage. *Nat Commun* **8**:14858.
- Horvath, P.**, Aulner, N., Bickle, M., Davies, A., Del Nery, E., Ebner, D., Montoya, M., Ostling, P., Pietiainen, V., Price, L., Shorte, S., Turcatti, G., von Schantz, C., Carragher, N. (2016) Screening out irrelevant cell-based models of disease. *Nat Rev Drug Discov* **15**: 751–769.
- Molnar, Cs., Jermyn, I., Kato, Z., Rahkama, V., Ostling, P., Mikkonen, P., Pietiainen, V., **Horvath, P.** (2016) Accurate morphology preserving segmentation of overlapping cells based on active contours. *Sci Rep* **6**: 32412.
- Piccinini, F., Kiss, A., **Horvath, P.** (2015) CellTracker (not only) for dummies. *Bioinformatics* **32**: 955–957.
- Smith, K., Li, Y., Piccinini, F., Csucs, G., Balazs, C., Bevilacqua, A., **Horvath, P.** (2015) CIDRE: an illumination-correction method for optical microscopy. *Nat Methods* **12**: 404–406.
- Banerjee, I., Miyake, Y., Nobs, S. P., Schneider, C., **Horvath, P.**, Kopf, M., Matthias, P., Helenius, A., Yamauchi, Y. (2014) Influenza A virus uses the aggresome processing machinery for host cell entry. *Science* **346**: 473-7.

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### RESEARCH AREA

Cancer is a leading cause of morbidity and mortality worldwide, and it is expected that annual cancer cases will rise from 14 million in 2012 to around 22 million within the next two decades. Resistance is a major factor promoting failure of chemotherapy and there is an urgent need for new therapeutic strategies.

By following a natural product based drug discovery strategy, our group focuses on novel chemical approaches to fight cancer and particularly multi-drug resistant cancer. In this endeavor, we aim at the preparation of nature-inspired chemical scaffolds that can act as chemo-sensitizers on resistant tumor cells, hence can be used as non-toxic adjuvants in combination with chemotherapeutics. A broad scale of interesting natural products are utilized as starting materials, e.g. well-known antioxidants, insect hormones utilized as anabolic food supplements, etc. Thanks to this and to our intensive international collaboration, an inspiring multidisciplinary working environment awaits the candidates to join our team.

### TECHNIQUES AVAILABLE IN THE LAB

Extraction and preparation of herbal constituents, as well as simple chemical reactions for their structural modification, a wide array of separation techniques used in natural product chemistry, including analytical and preparative HPLC, supercritical fluid HPLC (SFC), centrifugal partition chromatography (CPC), rotational planar chromatography, TLC and column chromatography, structure elucidation by spectroscopic techniques (NMR, MS, UV-VIS).

### SELECTED PUBLICATIONS

Müller, J., Martins, A., Csábi, J., Fenyvesi, F., Könczöl, A., **Hunyadi, A.**, Balogh, G.T. (2017) BBB Penetration-targeting Physicochemical Lead Selection: Ecdysteroids as Chemosensitizers Against CNS Tumors. *Eur J Pharm Sci* **96**: 571-577.

**Hunyadi, A.**, Herke, I., Lengyel, K., Báthori, M., Kele, Z., Simon, A., Tóth, G., Szendrei, K. (2016) Ecdysteroid containing food supplements from *Cyanotis arachnoidea* on the European market: evidence for spinach product counterfeiting. *Sci Rep* **6**: 37322.

Csábi, J., Hsieh, T.J., Hasanpour, F., Martins, A., Kele, Z., Gáti, T., Simon, A., Tóth, G., **Hunyadi, A.** (2015) Oxidized Metabolites of 20-Hydroxyecdysone and their Activity on Skeletal Muscle Cells: Preparation of a Pair of Desmotropes with Opposite Bioactivities. *J Nat Prod* **78**: 2339-2345.

**Hunyadi, A.**, Martins, A., Danko, B., Chang, F.R., Wu, Y.C. (2014) Protoflavones: a class of unusual flavonoids as promising novel anticancer agents. *Phytochem Rev* **13**: 69-77.

Martins, A., Tóth, N., Ványolós, A., Béni, Z., Zupkó, I., Molnár, J., Báthori, M., **Hunyadi, A.** (2012) Significant activity of ecdysteroids on the resistance to doxorubicin in mammalian cancer cells expressing the human ABCB1 transporter. *J Med Chem* **55**: 5034-5043.

# GÁBOR JUHÁSZ



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## RESEARCH AREA

Autophagy is one of the major degradative pathways in eukaryotic cells. During the main route, portions of cytosol and organelles are captured into double-membrane autophagosomes, which then fuse with lysosomes to deliver their cargo for degradation and reuse. Our group is studying the role and mechanisms of autophagy mainly using the popular animal model Drosophila. We are particularly interested in the mechanisms of autophagosome-lysosome fusion: we have identified several new fusion factors in recent years, and further ones are currently being characterized. The long-term aim of this project is to biochemically reconstitute autophagosome-lysosome fusion *in vitro*.

## TECHNIQUES AVAILABLE IN THE LAB

Genetic manipulation of Drosophila: gene knockouts, transgenic reporter constructs, mosaic analysis. Confocal microscopy, autophagic degradation and endocytic uptake and degradation assays. Transmission electron microscopy. Western blots, immunoprecipitations, proteomic analysis (done by the core facility). Cell culture facilities, yeast two-hybrid, molecular cloning, RT-PCR and qPCR. Purification of recombinant proteins, biochemical assays, antibody production.

## SELECTED PUBLICATIONS

- Lorincz, P., Lakatos, Z., Varga, A., Maruzs, T., Simon-Vecsei, Z., Darula, Z., Benko, P., Csordas, G., Lippai, M., Ando, I., Hegedus, K., Medzihradszky, K., Takats, S., **Juhász, G.** (2016) MiniCORVET is a Vps8-containing hemocyte- and nephrocyte-specific early endosomal tether in Drosophila. *Elife*, 5. pii: e14226.
- Takáts, S., Pircs, K., Nagy, P., Varga, Á., Kárpáti, M., Hegedűs, K., Kramer, H., Kovács, A.L., Sass, M., **Juhász, G.** (2014) Interaction of the HOPS complex with Syntaxin 17 mediates autophagosome clearance in Drosophila. *Mol Biol Cell* 25: 1338-54.
- Nagy, P., Varga, A., Pircs, K., Hegedus, K., **Juhász, G.** (2013) Myc-Driven Overgrowth Requires Unfolded Protein Response-Mediated Induction of Autophagy and Antioxidant Responses in *Drosophila melanogaster*. *Plos Genet* 9: e1003664.
- Takats, S., Nagy, P., Varga, A., Pircs, K., Karpati, M., Varga, K., Kovacs, A.L., Hegedus, K., **Juhász, G.** (2013) Autophagosomal Syntaxin17-dependent lysosomal degradation maintains neuronal function in Drosophila. *J Cell Biol* 201: 531-539.
- Juhász, G.**, Erdi, B., Sass, M., Neufeld, T.P. (2007) Atg7-dependent autophagy promotes neuronal health, stress tolerance, and longevity but is dispensable for metamorphosis in Drosophila. *Genes Dev* 21: 3061-6.

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## RESEARCH AREA

Sepsis remains one of the leading causes of death in the intensive care units which necessitates the development of new diagnostic tools and novel, more efficient therapeutic possibilities. The basic problem in sepsis is the discrepancy between oxygen delivery and oxygen consumption which can lead to irreversible oxygen extraction deficit and energy shortage. The cornerstone of acute care should be to prevent, assess and treat oxygen debt globally. We propose that causative factors and signs of oxygen deficit have to be examined together on microcirculatory, cellular (endothelial) and subcellular (mitochondrial) levels in different shock-affected organs (e.g. the intestine and lung) by employing sufficiently long-term, clinically relevant experimental models. With this theoretical background, the major goal of our study is to find optimal, clinically applicable manoeuvres for microcirculatory recruitment and mitochondrial resuscitation to minimize the energy deficit of organs during the septic response.

## TECHNIQUES AVAILABLE IN THE LAB

Our research laboratories are equipped with instruments to identify macro- and microcirculatory changes (hemodynamic computerized data-acquisition and analysis systems, laser-Doppler flowmetry, fluorescence-based intravital microscopy, orthogonal polarisation spectral imaging). Fluorescence confocal laser scanning endomicroscopy technique offers the possibility of acquiring precise *in vivo* data for histological analysis. A high resolution respirometer is available for examination of mitochondrial function (activities of the components of electron transport chain) and additional laboratory facilities (ELISA) to study inflammatory biomarkers. Animal house and fully-equipped operating theatres are available for surgical intervention of small (rats) and larger animals (minipigs).

## SELECTED PUBLICATIONS

- Érces, D., Nógrády, M., Varga, G., Szűcs, S., Mészáros, A.T., Fischer-Szatmári, T., Cao, C., Okada, N., Okada, H., Boros, M., **Kaszaki, J.** (2016) Complement C5a inhibition improves late hemodynamic and inflammatory changes in a rat model of nonocclusive mesenteric ischemia. **Surgery** **159**: 960-71.
- Érces, D., Nógrády, M., Nagy, E., Varga, G., Vass, A., Süveges, G., Imai, M., Okada, N., Okada, H., Boros, M., **Kaszaki, J.** (2013) Complement c5a antagonist treatment improves the acute circulatory and inflammatory consequences of experimental cardiac tamponade. **Crit Care Med** **41**: 344-351.
- Boros, M., Ghyczy, M., Érces, D., Varga, G., Tókés, T., Kupai, K., Torday, Cs., **Kaszaki, J.** (2012) The anti-inflammatory effects of methane. **Crit Care Med** **40**: 1269-1278.
- Kovács, T., Varga, G., Érces, D., Tókés, T., Tiszlavicz, L., Ghyczy, M., Boros, M., **Kaszaki, J.** (2012) Dietary phosphatidylcholine supplementation attenuates inflammatory mucosal damage in a rat model of experimental colitis. **Shock** **38**: 177-185.
- Kaszaki, J.**, Érces, D., Varga, G., Szabó, A., Vécsei, L., Boros, M. (2012) Kynurenines and intestinal neurotransmission – the role of N-methyl-D-aspartate receptors. **J Neural Transm** **119**: 211-223.

# LAJOS KEMÉNY



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### RESEARCH AREA

Trillions of bacteria, fungi and viruses colonize the skin surface, collectively comprising the skin microbiome. There is a continuous interaction between the microorganisms and the different cells in the skin. Recent data suggest that the skin commensal bacteria play an important role in providing a protection against more harmful bacteria, and in the regulation of skin immune system. Commensal bacteria can activate the different cells in the skin to produce inflammatory mediators. However, it is not known how the skin cells can differentiate between commensal and pathogenic bacteria. How do we tolerate the great number of bacteria without inducing inflammation in the skin? In special circumstances, the commensal flora has been suggested to play a role in the induction or in the maintenance of chronic inflammatory skin diseases, such as acne, rosacea or psoriasis. An important member of the skin's commensal flora is the bacterium called *Propionibacterium acnes* (*P. acnes*). Even though it resides in the pilosebaceous unit of the skin, under certain circumstances it may also play an important role in the pathogenesis of acne, the most common inflammatory skin disease. We investigate how and when this commensal microbe turns pathogenic and how this bacterium influences the skin immune system.

### SELECTED PUBLICATIONS

- Buzas, K., Marton, A., Vizler, C., Gyukity-Sebestyen, E., Harmati, M., Nagy, K., Zvara, A., Katona, R.L., Tubak, V., Endresz, V., Németh, I., Olah, J., Vigh, L., Biro, T., **Kemény, L.** (2016) Bacterial sepsis increases survival in metastatic melanoma: *Chlamydophila pneumoniae* induces macrophage polarization and tumor regression. *J Invest Dermatol* **136**: 862-865.
- Tax, G., Urbán, E., Palotás, Zs., **Kemény, L.**, Szabó, K. (2016) Propionic acid produced by *Propionibacterium acnes* strains contribute to their pathogenicity. *Acta Derm Venereol* **93**: 43-49.
- Manczinger, M., **Kemény, L.** (2013) Novel factors in the pathogenesis of psoriasis and potential drug candidates are found with systems biology approach. *Plos One* **8**: e80751.
- Szabó, K., **Kemény, L.** (2011) Studying the genetic predisposing factors in the pathogenesis of acne vulgaris. *Human Immunol* **72**: 766-773.
- Kinyó, A., Kiss-László, Z., Hambalkó, S., Bebes, A., Kiss, M., Széll, M., Bata-Csörgő, Z., Nagy, F., **Kemény, L.** (2010) COP1 contributes to UVB-induced signaling in human keratinocytes. *J Invest Dermatol* **130**: 541–545.

### TECHNIQUES AVAILABLE IN THE LAB

Various cell separation techniques, cell culturing methods, flow cytometry, immune-staining techniques of tissues and cells, protein, mRNA detection, cell cycle analysis, cell proliferation measurements.

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## RESEARCH AREA

Understanding the basic mechanisms of psychiatric disorders (schizophrenia, depression, posttraumatic reactions) is an ultimate challenge for sciences, humanities, and arts. Our team is dedicated to the delineation of the meeting-point of these traditionally remote areas of exploration and discovery, using the tools of neurosciences and psychology.

Beyond the clinical symptoms, we pay an outstanding attention to the basic cognitive building blocks of psychiatric disorders (e.g., dysfunctions of perception, attention, and memory), their neurobiological background, and finally we seek the link between these fundamental functions and higher human phenomena (e.g., the impact of psychological trauma, the relationship among psychotherapy, healing, and creativity).

What is the relationship between the pathophysiology of perception and memory and the symptom clusters of hallucinations and delusions? Why are these symptoms more common in immigrants and refugees? What is the role of psychological trauma? What kind of structural and functional brain plasticity can be found behind the response to psychotherapy? Is there any chance to find a relationship between these changes and the molecular mechanisms? Where is the boundary between medical sciences and humanities?

The research team works at three centers in a strong collaborative network with several psychiatric units: in addition to the Department of Physiology at the medical faculty of the University of Szeged, the network includes the National Institute for Psychiatry and Addictions, and the Department of Cognitive Science of Budapest University of Technology and Economics.

## TECHNIQUES AVAILABLE IN THE LAB

Clinical interview and rating scales, narrative deep interview, administration and development of neuropsychological tests (SuperCard and E-Prime programming environments), eye-tracking, EEG, structural brain measurements with magnetic resonance imaging (MRI), development and clinical validation of biochip technologies.

## SELECTED PUBLICATIONS

Szily, E., Kéri, Sz. (2013) Delusion proneness and emotion appraisal in individuals with high psychosis vulnerability. *Clin Psychol Psychother* **20**: 166-70.

Levy-Gigi, E., Kéri, Sz. (2012) Falling out of time: enhanced memory for scenes presented at behaviorally irrelevant points in time in posttraumatic stress disorder (PTSD). *PLoS One* **7**: e42502.

Kéri, Sz. (2011) Solitary minds and social capital: Latent inhibition, general intellectual functions and social network size predict creative achievements. *Psychol Aesthet Creat Arts* **5**: 215-221.

Kéri, Sz., Moustafa, A.A., Myers, C.E., Benedek, G., Gluck, M.A. (2010) Alpha-Synuclein gene duplication impairs reward learning. *Proc Natl Acad Sci USA* **107**: 15992-4.

Kéri, Sz., Beniczky, S., Kelemen, O. (2010) Suppression of the P50 evoked response and neuregulin 1-induced AKT phosphorylation in first-episode schizophrenia. *Am J Psychiatry* **167**: 444-50.

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### RESEARCH AREA

The general strategy to treat cancer relies largely on traditional chemotherapy using small molecular drugs. Although conventional chemotherapy has a decent success rate it frequently causes severe side effects and can even result in the evolution of multidrug resistant cancer phenotypes. Nanoparticle based treatment of solid tumors is regarded as a novel, attractive strategy to improve cancer therapy, since approximately 10-200 nm sized materials are selectively accumulated in tumor tissues due to the passive targeting effect, where many of them, especially metallic particles can exert direct anti-cancer activity. Owing to their large surface area nanomaterials can also serve as controllable delivery platforms of various cytotoxic drugs for active tumor targeting. Our research group investigates the cellular and molecular events behind the anti-cancer activity of different types of metal nanoparticles in *in vitro* and *in vivo* animal model systems.

### TECHNIQUES AVAILABLE IN THE LAB

Standard cell and tissue culture techniques, *in vitro* model systems, co-cultures, testing drugs and nanomaterials, toxicity screens, cell migration and invasion assays, biochemical and molecular biology methods, ELISA, Western blot analysis, RT-qPCR, next generation sequencing, fluorescent and confocal microscopy, histological analysis, immunocytochemistry, reporter systems, gene silencing.

### SELECTED PUBLICATIONS

- Rónavári, A., Kovács, D., Igaz, N., Vágvölgyi, C., Boros, I.M., Kónya, Z., Pfeiffer, I., **Kiricsi, M.** (2017) Biological activity of green synthesized silver nanoparticles depends on the applied natural extracts: a comprehensive study. *Int J Nanomedicine* **12**: 1-13.
- Igaz, N., Kovács, D., Rázga, Z., Kónya, Z., Boros, I.M., **Kiricsi, M.** (2016) Modulating chromatin structure and DNA accessibility by deacetylase inhibition enhances the anti-cancer activity of silver nanoparticles. *Colloids Surf B Biointerfaces* **146**: 670-7.
- Kovács, D., Igaz, N., Keskeny, C., Bélteky, P., Tóth, T., Gáspár, R., Madarász, D., Rázga, Z., Kónya, Z., Boros, I.M., **Kiricsi, M.** (2016) Silver nanoparticles defeat p53-positive and p53-negative osteosarcoma cells by triggering mitochondrial stress and apoptosis. *Sci Rep* **6**: 27902.
- Kovács, D., Szőke, K., Igaz, N., Spengler, G., Molnár, J., Tóth, T., Madarász, D., Rázga, Z., Kónya, Z., Boros, I.M., **Kiricsi, M.** (2016) Silver nanoparticles modulate ABC transporter activity and enhance chemotherapy in multidrug resistant cancer. *Nanomedicine* **12**: 601-10.
- Deák, F., Mátés, L., Korpos, E., Zvara, A., Szénási, T., **Kiricsi, M.**, Mendlér, L., Keller-Pintér, A., Ozsvári, B., Juhász, H., Sorokin, L., Dux, L., Mermod, N., Puskás, L.G., Kiss I. (2014) Extracellular deposition of matrilin-2 controls the timing of the myogenic program during muscle regeneration. *J Cell Sci* **127**: 3240-56.

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## RESEARCH AREA

The central nervous system is one of the most complex and meantime the most sensitive part of our organism. For its proper function the central nervous system needs a steady state environment which is largely provided by the blood-brain barrier. In this respect changes in the blood-brain barrier permeability have important consequences in causing or aggravating a large number of neurological diseases. The main goal of our research is to understand the molecular mechanisms underlying the function of the blood-brain barrier under physiological and pathological conditions. For this purpose, we use *in vitro* models and *in vivo* two-photon microscopy. On the one side, we investigate the role of the blood-brain barrier in the formation of brain metastases and the mechanisms of migration of tumor cells into the brain. On the other hand, we investigate how cellular components of the blood-brain barrier communicate with each other in neurological disorders associated with inflammatory processes. Here our special emphasis is on pattern recognition receptors.

## TECHNIQUES AVAILABLE IN THE LAB

Isolation of different cell types from mammalian brain, *in vitro* model systems including disease models, barrier permeability studies, biochemical and molecular biology methods, ELISA, fluorescence and confocal microscopy, *in vivo* two-photon microscopy.

## SELECTED PUBLICATIONS

Nyúl-Tóth, Á., Suciu, M., Molnár, J., Fazakas, C., Haskó, J., Herman, H., Farkas, A.E., Kaszaki, J., Hermenean, A., Wilhelm, I., **Krizbai, I.A.** (2016) Differences in the molecular structure of the blood-brain barrier in the cerebral cortex and white matter: an *in silico*, *in vitro* and *ex vivo* study. **Am J Physiol Heart Circ Physiol** **310**: H1702-14.

Nagyősi, P., Nyúl-Tóth, Á., Fazakas, C., Wilhelm, I., Kozma, M., Molnár J., Haskó, J., **Krizbai, I.A.** (2015) Regulation of NOD-like receptors and inflammasome activation in cerebral endothelial cells. **J Neurochem** **135**: 551-64.

**Krizbai, I.A.**, Gasparics, Á., Nagyősi, P., Fazakas, C., Molnár, J., Wilhelm, I., Benics, R., Rosivall, L., Sebe, A. (2015) Endothelial-mesenchymal transition of brain endothelial cells: possible role during metastatic extravasation. **PLoS One** **10**: e0119655.

Wilhelm, I., Fazakas, C., Molnár, J., Haskó, J., Végh, A.G., Cervenák, L., Nagyősi, P., Nyúl-Tóth, A., Farkas, A.E., Bauer, H., Guillemin, G.J., Bauer, H.C., Váró, G., **Krizbai, I.A.** (2014) Role of Rho/ROCK signaling in the interaction of melanoma cells with the blood-brain barrier. **Pigment Cell Melanoma Res** **27**: 113-23.

Ramirez, S.H., Haskó, J., Skuba, A., Fan, S., Dykstra, H., McCormick, R., Reichenbach, N., **Krizbai, I.A.**, Mahadevan, A., Zhang, M., Tuma R., Son, Y.J., Persidsky, Y. (2012) Activation of cannabinoid receptor 2 attenuates leukocyte-endothelial cell interactions and blood-brain barrier dysfunction under inflammatory conditions. **J Neurosci** **32**: 4004-16.

# TAMÁS MARTINEK



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### RESEARCH AREA

The aim of our research group is to create new macromolecules from unnatural building blocks (foldamers), of which 3D structure can be predicted and programmed. Manipulating protein-protein, protein-membrane and protein-carbohydrate interactions by these chemically well defined substances is a great challenge and holds promise. While small molecule drugs can not effectively decouple macromolecule interactions in general because of their geometry, the right sized and often used antibodies have many disadvantages. We utilize foldamers as artificial self-organizing protein mimetics to modulate protein interactions, to develop diagnostic tools and novel antibacterial materials.

### TECHNIQUES AVAILABLE IN THE LAB

Foldamers are synthesised chemically by using automated methods and the design heavily relies on computer modeling. Their structure is analyzed by HPLC-MS. To analyze protein-ligand interactions, NMR spectrometry is deployed with a special emphasis on protein NMR methods including 3D structure refinement and the analysis of protein dynamics. Proteins are produced via bacterial expression systems. We analyze protein – ligand interactions with the help of isothermal titration calorimetry and various fluorescent techniques. Biological activity of the compounds are tested in cell-based assays.

### SELECTED PUBLICATIONS

- Hegedus, Z., Makra, I., Imre, N., Hetényi, A., Mándity, I.M., Monostori, É., **Martinek, T.A.** (2016) Foldameric probes for membrane interactions by induced  $\beta$ -sheet folding. *Chem Commun* 52: 1819.
- Olajos, G., Hetényi, A., Wéber, E., Németh, L.J., Szakonyi, Z., Fülöp, F., **Martinek, T.A.** (2015) Induced Folding of Protein-Sized Foldameric  $\beta$ -Sandwich Models with Core  $\beta$ -Amino Acid Residues. *Chemistry* 21: 6173-6180.
- Hegedus, Z., Weber, E., Kriston-Pal, E., Makra, I., Czibula, A., Monostori, E., **Martinek, T.A.** (2013) Foldameric alpha/beta-Peptide Analogs of the beta-Sheet-Forming Antiangiogenic Anginex: Structure and Bioactivity. *J Am Chem Soc* 135: 16578-16584.
- Fülöp, L., Mándity, I.M., Juhász, G., Szegedi, V., Hetényi, A., Wéber, E., Bozsó, Z., Simon, D., Benkő, M., Király, Z., **Martinek, T.A.** (2012) A Foldamer-Dendrimer Conjugate Neutralizes Synaptotoxic  $\beta$ -Amyloid Oligomers. *Plos One* 7: e39485.
- Berlicki, Ł., Pilsl L., Wéber, E., Mándity, I.M., Cabrele, C., **Martinek, T.A.**, Fülöp, F., Reiser, O. (2012) Unique  $\alpha,\beta$ - and  $\alpha,\alpha,\beta,\beta$ -peptide foldamers based on cis- $\beta$ -aminocyclopentanecarboxylic acid. *Angew Chem Int Ed Engl* 51: 2208-2212.

# LAJOS MÁTÉS



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## RESEARCH AREA

Cancer is the leading cause of death in the developed world. According to estimates from the International Agency for Research on Cancer, there were 8.2 million cancer deaths in 2012 worldwide.

Cancer research began as early as at the end of the 19<sup>th</sup> century, indicating the social efforts to control this devastating disease. In recent years, the tremendous advances reached in molecular biology and genomics has given further impetus to the development of this field. Among other things, the recently developed high-throughput sequencing technology platforms have generated massive amounts of genetic variation data from a huge number of cancer samples. The collected data support the concept that cancer is a disease of our genome, because in the majority of tumors tens or even hundreds of thousands of mutations have been detected. These data also show that the spontaneous mutation rate observed in normal cells is not sufficient to account for the high number of mutations found in cancers. The key feature of cancer cells, allowing them to rapidly evolve more and more new mutations, is the instability of their genetic material.

The long-term objective of our laboratory is to explore genetic alterations fuelling malignant transformation by undermining the stability of the genome.

## TECHNIQUES AVAILABLE IN THE LAB

Basic molecular biological methods, involving isolation manipulation and analysis of DNA, RNA and proteins, standard mammalian tissue culture techniques, basic mouse colony management techniques, gene knockout and gene knock-down techniques, advanced gene delivery methods used in tissue culture and in animal models.

## SELECTED PUBLICATIONS

Katter, K., Geurts, A.M., Hoffmann, O., **Mátés, L.**, Landa, V., Hiripi, L., Moreno, C., Lazar, J., Bashir, S., Zideke, V., Popova, E., Jerchowc, B., Beckerc, K., Devarajc, A., Walterj, I., Grzybowksib, M., Corbettb, M., Filhol, A.R., Hodgesb, M.R., Baderc, M., Ivics, Z., Jacob, H.J., Pravenec, M., Bősze, Z., Rülicke, T., Izsvák, Z. (2013) Transposon-mediated Transgenesis, Transgenic Rescue, and Tissue-specific Gene Expression in Rodents and Rabbit. **FASEB J** **27**: 930-941.

Xue, X., Huang, X., Nodland, S.E., **Mátés, L.**, Ma, L., Izsvák, Z., Ivics, Z., LeBien, T.W., McIvor, R.S., Wagner, J.E., Zhou, X. (2009) Stable gene transfer and expression in cord blood-derived CD34+ hematopoietic stem and progenitor cells by a hyperactive Sleeping Beauty transposon system. **Blood** **114**: 1319-1330.

**Mátés, L.**, Chuah, M.K., Belay, E., Jerchow, B., Manoj, N., Acosta-Sánchez, A., Grzela, D.P., Schmitt, A., Becker, K., Matrai, J., Ma, L., Samara-Kuko, E., Gysemans, C., Pryputniewicz, D., Miskey, C., Fletcher, B., VandenDriessche, T., Ivics, Z., Izsvák, Z. (2009) Molecular evolution of a novel hyperactive Sleeping Beauty transposase enables robust stable gene transfer in vertebrates. **Nature Genetics** **41**: 753-761.

Ivics, Z., Li, M.A., **Mátés, L.**, Boeke, J.D., Nagy, A., Bradley, A., and Izsvák, Z. (2009) Transposon-mediated genome manipulation in vertebrates. **Nat Methods** **6**: 415-422.

**Mátés, L.**, Izsvák, Z., Ivics, Z. (2007) Technology transfer from worms and flies to vertebrates: transposition-based genome manipulations and their future perspectives. **Genome Biol** **8 Suppl 1**: S1.

# JÓZSEF MIHÁLY



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## RESEARCH AREA

The highly dynamic actin cytoskeleton is one of the structurally and functionally most important cellular constituent. The actin cytoskeleton is involved in such fundamental cell biological processes as the maintenance of cell shape, cell division, intracellular transport and motility. Beyond that, the actin cytoskeleton is known to play a central role in the growth and proper navigation of neuronal axons and dendrites that are necessary to the formation of a functional nervous system. Our major scientific interest is to gain a better understanding of the molecular mechanisms of axonal growth and guidance by uncovering the role of the growth cone actin cytoskeleton regulatory proteins.

Considering that certain developmental disorders, accidental injuries and neurodegenerative diseases often result in severe axonal growth defects or axonal injuries, our studies are of potential biomedical relevance as they may help to develop more efficient neuronal regeneration methods.

## TECHNIQUES AVAILABLE IN THE LAB

Classical and molecular Drosophila genetics, molecular biology, cell biology, cytoskeleton analysis, immunohistochemistry, the basic methods of biochemistry, fluorescent and confocal microscopy, behavioral tests, live imaging, digital image analysis.

## SELECTED PUBLICATIONS

- Gombos, R., Migh, E., Antal, O., Mukherjee, A., Jenny, A., **Mihály, J.** (2015) The Formin DAAM Functions as Molecular Effector of the Planar Cell Polarity Pathway during Axonal Development in *Drosophila*. *J Neurosci* **35**: 10154-67.
- Nelson, KS., Khan, Z., Molnár, I., **Mihály, J.**, Kaschube, M., Beitel, GJ. (2012) *Drosophila* Src regulates anisotropic apical surface growth to control epithelial tube size. *Nat Cell Biol* **14**: 518-525.
- Matusek, T., Gombos, R., Szécsényi, A., Sánchez-Soriano, N., Czibula, A., Pataki, C., Gedai, A., Prokop, A., Raskó, I., **Mihály, J.** (2008). Formin proteins of the DAAM subfamily play a role during axon growth. *J. Neurosci* **28**: 13310-13319.
- Boutros, M., **Mihaly, J.**, Bouwmeester, T., Mlodzik, M. (2000) Signaling specificity by Frizzled receptors in *Drosophila*. *Science* **288**: 1825-1828.
- Hogga, I., **Mihaly, J.**, Barges, S., Karch, F. (2001) Replacement of Fab-7 by the gypsy or scs Insulator Disrupts Long-Distance Regulatory Interactions in the Abd-B Gene of the Bithorax Complex. *Mol Cell* **8**: 1145-1151.
- Mihaly, J.**, Mishra, R.K., Karch, F. (1998) A conserved sequence motif in Polycomb-response elements. *Mol Cell* **1**: 1065-1066.

# FERENC NAGY



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### RESEARCH AREA

Synthetic biology is the design and construction of biological devices for useful purposes; it combines biology and engineering, and employs a broad variety of methods and approaches. One of the fastest developing segment of synthetic biology is optogenetics, which uses genetically encoded photosensors to transform light energy into specifically engineered biological processes. Because of their fast on/off features, optogenetic systems offer superior spatio-temporal resolution as compared to chemically inducible systems and have an enormous potential for interrogating so far not tractable cellular events. Our recent research on one group of plant photosensors, termed phytochromes, established that these chromoproteins function as red/far-red light regulated molecular switches. Our laboratory is interested in modifying these light-regulated molecular switches to endow them with the capability to control gene expression, at both transcriptional and translational levels, in mammalian cells. We have shown, in collaboration with the research group led by Prof. Wilfried Weber at the University of Freiburg, that a molecular switch consisting of two plant proteins can regulate angiogenesis of chicken embryos in a red/far-red light dependent fashion. We are interested in developing novel light-responsive molecular switches and use them to regulate various cellular processes in mammalian cells.

### TECHNIQUES AVAILABLE IN THE LAB

State-of-the-art plant and general molecular biology methods, confocal microscopy, *in vivo* imaging using the luciferase reporter, protein expression/purification.

### SELECTED PUBLICATIONS

- Muller, K., Engesse, R., Metzger, S., Schulz, S., Kampf, M-M., Busacker, M., Steinberg, T., Tomakidi, P., Ehrbar, M., **Nagy F.**, Zurbriggen, M-D., Weber, W. (2013) A red/far-red light-responsive bi-stable toggle switch to control gene expression in mammalian cell. **Nucleic Acids Res** **41**: e77.
- Medzihradsky, M., Bindics, J., Adám, E., Viczián, A., Klement, E., Lorrain, S., Gyula, P., Mérai, Z., Fankhauser, C., Medzihradsky, K.F., Kunkel, T., Schäfer, E., **Nagy, F.** (2013) Phosphorylation of Phytochrome B Inhibits Light-Induced Signaling via Accelerated Dark Reversion in Arabidopsis. **Plant Cell** **2**: 535-544.
- Rizzini, L., Favouri, J., Cloix, C., Faggionato, D., O'Hara, A., Kaiserli, E., Baumeister, R., Schafer, E., **Nagy, F.**, Jenkins, G., Ulm, R. (2011) Perception of UV-B by the Arabidopsis UVR8 protein. **Science** **332**: 103-106.
- Kinyo, A., Kiss-Laszlo, Zs., Hambalko, Sz., Bebes, A., Kiss, M., Szell, M., Bata-Csorgo, Zs., **Nagy, F.**, Kemeny, L. (2010) COP1 contributes to UVB-induced signaling in human keratinocytes. **Investigat Dermatol** **130**: 541-545.
- Sorokina, O., Kapus, A., Terecskei, K., Dixon, L.E., Kozma-Bognar, L., **Nagy, F.**, Millar, A.J. (2009) A switchable light-input, light-output system modelled and constructed in yeast. **Biol Eng** **3**: 15.

# CSABA PÁL



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## RESEARCH AREA

Evolution is central to our understanding of the biological world. We address some of the most central questions of the field, for example: How can genes change their function during evolution? Is most of the DNA junk? Why are seemingly essential genes lost in certain species? What is the role of transposable elements ("jumping genes")? Is large-scale engineering of the genome possible? Beyond these basic research issues, we study the evolution of antibiotic resistance in bacteria. Here, we are keen to develop novel therapeutic strategies.

For more details, see [www.brc.hu/sysbiol/](http://www.brc.hu/sysbiol/) and [http://group.szbk.u-szeged.hu/sysbiol/Papers/Termeszet\\_Vilaga\\_2010.pdf](http://group.szbk.u-szeged.hu/sysbiol/Papers/Termeszet_Vilaga_2010.pdf)

## TECHNIQUES AVAILABLE IN THE LAB

We study microbial evolution in real time under controlled laboratory conditions, employ standard protocols of whole genome sequence analyses, molecular genetics and bioinformatics.

## SELECTED PUBLICATIONS

Lazar, V., Pal Singh, G., Spohn, R., Nagy, I., Horváth, B., Hrtyan, M., Busa-Fekete, R., Bogos, B., Méhi, O., Csörgő, B., Pósfai, G., Fekete, G., Szappanos, B., Kégl, B., Papp, B., **Pál, C.** (2013) Bacterial evolution of antibiotic hypersensitivity. *Mol Sys Biol* **9**: 700.

Fehér, T., Bogos, B., Méhi, O., Fekete, G., Csörgő, B., Kovács, K., Pósfai, G., Papp, B., Hurst, L.D., **Pál, C.** (2012) Competition between Transposable Elements and Mutator Genes in Bacteria *Mol Biol Evol* **29**: 3153.

Papp, B., Notebaart, R.A., **Pál, C.** (2011) Systems-biology approaches for predicting genomic evolution. *Nature Rev Genet* **12**: 591.

**Pál, C.**, Macia, M., Oliver, A., Schacher, I., Buckling, A. (2007) Coevolution with viruses drives the evolution of bacterial mutation rates. *Nature* **450**: 1079-81.

# BALÁZS PAPP



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## RESEARCH AREA

Thanks to recent advances in molecular biology techniques, a vast amount of data has been accumulated on the genetic material of organisms and ‘molecular circuits’ (i.e. molecular constituents and their interactions) of their cells. Our rapidly increasing knowledge on the molecular details allows us to address some of the most fundamental questions of biology. What are the general principles governing the structure and function of molecular circuits? Is it possible to predict the cell’s behavior, such as the nutrient utilization of bacteria, based on knowledge of the wiring diagram of its molecular circuits? How do mutations and environmental changes (such as the administration of drug compounds) influence the operation of molecular circuits? Can we predict whether a mutation is harmful for the organism? How did molecular circuits arise during evolution and why do we observe the naturally occurring circuits instead of chemically possible alternative ones? Employing computational biology techniques and large-scale molecular datasets, our lab investigates these questions in the best characterized unicellular organisms, *Escherichia coli* and baker’s yeast. Among others, our work offers insights into the rewiring of molecular circuits in bacteria during the evolution of antibiotic resistance.

## TECHNIQUES AVAILABLE IN THE LAB

Basic bioinformatics and chemoinformatics methods, comparative genomics methods, modeling metabolic networks, metabolomics, integrating functional genomics datasets, R statistical programming language, Matlab programming language, Perl programming language, statistical methods, image analysis, machine learning.

## SELECTED PUBLICATIONS

- Notebaart, R.A., Szappanos, B., Kintses, B., Pál, F., Györkei, A., Bogos, B., Lázár, V., Spohn, R., Csörgő, B., Wagner, A., Ruppin, E., Pál, C., **Papp, B.** (2014) Network-level architecture and the evolutionary potential of underground metabolism. *Proc Natl Acad Sci USA* **111**: 11762-11767.
- Szappanos, B., Kovács, K., Szamecz, B., Honti, F., Costanzo, F., Baryshnikova, A., Gelius-Dietrich, G., Lercher, M.J., Jelasity, M., Myers, C.L., Andrews, B.J., Boone, C., Oliver, S.G., Pál, C., **Papp, B.** (2011) An integrated approach to characterize genetic interaction networks in yeast metabolism. *Nature Genet* **43**: 656-62.
- Pál, C., **Papp, B.**, Lercher, M.J., Csermely, P., Oliver, S.G., Hurst, L.D. (2006) Chance and necessity in the evolution of minimal metabolic networks. *Nature* **440**: 667-70.
- Papp, B.**, Pál, C., Hurst, L.D. (2004) Metabolic network analysis of the causes and evolution of enzyme dispensability in yeast. *Nature* **429**: 661-4.
- Papp, B.**, Pál, C., Hurst, L.D. (2003) Dosage sensitivity and the evolution of gene families in yeast. *Nature* **424**: 194-7.

# GYÖRGY PÓSFAI



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## RESEARCH AREA

Synthetic biology aims at constructing life forms that do not exist in nature. The motivation is two-fold: better understanding of the living cell, and creating useful cells for industrial purposes.

We are currently focusing on the large-scale remodeling of bacterial genomes to understand principles shaping genome content and architecture, and to construct cells that serve as improved model organisms for research, and as a cellular chassis for biotechnological applications. We are particularly interested in:

- Developing fast and effective genome engineering protocols
- Minimizing and shuffling the genomes of *E. coli* strains
- Studying the effect of specific genomic elements on genome architecture and evolution.

## TECHNIQUES AVAILABLE IN THE LAB

Synthetic and molecular biology techniques, microbiological protocols, assembly and multiplex modification of genes and genomes, genome analysis.

## SELECTED PUBLICATIONS

Kolisnychenko, V., Plunkett, G.III., Herring, C.D., Fehér, T., Pósfai, J., Blattner, F.R., **Pósfai, G.** (2002) Engineering a reduced *E. coli* genome. **Genome Res** **12**: 640-647.

**Pósfai, G.**, Plunkett, G.3rd., Fehér, T., Frisch, D., Keil, G., Umenhoffer, K., Kolisnychenko, V., Stahl, B., Arruda, M., Sharma, S.S., Burland, V., Harcum, S.W., Blattner, F.R. (2006) Emergent properties of reduced-genome *Escherichia coli*. **Science** **312**: 1044-1046.

Fehér, T., Papp, B., Pál, C., **Pósfai, G.** (2007) Systematic genome reductions: Theoretical and experimental aspects. **Chem Rev** **107**: 3498-3513.

Csörgő, B., Fehér, T., Timár, E., Blattner, F.R., **Pósfai, G.** (2012) Low-mutation-rate, reduced-genome *Escherichia coli*: An improved host for faithful maintenance of engineered genetic constructs. **Microb Cell Fact** **11**: 11.

Fehér, T., Burland, V., **Pósfai, G.** (2012) In the fast lane: Large-scale bacterial genome engineering. **J Biotechnol** **160**: 72-79.

# LÁSZLÓ PUSKÁS



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## RESEARCH AREA

During the second half of the twentieth century investigation of the function and the regulation of a specific gene was based on individual analysis. Based on the detailed or partial sequence information of diverse organisms novel technologies has been emerged to systematically analyze gene function. Our group applies different functional genomics methods to answer to those questions that enables us better understanding of the behaviour of different organisms and diseases at the molecular level. In our laboratory there are unique, high-throughput instruments that are capable of genomic (mRNA and miRNA) analysis of different biological samples (bacteria, plants, animal tissues, human clinical samples) in a global (analyzing the entire genome) or in a focused way (e.g. part of a biochemical pathway).

Dinamic changes at the gene level characterize the adaptation and response to environmental stimuli of a given organism; define its development, aging, determines the type, development, progression and drug resistance of a disease.

We have developed a special, single cell functional genomic approach that is capable of analyzing individual cells. Molecular scanning of individual cells can be applied in neuroscience, as well as clinical studies to characterize diseased or drug treated cells in an unprecedent resolution. Among these technologies digital PCR is one of the most recent methods developed. We intend to use this approach to detect rare mutations in cancer cells and to identify novel targets and mechanisms in central nervous system diseases.

## TECHNIQUES AVAILABLE IN THE LAB

DNA microarray technology to assess global gene activity profiles; focused, real-time PCR experiments to detect changes in quantity and composition of DNA, RNA and miRNA; digital PCR methods; purification and analysis of nucleic acids and proteins.

## SELECTED PUBLICATIONS

Faragó, N., Kocsis, Á.K., Lovas, S., Molnár, G., Boldog, E., Rózsa, M., Szemenyei, V., Vámos, E., Nagy, L.I., Tamás, G., **Puskás, L.G.** (2013) Digital PCR to determine the number of transcripts from single neurons after patch-clamp recording. *Biotechniques* **54**: 327-36.

Kitajka, K., Sinclair, A.J., Weisinger, R.S., Weisinger, H.S., Mathai, M., Jayasooriya, A.P., Halver, J.E., **Puskás, L.G.** (2004) Effects of dietary omega-3 polyunsaturated fatty acids on brain gene expression. *Proc Natl Acad Sci USA* **101**: 10931-6.

**Puskás, L.G.**, Kitajka, K., Nyakas, C., Barcelo-Coblijn, G., Farkas, T. (2003) Short-term administration of omega 3 fatty acids from fish oil results in increased transthyretin transcription in old rat hippocampus. *Proc Natl Acad Sci USA* **100**: 1580-5.

Kitajka, K., **Puskás, L.G.**, Zvara, A., Hackler, L. Jr., Barceló-Coblijn, G., Yeo, Y.K., Farkas, T. (2002) The role of n-3 polyunsaturated fatty acids in brain: modulation of rat brain gene expression by dietary n-3 fatty acids. *Proc Natl Acad Sci USA* **99**: 2619-24.

Onody, A., Zvara, A., Hackler, L. Jr., Vigh, L., Ferdinandy, P., **Puskás, L.G.** (2003) Effect of classic preconditioning on the gene expression pattern of rat hearts: a DNA microarray study. *FEBS Lett* **536**: 35-40.

# LÁSZLÓ SIKLÓS



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## RESEARCH AREA

The saying originating from the US at the beginning of the previous century "*A picture is worth a thousand words*" is particularly adequate for the description of the complexity of the brain. A new discipline, called geometrical statistics, is used now by micro-anatomical photography to derive unbiased data characterizing the number, size, specified surface portions, etc. of nerve cells by using tiny samples from an enormously high population ( $\approx 200$  billion) of neurons constituting the brain.

The results of such investigations either may contribute to the interpretation of the industrial amount of data coming from (sometimes) automated molecular biology instruments, or may substitute those, when variations of biological functions should be attributed to distributional instead of quantitative changes in e.g. gene expression. The development of biological micro-structural investigations is undoubtedly motivated by a typical human desire expressed by "*seeing is believing*". This is most obvious in the regular need of seeking the structural correlates of the results obtained by another cutting edge technology, electrophysiology.

Our micro-anatomical research is aimed to derive quantitative data characterizing nerve cells in healthy conditions, during disease and ageing, which are also suitable to measure the effect of treatments aimed to halt or reverse disease progression.

## TECHNIQUES AVAILABLE IN THE LAB

Basic methods in structural investigations (light, fluorescent, and electron microscopic techniques), sample preparation methods for biological structural research, labeling techniques for molecular imaging, statistical basis of sampling for unbiased quantitative microscopy, derivation of biological relevant three-dimensional parameters from biological tissue, interactive and automatic computer assisted image analysis, image analysis programming languages.

## SELECTED PUBLICATIONS

Patai, R., NÓGRÁDI, B., OBÁL, I., ENGELHARDT, J.I., **Siklós, L.** (2017) Calcium in the pathomechanism of amyotrophic lateral sclerosis – taking center stage? **Biochem Biophys Res Comm** **483**: 1031-1039.

Adalbert, R., Morreale, G., Paizs, M., Conforti L., Walker, S.A., Roderick, H.L., Bootman, M.D., **Siklós, L.**, Coleman, M.P. (2012) Intra-axonal calcium changes after axotomy in wild-type and slow Wallerian degeneration axons. **Neuroscience** **225**: 44-54.

Paizs, M., Tortarolo, M., Bendotti, C., **Siklós, L.** (2011) Talampanel reduces the level of motoneuronal calcium in transgenic mutant SOD1 mice only if applied presymptomatically. **Amyotroph Lateral Scler** **12**: 340-344.

Paizs, M., Engelhardt, J.I., Katarova, Z., **Siklós, L.** (2010) Hypoglossal motor neurons display reduced calcium increase after axotomy in mice with upregulated parvalbumin. **Comp Neurol** **518**: 1946-1961.

Paizs, M., Engelhardt, J.I., **Siklós, L.** (2009) Quantitative assessment of relative changes of immunohistochemical staining by light microscopy in specified anatomical regions. **Microscopy (Oxford)** **234**:103-112.

Beers, D.R., Henkel, J.S., Xiao, Q., Zhao, W., Wang, J., Yen, A.A., **Siklós, L.**, McKercher, S.R., Appel, S.H. (2006) Wild type microglia extend survival in PU.1 knockout mice with familial amyotrophic lateral sclerosis. **Proc Natl Acad Sci USA** **103**: 16021-16026.

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## RESEARCH AREA

It has been quite well known that genes govern ontogenesis. Many of these genes do it through maternal effect: their products - mRNA and/or protein molecules - are present in the cytoplasm of the egg cells and persist in the zygotes to determine the initial steps of embryogenesis. Obviously, in absence of any of the maternal effect gene function the zygotes die and the females are sterile. Which are the maternal effect genes? What are their functions? How do they govern early embryogenesis? To answer these questions our group made use of the fruit fly (*Drosophila melanogaster*), one of the model species in developmental biology research. We generated mutations that prevent the commencement of embryogenesis. By making use as „tools” of the mutations we got to understand the molecular function of a number of the normal genes. Combining the techniques of „genetic dissection” with molecular, cell and developmental biology our laboratory discovered novel features of nuclear protein import, formation of the nuclear envelope, functions of the microtubules as well as chromosome segregation and unwinding at the end of mitosis. We also developed genetic-based techniques that allow the detection of environmental agents to induce point mutations, chromosome breakages and abnormal chromosome segregation.

## TECHNIQUES AVAILABLE IN THE LAB

The technical repertoire of our laboratory includes (or better to say used to include) Drosophila genetics, molecular cloning, the generation of transgenic Drosophila lines, construction of germ-line and ovarian chimeras (through the transplantation of cells or larval ovaries), fluorescent illumination of different cell components, confocal microscopy and image processing.

## SELECTED PUBLICATIONS

- Szikora, S., Gáspár, I., **Szabad, J.** (2013) Poking microtubules bring about nuclear wriggling to position nuclei. *J Cell Sci* **126**: 254-262.
- Szabad, J.**, Bellen, H.J. and Venken, K.J.T. (2012) An assay to detect *in vivo* Y chromosome loss in *Drosophila* wing disc cells. *G3: Genes, Genomes, Genetics* **2**: 1095-1102.
- Villányi, Z., Gáspár, I., Szikora, S., Puskás, L.G., **Szabad, J.** (2011) Importin- $\beta$  and peroxiredoxin-6005 are involved in mitochondrial biogenesis. *Mech Dev* **128**: 191-199.
- Szabad, J.** (2010) Putting together rather than taking apart. *EMBO Reports* **11**: 904-906.
- Szalontai T., Gáspár I., Belecz I., Kerekes I., Erdélyi M., Boros M., **Szabad J.** (2009) Horka, a chromosome instability-causing mutation in *Drosophila*, is a dominant-negative allele of lodestar. *Genetics* **181**: 367-377.

# MÁRTA SZÉLL



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### RESEARCH AREA

The genome programs of the past decades have provided an enormous amount of information about the human genome and how this information is translated to the "language of life". This knowledge is essential for understanding the pathogenesis of human diseases at the molecular level and, in fact, is currently being used to develop novel diagnostics and therapeutic modalities. Our workgroup identifies novel pathogenic mutations that result in rare monogenic human diseases. By performing functional analyses of these mutations, we attempt to understand how their mode of action leads to human disease. In another project, we investigate the genetics and molecular susceptibility factors of multifactorial human skin diseases, with a primary focus on psoriasis. We are also engaged in the investigation of non-coding RNAs. In particular, we analyze the role of the PRINS mRNA-like non-coding RNA, which was previously identified by our workgroup, in cellular stress responses and in various human diseases. In the last few years our research group has joined the Hungarian Brain Research Program (NAP Project) and as the member of the clinical branch we are engaged in the identification of genetic factors in neurodegenerative human diseases. This work has already yielded several new results for the field.

### TECHNIQUES AVAILABLE IN THE LAB

After identifying mutations using the polymerase chain reaction (PCR) and sequencing methods, various bioinformatics tools are used for sequence analysis. For our functional analyses, we employ *in vitro* DNA and cloning techniques as well as specific gene-silencing methods. Gene and protein expression is assessed using real-time reverse transcriptase PCR, western blot analysis, immunohistochemistry and immunocytochemistry. In the last few years we have introduced next generation sequencing (NGS) into our laboratory and we apply it routinely in our research work. Data provided by NGS are analyzed by various bioinformatics tools.

### SELECTED PUBLICATIONS

- Szell, M., Danis, J., Bata-Csorgo, Z., Kemeny, L. (2016) PRINS, a primate-specific long non-coding RNA, plays a role in the keratinocyte stress response and psoriasis pathogenesis. *Pflugers Archiv* **468**: 935-943.
- Szell, M., Bata-Csorgo, Z., Kemeny, L. (2008) The enigmatic world of mRNA-like ncRNAs: Their role in human evolution and in human diseases. *Semin Cancer Biol* **18**: 141-148.
- Sonkoly, E., Bata-Csorgo, Z., Pivarcsi, A., Polyanka, H., Kenderessy, Szabo, A., Molnar, G., Szentpali, K., Bari, L., Megyeri, K., Mandi, Y., Dobozy, A., Kemeny, L., Szell, M. (2005) Identification and characterization of a novel, psoriasis susceptibility-related noncoding RNA gene, PRINS. *J Biol Chem* **280**: 24159-24167.
- Széll, M., Bata-Csorgo, Z., Koreckm, A., Pivarcsim, A., Polyán-kam, H., Szeg, C., Gaál, M., Dobozy, A., Kemény, L. (2004) Proliferating keratinocytes are putative sources of the psoriasis susceptibility related EDA+ oncofoetal fibronectin. *J Investig Dermatol* **123**: 537-546.
- Beff, R., Szell, M., Meuwly, P., Pay, A., Vögeli-Lange, R., Métraux, J.P., Neuhaus, G., Meins, F. Jr., Nagy, F. (1995) Cholera toxin elevates pathogen resistance and induces systemic acquired resistance in transgenic tobacco. *EMBO J* **14**: 5753-5761.

# GÁBOR TAMÁS



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## RESEARCH AREA

Our research is characterized by a combination of technically challenging electrophysiology, molecular biology, imaging and anatomy in pursuit of the function of cell types and their synapses in the human and rodent cerebral cortex. We discovered the cellular source (neurogliaform cells) of slow, GABAB receptor mediated inhibition in the cerebral cortex. Subsequently, we discovered the mechanism of this slow inhibition as single neuron driven nonsynaptic or volume transmission of the neurotransmitter GABA. In addition, our experiments assigned a new, excitatory role to axo-axonic cells, which were considered as the most specific inhibitory neurons of the cortex. Our commitment to cutting edge methodology recently resulted in recordings from identified interneurons in completely unaesthetized, freely behaving rodents and identified the first ripple-like oscillatory events in the neocortex and their cellular structure. We initiated a research program in 2004 for multiple patch clamp recordings in slices taken from the human cerebral cortex leading to the first recordings of human synaptic interactions and showing the existence of Hebbian networks in the human cerebral cortex.

## TECHNIQUES AVAILABLE IN THE LAB

*In vivo* juxtacellular recordings from neurons of the cerebral cortex in freely behaving rodents, *in vivo* patch clamp electrophysiology, human *in vitro* brain slice patch clamp electrophysiology, *in vivo* and *in vitro* multiphoton imaging (acusto optical and resonant scanning), CARS microscopy in brain slices, transmission electron microscopy, 3D neuron reconstruction with Neurolucida, single digital PCR, single and oligocellular next generation sequencing.

## SELECTED PUBLICATIONS

Averkin, R., Szemenyei, V., Borde, S., **Tamas, G.** (2016) Identified cellular correlates of neocortical ripple and high-gamma oscillations during spindles of natural sleep. **Neuron** **92**: 916-92.

Molnar, G., Rozsa, M., Baka, J., Holderith, N., Barzo, P., Nusser, Z., **Tamas, G.** (2016) Human pyramidal to interneuron synapses are mediated by multi-vesicular release and multiple docked vesicles. **eLife**: e18167.

Olah, S., Fule, M., Komlosi, G., Varga, C., Baldi, R., Barzo, P., **Tamas, G.** (2009) Regulation of cortical microcircuits by unitary GABA-mediated volume transmission. **Nature** **461**: 1278-81.

Szabadics, J., Varga, C., Molnar, G., Olah, S., Barzo, P., **Tamas, G.** (2006) Excitatory effect of GABAergic axo-axonic cells in cortical microcircuits. **Science** **311**: 233-5.

**Tamas, G.**, Lorincz, A., Simon, A., Szabadics, J. (2003) Identified sources and targets of slow inhibition in the neocortex. **Science** **299**: 1902-1905.

# ANDRÁS VARRÓ



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## RESEARCH AREA

Sudden cardiac death is among the leading causes of mortality worldwide. Therefore to better understand the mechanisms of sudden cardiac death and consequently to introduce effective preventive measures represent extremely important issues in the field of public health care. Sudden cardiac death may occur due to cardiac ischaemia, adverse reaction following drug treatment is associated with diseases like heart failure, congenital diseases or can develop in top athletes due to excessive exercise and/or doping. These cases can manifest due to electrophysiological malfunctions of the heart as a consequence of disturbances in cardiac transmembrane ion channel function including various types of potassium channels. Our research team focuses on investigations on the physiology and pathophysiology of these ion channels including pharmacological modulation and possible prevention of cardiac arrhythmias in general, achieving international attention worldwide.

## TECHNIQUES AVAILABLE IN THE LAB

Basic cardiac electrophysiological and molecular biological methods, such as *in vivo* arrhythmia models, cellular action potential measurements, patch-clamp techniques, epifluorescent  $\text{Ca}^{2+}$  signal detection, gene transfer, PCR and Western Blot techniques.

## SELECTED PUBLICATIONS

Jost, N., Virág, L., Comtois, P., Ördög, Ö., Szűts, V., Seprényi, Gy., Bitay, M., Kohajda, Zs., Koncz, I., Nagy, N., Szél, T., Magyar, J., Kovács, M., Puskás, LG., Lengyel, Cs., Wettwer, E., Ravens, U., Nánási, PP., Papp, JGy., **Varró, A.**, Nattel, S. (2013) Ionic mechanisms limiting cardiac repolarization-reserve in humans compared to dogs. *J Physiol* **591**: 4189-4206.

Jost, N., Nagy, N., Corici, C., Kohajda, Zs., Horváth, A., Acsai, K., Biliczki, P., Levijoki, J., Pollesello, P., Koskelainen, T., Otsomaa, L., Tóth, A., Papp, J.Gy., **Varró, A.**, Virág, L. (2013) ORM-10103, a novel specific inhibitor of the sodium/calcium exchanger, decreases early and delayed afterdepolarization in the canine heart. *Brit J Pharmacol* **170**: 768-778.

Nagy, N., Acsai, K., Kormos, A., Sebők, Zs., Farkas, A.S., Jost, N., Nánási, P.P., Papp, J.Gy., **Varró, A.**, Tóth, A. (2013)  $[\text{Ca}^{2+}]$  i-induced augmentation of the inward rectifier potassium current (IK1) in canine and human ventricular myocardium. *Pflügers Arch Eur J Physiol* **465**: 1621-35.

Jost, N., Virág, L., Bitay, M., Takács, J., Lengyel, Cs., Biliczki, P., Nagy, Zs., Bogáts, G., Lathrop, D.A., Papp, J.Gy., **Varró, A.** (2005) Restricting excessive cardiac action potential and QT prolongation: a vital role for IKs in human ventricular muscle. *Circulation* **112**: 1392-1399.

**Varró, A.**, Baláti, B., Jost, N., Takács, J., Virág, L., Lathrop, D.A., Lengyel, C., Tálosi, L., Papp, J.Gy. (2000) The role of IKs in dog ventricular muscle and Purkinje fibre repolarisation. *J Physiol (London)* **523**: 67-81.

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## RESEARCH AREA

Our main research interest is the experimental and clinical investigation of the pathomechanism and possible therapeutic targets of neurological diseases. With the aid of MR imaging and electrophysiological recordings we search for the characteristic features of multiple sclerosis, Alzheimer's disease, Parkinson's disease and given headache disorders. From cerebrospinal fluid and from blood samples we determine biomarkers, which could help the diagnosis confirmation and provide details about the course of the diseases. In genetic studies, we investigate the genetic background of multiple sclerosis and Parkinson's disease. The foundation of these experiments is our Biobank of human tissue samples, which we collect continuously.

In our animal models we examine the molecular background of neurological disorders, particularly the protective effects of kynurenic acid derivatives. The kynurenic acid system is our main research target, which is involved in the pathomechanism of numerous neurological disorders due to the modulatory effects on glutamatergic neurotransmission. In previous experiments, these molecules were effective in the experimental models of headache, Huntington's disease, epilepsy and stroke. Our aim is to further elucidate the mechanisms of effect and potential therapeutic value of this molecules.

## TECHNIQUES AVAILABLE IN THE LAB

MR imaging and data processing, clinical electrophysiological recordings, transcranial direct/alternating current stimulation, RNA and DNA isolation, different PCR and ELISA methods, immunohistochemistry, Western blotting, behavioral experiments on animals, HPLC.

## SELECTED PUBLICATIONS

- Majlath, Zs., Annus, A., **Vécsei, L.** (2017) Kynurenic acid system and multiple sclerosis, pathomechanism and drug targets with an emphasis on laquinimod. **Curr Drug Targets** in press.
- Vécsei, L.**, Majláth, Z., Balog, A., Tajti, J. (2015) Drug targets of migraine and neuropathy: treatment of hyperexcitability. **CNS Neurol Disord Drug Targets** **14**: 664-76.
- Szabó, N., Kincses, ZT., Párdutz, A., Tóth, E., Szok, D., Csete, G., **Vécsei, L.** (2013) White matter disintegration in cluster headache. **J Headache Pain** **24**: 14:64.
- Vécsei, L.**, Szalárdy, L., Fülöp, F., Toldi, J. (2013) Kynurenines in the CNS: recent advances and new questions. **Nat Rev Drug Discov** **12**: 64-82.
- Kincses, Z.T., Szabó, N., Valálík, I., Kopniczky, Z., Dézsi, L., Klivényi, P., Jenkinson, M., Király, A., Babos, M., Vörös, E., Barzó, P., **Vécsei, L.** (2012) Target identification for stereotactic thalamotomy using diffusion tractography. **PLoS One** **7**: e29969.
- Szalárdy, L., Klivényi, P., Zádori, D., Fülöp, F., Toldi, J., **Vécsei, L.** (2012) Mitochondrial disturbances, tryptophan metabolites and neurodegeneration: medicinal chemistry aspects. **Cur Med Chemistry** **19**:1899-1920.
- Vécsei, L.** (ed.) (2012) Kynurenines and the nervous system: therapeutic perspectives. **J Neural Transm** **119**: 107-296.

# ÁGNES VÉGH



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## RESEARCH AREA

The problem of sudden cardiac death resulting from ventricular fibrillation during acute myocardial ischaemia is still the biggest challenge facing modern cardiology. As drug therapy has proved to be largely ineffective, understanding the underlying mechanisms that lead to these life-threatening ventricular arrhythmias is crucial for developing novel therapeutic strategies.

Over the last 30 years our research has focused on to explore possibilities which are able to protect the heart against these severe often fatal arrhythmias. One of such possibilities is the phenomenon of preconditioning through which the heart is able to increase its tolerance against the consequences of a harmful, by itself fatal ischaemic stress. Efforts are made on to explore the triggers, the signalling pathways and end-effectors, which are likely to be involved in the preconditioning-induced cardioprotection. We attempt to establish protocols which might be useful in the therapy for the attenuation of the risk of sudden cardiac death.

We address various questions using pharmacological approaches in *in vivo* animal studies and also in *in vitro* examinations by applying various biochemical and molecular biological methods. Such a comprehensive approach makes possible to assess processes which act and influence arrhythmogenesis in the whole body and count for these at cellular level.

## TECHNIQUES AVAILABLE IN THE LAB

*In vivo methods:* Experiments in large animals – surgical interventions, measurements of basic haemodynamic, electrophysiological, blood flow and contractile function parameters.

*In vitro methods:* immuno-blotting (e.g. Western blot), RT-PCR, image analysis (e.g. immunofluorescence confocal microscopy), immunoprecipitation, ELISA. Through our collaboration several other methods are available, e.g. SNO-RAC analysis, RIA.

## SELECTED PUBLICATIONS

Gönczi, M., Kovács, M., Seprényi, Gy., **Végh, Á.** (2012) The involvement of gap junctions in the delayed phase of the protection induced by cardiac pacing in dogs. *Clin Sci* 123: 39-51.

Papp, R., Gönczi, M., Kovács, M., Seprényi, Gy., **Végh, Á.** (2007) Gap junctional uncoupling plays a trigger role in the antiarrhythmic effect of ischaemic preconditioning. *Cardiovasc Res* 74: 396-405.

Babai, L., Szigeti, Zs., Parratt, J.R., **Végh, Á.** (2002) Delayed cardioprotective effects of exercise in dogs are amino-guanidine sensitive: possible involvement of nitric oxide. *Clin Sci* 102: 435-445.

**Végh, Á.**, Szekeres, L., Parratt, J.R. (1992) Preconditioning of the ischaemic myocardium; involvement of the L-arginine - nitric oxide pathway. *Br J Pharmacology* 107: 648-652.

**Végh, Á.**, Komori, S., Szekeres, L., Parratt, J.R. (1992) Anti-arrhythmic effects of preconditioning in anaesthetized dogs and rats. *Cardiovasc Res* 26: 487-495.

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## RESEARCH AREA

As a "central dogma" earlier it was suggested that stress-induced protein denaturation serves as a major stress-sensing machinery, which triggers the expression of the molecular chaperone heat shock proteins (HSPs). We have introduced a new but not exclusive cellular "membrane thermosensor" model, which predicts the existence of membrane-associated stress sensing and signaling mechanisms. It proposes that changes in the physical state and composition of lipid molecular species with the concomitant destabilization/reorganization of membrane microdomains ("rafts") can serve also as "molecular switches" to operate "cellular thermometers". Using mammalian cells and the fission yeast (*S.pombe*) as models we intend to elucidate the mechanism of membrane-associated stress sensors, signaling pathways and the interplay and networking of potential cellular stress survival strategies. Since HSPs play a fundamental role in the pathology of several human diseases, understanding the mechanism whereby mammalian cells can elicit a stress response may also be of paramount importance for the design of novel drug molecules.

## TECHNIQUES AVAILABLE IN THE LAB

Classical biochemical and molecular biology methods. Membrane biophysics: spectroscopy, Langmuir monolayers, ultrasensitive fluorescence microscopy, single molecule tracking, image analysis. Lipidomic analysis: chromatographic and mass spectrometry techniques. Multidimensional data analysis, statistical methods.

## SELECTED PUBLICATIONS

Escribá, P.V., Busquets, X., Inokuchi, J.I., Balogh, G., Török, Z., Horváth, I., Harwood, J.L., **Vigh, L.** (2015) Membrane lipid therapy: Modulation of the cell membrane composition and structure as a molecular base for drug discovery and new disease treatment. **Prog Lipid Res** **59**: 38-53.

Nagy, E., Balogi, Z., Gombos, I., Akerfelt, M., Björkbom, A., Balogh, G., Török, Z., Maslyanko, A., Fiszer-Kierzkowska, A., Lisowska, K., Slotte, P.J., Sistonen, L., Horváth, I., **Vigh, L.** (2007) Hyperfluidization-coupled membrane microdomain reorganization is linked to activation of the heat shock response in a murine melanoma cell line. **Proc Natl Acad Sci USA** **104**: 7945-7950.

**Vigh, L.**, Horváth, I., Maresca, B., Harwood, J.L. (2007) Can the stress protein response be controlled by membrane-lipid therapy? **Trends Biochem Sci** **32**: 357-363.

Török, Z., Tsvetkova, N.M., Balogh, G., Horváth, I., Nagy, E., Péntes, Z., Hargitai, J., Bensaude, O., Csermely, P., Crowe, J.H., Maresca, B., **Vigh, L.** (2003) Heat shock protein coinducers with no effect on protein denaturation specifically modulate the membrane lipid phase. **Proc Natl Acad Sci USA** **100**: 3131-3136.

**Vigh, L.**, Literáti, P.N., Horváth, I., Török, Z., Balogh, G., Glatz, A., Kovács, E., Boros, I., Ferdinándy, P., Farkas, B., Jaszlits, L., Jednákovits, A., Korányi, L., Maresca, B. (1997) Bimoclomol: a nontoxic, hydroxylamine derivative with stress protein-inducing activity and cytoprotective effects. **Nature Medicine** **3**: 1150-1154.

# LÁSZLÓ ZIMÁNYI



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## RESEARCH AREA

Proteins are polypeptide chains characterized by unique amino acid sequences (primary structures) and specific secondary and tertiary three dimensional structures. They are the key players in many biophysical, biochemical and physiological processes. (*Nota bene*, many intrinsically disordered proteins have recently been discovered whose functional form lacks any defined 3D structure...). In many cases the presence of non-amino-acid cofactors is also essential for the protein's function. Typical examples are the proteins excited by visible light (e.g. in visual perception and light sensing), or certain electron transport – so called redox – proteins, such as the cytochromes, that are also colored. In our research group we study such "colorful" proteins, their properties, function, physiological roles, taking advantage of the fact that the structural changes accompanying their function can usually be followed by measuring their color changes using static or kinetic (rapid time-resolved) absorption spectroscopy. The colored (possessing chromophores) or the redox proteins may exhibit interesting or useful properties not only in their natural physiological environment but also in very different artificial environments. One can envisage biophotonics or bioelectronics applications from the appropriate interfacing of certain proteins with photonic crystals or semiconductor materials. Hence we also study the interactions of porous silicon based photonic crystals (periodic structures commensurate with the wavelength of light) and select proteins.

## TECHNIQUES AVAILABLE IN THE LAB

Expression and purification of proteins, static and kinetic spectroscopies, electrochemical technique (voltammetry), preparation and functionalization of porous silicon photonic samples, control of pulsed laser laboratory, Matlab programming language.

## SELECTED PUBLICATIONS

Hajdu, K., Gergely, C., Martin, M., Cloitre, T., **Zimányi, L.**, Tenger, K., Khoroshyy, P., Palestino, G., Agarwal, V., Hernádi, K., Németh, Z., Nagy, L. (2012) Porous silicon / photosynthetic reaction center hybrid nanostructure. **Langmuir** **28**: 11866-11873.

Levantino, M., Cupane, A., **Zimányi, L.**, Ormos, P. (2004) Different relaxations in myoglobin after photolysis. **Proc Natl Acad Sci USA** **101**: 14402-14407.

**Zimányi, L.**, Kulcsár, Á., Lanyi, J.K., Sears, D.F., Saltiel, J. (1999) Singular value decomposition with self-modeling applied to determine bacteriorhodopsin intermediate spectra: Analysis of simulated data. **Proc Natl Acad Sci USA** **96**: 4408-4413.

**Zimányi, L.**, Kulcsár, Á., Lanyi, J.K., Sears, D.F., Saltiel, J. (1999) Intermediate spectra and photocycle kinetics of the Asp96 ->Asn mutant bacteriorhodopsin determined by singular value decomposition with self-modeling. **Proc Natl Acad Sci USA** **96**: 4414-4419.

Dér, A., Oroszi, L., Kulcsár, Á., **Zimányi, L.**, Tóth-Boconádi, R., Keszthelyi, L., Stoeckenius, W., Ormos, P. (1999) Interpretation of the spatial charge displacements in bacteriorhodopsin in terms of structural changes during the photocycle. **Proc Natl Acad Sci USA** **96**: 2776-2781.

# ISTVÁN ZUPKÓ



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### RESEARCH AREA

In spite of the impressive achievements in the treatment possibilities of malignant disorders, cancers still have leading roles in mortality statistics worldwide indicating the need for novel anticancer agents. Natural products and their analogs are inexhaustible source of drugs candidates. The main aims of our group are to identify potential lead molecules by screening isolated and synthetic compounds for their anticancer properties. *In vitro* cell culture based studies are performed in order to characterize the cancer selectivity and the mechanism of the action of the most promising hits.

### TECHNIQUES AVAILABLE IN THE LAB

Determination of antiproliferative action against cancer cells, cell cycle analysis by flow cytometry, fluorescent microscopy, tubulin polymerization assay, apoptosis detection (measurement of activities of caspases), cell-based assays for hormonal activity, Western blot analysis, RT-PCR.

### SELECTED PUBLICATIONS

- Bózsity, N., Minorics, R., Szabó, J., Mernyák, E., Schneider, G., Wölfling, J., Wang, H.C., Wu, C.C., Ocsovszki, I., **Zupkó, I.** (2017) Mechanism of antiproliferative action of a new d-secoestrone-triazole derivative in cervical cancer cells and its effect on cancer cell motility. *J Steroid Biochem Mol Biol* **165**: 247-57.
- Molnár, J., Szebeni, J.G., Csupor-Löffler, B., Hajdú, Z., Szekeres, T., Saiko, P., Ocsovszki, I., Puskás, G.L., Hohmann, J., **Zupkó, I.** (2016) Investigation of the antiproliferative properties of natural sesquiterpenes from Artemisia asiatica and Onopordum acanthium on HL-60 cells *in vitro*. *Int J Mol Sci* **17**: 83.
- Molnár, J., Frank, É., Minorics, R., Kádár, Z., Ocsovszki, I., Schönecker, B., Wölfling, J., **Zupkó, I.** (2015) A click approach to novel D-ring-substituted 16 $\alpha$ -triazoleestrone derivatives and characterization of their antiproliferative properties. *PLOS ONE* **10**: e0118104.
- Mernyák, E., Kovács, I., Minorics, R., Sere, P., Czégány, D., Sinka, I., Wölfling, J., Schneider, G., Újfaludi, Z., Boros, I., Ocsovszki, I., Varga, M., **Zupkó, I.** (2015) Synthesis of trans-16-triazolyl-13 $\alpha$ -methyl-17-estradiol diastereomers and the effects of structural modifications on their *in vitro* antiproliferative activities. *J Steroid Biochem Mol Biol* **150**: 123-34.
- Minorics, R., Bózsity, N., Molnár, J., Wölfling, J., Mernyák, E., Schneider, G., Ocsovszki, I., **Zupkó, I.** (2015) A molecular understanding of d-homoestrone-induced G2/M cell cycle arrest in HeLa human cervical carcinoma cells. *J Cell Mol Med* **19**: 2365-74.

# SZENT-GYÖRGYI JUNIOR MENTORS



"Science is built on the premise that Nature answers intelligent questions intelligently; so if no answer exists, there must be something wrong with the question."

*Albert Szent-Györgyi*

**Szent-Györgyi Mentors** have the opportunity to appoint a young talented researcher working in his/her laboratory who becomes the **Szent-Györgyi Junior Mentor** of the **Szent-Györgyi Student** and takes part in the Student's education actively.

Their main tasks are

- taking active part in the Student's education
- taking part in the Meeting of Nobel Laureates and Talented Students organized twice a year

The work of the 42 mentors is assisted by the 16 **Szent-Györgyi Junior Mentors** who are all scientists of the University of Szeged or the Hungarian Academy of Sciences Biological Research Center.

# GYÖNGYI ILONA CINEGE



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## RESEARCH AREA

Analysis of the Nimrod gene cluster in the model organism, *Drosophila melanogaster*. The cluster carries genes which encode proteins having role in the innate immune responses, as bacterial binding, phagocytosis, moreover composition of the first barrier, the cuticle. Furthermore, in the species of the *ananassae* subgroup following parasitoid wasp infection, multinucleated giant hemocytes (MGH) are synthesized, which kill with high efficiency the parasitoid larvae by encapsulation. We analyze the proteins expressed in the MGH, to better understand the effective killing procedure. We hope that our studies will serve as a granuloma model.

## TECHNIQUES AVAILABLE IN THE LAB

DNA preparation, construction of plasmids, generation of transgenic fly stocks, indirect immuno fluorescence, western blot, immunoprecipitation, immunohisto-chemistry, preparation of fluorophore labeled bacteria, phagocytosis, RNA isolation, RT-PCR, development of monoclonal antibodies.

## SELECTED PUBLICATIONS

Kari, B., Csordás, G., Honti, V., **Cinege, G.**, Williams, M.J., Andó, I., Kurucz, É. (2016) The raspberry gene is involved in the regulation of the cellular immune response in drosophila melanogaster. **PLoS One** **11**: e0150910.

Márkus, R., Lerner, Z., Honti, V., Csordás, G., Zsámboki, J., **Cinege, G.**, Párducz, Á., Lukacsovich, T., Kurucz, É., Andó, I. (2015) Multinucleated giant hemocytes are effector cells in cell-mediated immune responses of drosophila. **J Innate Immun** **7**: 340-53.

Honti, V., **Cinege, G.**, Csordás, G., Kurucz, É., Zsámboki, J., Evans, C.J., Banerjee, U., Andó, I. (2013) Variation of NimC1 expression in Drosophila stocks and transgenic strains. **FLY** **7**: 263-266.

**Cinege, G.**, Louis, S., Hänsch, R., Schnitzler, J.P. (2009) Regulation of isoprene synthase promoter by environmental and internal factors. **Plant Mol Biol** **69**: 593-604.

**Cinege, G.**, Kereszt, A., Kertész, S., Balogh, G., Dusha I. (2003) The roles of the different regions of the CycH protein in c-type cytochrome biogenesis in *Sinorhizobium meliloti*. **Mol Genet Genomics** **271**: 171-179.

# BÁLINT CSOBOZ



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## RESEARCH AREA

As a "central dogma" earlier it was suggested that stress-induced protein denaturation serves as a major stress-sensing machinery, which triggers the expression of the molecular chaperone heat shock proteins (HSPs). We have introduced a new but not exclusive cellular "membrane thermosensor" model, which predicts the existence of membrane-associated stress sensing and signaling mechanisms. It proposes that changes in the physical state and composition of lipid molecular species with the concomitant destabilization/reorganization of membrane microdomains ("rafts") can serve also as "molecular switches" to operate "cellular thermometers". Using mammalian cells and the fission yeast (*S. pombe*) as models we intend to elucidate the mechanism of membrane associated stress sensors, signaling pathways and the interplay and networking of potential cellular stress survival strategies. Since HSPs play a fundamental role in the pathology of several human diseases, understanding the mechanism whereby mammalian cells can elicit a stress response may also be of paramount importance for the design of novel drug molecules.

## SELECTED PUBLICATIONS

Török, Z., Crul, T., Maresca, B., Schütz, G.J., Viana, F., Dindia, L., Piotto, S., Brameshuber, M., Balogh, G., Péter, M., Porta, A., Trapani, A., Gombos, I., Glatz, A., Gungor, B., Peksel, B., Vigh, L. Jr., **Csoboz, B.**, Horváth, I., Vijayan, M.M., Hooper, P.L., Harwood, J.L., Vigh, L. (2014) Plasma membranes as heat stress sensors: from lipid-controlled molecular switches to therapeutic applications. *Biochim Biophys Acta* **1838**: 1594-618.

**Csoboz, B.**, Balogh, G.E., Kusz, E., Gombos, I., Peter, M., Crul, T., Gungor, B., Haracska, L., Bogdanovics, G., Torok, Z., Horvath, I., Vigh, L. (2013) Membrane fluidity matters: hyperthermia from the aspects of lipids and membranes. *Int J Hyperther* **29**: 491-499.

## TECHNIQUES AVAILABLE IN THE LAB

Classical biochemical and molecular biology methods.  
Fluorescent and confocal microscopy, tissue culture.

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## RESEARCH AREA

Genotyping has key importance for identifying the genetic susceptibility factors and for understanding the pathogenesis of human diseases. Our workgroup is focusing on Parkinson's disease (PD) which is the second most common neurodegenerative disorder and affects 1% of the population worldwide. The neural tissues express great amount of long non-coding RNAs, where they play important role in brain development, neuron function and maintenance, and are also related to the development of neurodegenerative diseases. We aimed to investigate the susceptibility roles of lncRNAs gene polymorphisms in the development of PD. In another project we investigate the genetics and molecular susceptibility factors of multifactorial human skin diseases, with a primary focus on psoriasis. By performing functional analyses of these factors, we try to understand how their mode of action leads to the pathogenesis of human disease.

## TECHNIQUES AVAILABLE IN THE LAB

After DNA isolation (from peripheral blood samples, cells or tissue samples) the polymorphism analysis is carried out using polymerase chain reaction (PCR) method.

The identified susceptibility factors are further analyzed both on cellular and histological level using various primary cells, cell lines and tissue samples.

For functional analyses, *in vitro* DNA techniques and gene-specific silencing methods are used. Gene and protein expression is assessed using PCR, western blot analysis, immunohistochemistry and immunocytochemistry, flow cytometry, and ELISA.

## SELECTED PUBLICATIONS

**Göblös, A.**, Danis, J., Vas, K., Bata-Csörgő, Z., Kemény, L., Dobozy, A., Széll, M. (2016) Keratinocytes express functional CARD18, a negative regulator of inflammasome activation, and its altered expression in psoriasis may contribute to disease pathogenesis. *Mol immunol* **73**: 10-18.

Szegedi, K., **Göblös, A.**, Bacsa, S., Antal, M., Németh, I.B., Bata-Csörgő, Z., Kemény, L., Dobozy, A., Széll, M. (2013) Expression and Functional Studies on the Noncoding RNA, PRINS. *Int J Mol Sci* **14**: 205-225.

Szabó, E.Z., Manczinger, M., **Göblös, A.**, Kemény, L., Lakatos, L. (2012) Switching on RNA silencing suppressor activity by restoring Argonaute binding to a viral protein. *J Virol* **86**: 8324-7.

Gellért, L., Fuzik, J., **Göblös, A.**, Sárközi, K., Marosi, M., Kis, Z., Farkas, T., Szatmári, I., Fülöp, F., Vécsei, L., Toldi, J. (2011) Neuroprotection with a new kynurenic acid analog in the four-vessel occlusion model of ischemia. *Eur J Pharmacol* **667**: 182-7.

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## RESEARCH AREA

Functional and morphological changes within mitochondria and their altered interaction with other organelles are suggested to play a critical role in the pathogenesis of various diseases associated with life-threatening organ dysfunction. Some of them, such as sepsis and ischaemia/reperfusion-induced injury (I/R) have more recently become an intensively developing field of basic research. Our main purpose is to investigate the underlying mitochondrial and cellular mechanisms involved in the corresponding animal model of diseases.

## TECHNIQUES AVAILABLE IN THE LAB

Preparation of intact mitochondria/tissue homogenates from various tissues/organs of laboratory animals (e.g., liver, small intestine and kidney), evaluation of cellular respiratory function and states using high-resolution respirometry (OROBOROS O2k), simultaneous monitoring of changes in mitochondrial membrane potential (safranin fluorescence), and mitochondrial reactive oxygen species (HRP/Amplex UltraRed assay). Assesement of oxidative and nitrosative stress markers.

## SELECTED PUBLICATIONS

- Kaszaki, J., László, I., **Juhász, L.**, Szabó, A. (2016) Szepszis-mikrokeringéstől a mitokondriumokig / Sepsis-from the microcirculation to the mitochondrial function. *Aneszteziológia és Intenzív Terápia* **47**: 15-22.
- Juhász, L.**, Déri, S., Kisvári, G., Kiss, A., Seprényi, G., Gardi, J., Végh, Á. (2014) The effect of ischaemic preconditioning on nitric oxide synthase activity during myocardial ischaemia and reperfusion in anaesthetized dogs. *Curr Res Cardiol* **2**: 73-78.
- Juhász, L.**, Kiss, A., Nyeső, E., Kovács, M., Seprényi, G., Kaszaki, J., Végh, Á. (2011) Is there a trigger role of peroxynitrite in the anti-arrhythmic effect of ischaemic preconditioning and peroxynitrite infusion? *Eur J Pharmacol* **667**: 306-313.
- Kiss, A., **Juhász, L.**, Seprényi, G., Kupai, K., Kaszaki, J., Végh, Á. (2010) The role of nitric oxide, superoxide and peroxynitrite in the anti-arrhythmic effects of preconditioning and peroxynitrite infusion in anaesthetized dogs. *Br J Pharmacol* **160**: 1263-1272.
- Kiss, A., **Juhász, L.**, Huliák, I., Végh, Á. (2008) Peroxynitrite decreases arrhythmias induced by ischaemia reperfusion in anaesthetized dogs, without involving mitochondrial KATP channels. *Br J Pharmacol* **155**: 1015-1024.

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## RESEARCH AREA

Skeletal muscle is capable of exceptional regeneration following injury. During the regeneration process, the quiescent satellite stem cells are activated and form myoblasts that will subsequently proliferate, differentiate, and then fuse into multinucleated myotubes. The analysis of signalling events of muscle regeneration and differentiation has an important role in developmental biology; and it helps to reveal the pathomechanisms and therapeutic possibilities of muscle diseases. Furthermore, it can contribute to enhance the muscle regeneration following sport injuries.

Skeletal muscle is a highly dynamic tissue; it can change in size in response to physiological effects, or due to diseases (e.g. chronic cardiac disease, chronic kidney diseases, or cancer). Our other research projects focus on the analysis of the molecular mechanisms influencing muscle adaptation, regulation of muscle size and metabolism.

## TECHNIQUES AVAILABLE IN THE LAB

Mammalian tissue culture techniques, *in vivo* animal models, immunohistochemistry, immunocytochemistry, fluorescent microscopy, image analysis, flow cytometry, cell cycle analysis, cell proliferation assays, spectrophotometry (measurement of enzyme activities, metabolites), PCR, co-immunoprecipitation, GTP-ase activity assays, Western blot.

## SELECTED PUBLICATIONS

Kocsis, T., Trencsenyi, G., Szabo, K., Baán, J.A., Müller, G., Mendler, L., Garai, I., Reinauer, H., Deak, F., Dux, L., **Keller-Pintér, A.** (2017) Myostatin propeptide mutation of the hypermuscular Compact mice decreases the formation of myostatin and improves insulin sensitivity. **Am J Physiol Endocrinol Metab** **312**: E150-E160.

Kocsis, T., Baán, J., Müller, G., Mendler, L., Dux, L., **Keller-Pintér, A.** (2014) Skeletal muscle cellularity and glycogen distribution in the hypermuscular Compact mice. **Eur J Histochem** **58**: 169-75.

Deák, F., Mátés, L., Korpos, É., Zvara, Á., Szénási, T., Kiricsi, M., Mendler, L., **Keller-Pintér, A.**, Ózsvári, B., Juhász, H., Sorokin, L., Dux, L., Mermod, N., Puskás, L.G., Kiss, I. (2014) Extracellular matrilin-2 deposition controls the myogenic program timing during muscle regeneration. **J Cell Sci** **127**: 3240-56.

Baán, J.A., Kocsis, T., **Keller-Pintér, A.**, Müller, G., Zádor, E., Dux, L., Mendler, L. (2013) The Compact mutation of myostatin causes a glycolytic shift in the phenotype of fast skeletal muscles. **J Histochem Cytochem** **60**: 889-900.

**Keller-Pintér, A.**, Bottka, S., Timar, J., Kulka, J., Katona, R., Dux, L., Deak, F., Szilak, L. (2010) Syndecan-4 promotes cytokinesis in a phosphorylation-dependent manner. **Cell Mol Life Sci** **67**: 1881–94.

# LÓRÁND KISS



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## RESEARCH AREA

Acute pancreatitis is a sudden inflammation of the pancreas. In 80% of cases, it presents in mild form; however, 20% of patients show moderate to severe condition with local and systemic complications including organ failure and sepsis. Although the pathogenesis of the disease is uncertain, excessive alcohol consumption and gallstone disease account for 70-80% of the cases of acute pancreatitis. It is a potentially fatal syndrome and the overall mortality can reach 10%. There are supportive therapies, but no specific treatment against it. The enzyme producing acinar, and fluid and bicarbonate secreting ductal cells are involved in the initiation and progression of the acute inflammation process. Although there is lot of knowledge about this disease, the exact pathomechanism is still unclear. Our aims are to investigate the roles of pancreatic acinar and ductal cells in the development of acute pancreatitis. Our hope is to eventually open up new therapeutic possibilities in acute pancreatitis.

## TECHNIQUES AVAILABLE IN THE LAB

Induction of acute pancreatitis in animals and the related surgery techniques, isolation of pancreatic acinar and ductal cells, measurement of enzyme (amylase, trypsin, myeloperoxidase, lactate dehydrogenase) activities, immunohistochemistry, confocal microscopy, histological analysis, ELISA, microspectrofluorimetry (intracellular pH measurement), microperfusion of pancreatic ducts, measurement of pancreatic ductal fluid secretion, Western blot analysis, RT-PCR, patch clamp technique.

## SELECTED PUBLICATIONS

- Sántha, P., Veszelka, S., Hoyk, Z., Mészáros, M., Walter, F.R., Tóth, A.E., **Kiss, L.**, Kincses, A., Oláh, Z., Seprényi, G., Rákely, G., Dér, A., Pákáski, M., Kálmán, J., Kittel, Á., Deli, M.A. (2016) Restraint Stress-Induced Morphological Changes at the Blood-Brain Barrier in Adult Rats. *Front Mol Neurosci* **8**: 88.
- Kiss, L.**, Hellinger, É., Pilbat, A.M., Kittel, Á., Török, Z., Füredi, A., Szakács, G., Veszelka, S., Sipos, P., Ózsvári, B., Puskás, L.G., Vastag, M., Szabó-Révész, P., Deli, M.A. (2014) Sucrose Esters Increase Drug Penetration, But Do Not Inhibit P-Glycoprotein in Caco-2 Intestinal Epithelial Cells. *J Pharm Sci* **103**: 3107-3119.
- Tóth, A.E., Tóth, A., Walter, F.R., **Kiss, L.**, Veszelka, S., Ózsvári, B., Puskás, L.G., Heimesaat, M.M., Dohgu, S., Kataoka, Y., Rákely, G., Deli, M.A. (2014) Compounds Blocking Methylglyoxal-induced Protein Modification and Brain Endothelial Injury. *Arch Med Res* **45**: 753-764.
- Kiss, L.**, Walter, F.R., Bocsik, A., Veszelka, S., Ozsvári, B., Puskás, L.G., Szabó-Révész, P., Deli, M.A. (2013) Kinetic analysis of the toxicity of pharmaceutical excipients cremophor EL and RH40 on endothelial and epithelial cells. *J Pharm Sci* **102**: 1173-1181.
- Horvát, S., Fehér, A., Wolburg, H., Sipos, P., Veszelka, S., Tóth, A., **Kiss, L.**, Kurunczi, A., Balogh, G., Kürti, L., Eros, I., Szabó-Révész, P., Deli, M.A. (2009) Sodium hyaluronate as a mucoadhesive component in nasal formulation enhances delivery of molecules to brain tissue. *Eur J Pharm Biopharm* **72**: 252-259.

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### RESEARCH AREA

Epithelial cells are essential orchestrators of organ physiology by determining fluid and volume homeostasis and secreting many biologically active compounds (including enzymes and mucins). Furthermore impaired epithelial function is associated with a plethora of severe and potentially lethal diseases, such as cystic fibrosis, or acute pancreatitis, whereas malignant epithelial transformation leads to different forms of cancer. Thus, epithelial functions are extensively regulated, but the details of these regulatory pathways are not well understood. I believe that the detailed understanding of complex epithelial functions will lead to better treatment of lethal diseases therefore in my research projects I focus on the physiological and pathophysiological roles of pancreatic epithelial cells.

### TECHNIQUES AVAILABLE IN THE LAB

Isolation of pancreatic acinar and ductal cells, pancreatic organoid cultures, cell culture techniques, confocal microscopy, fluorescent microscopy (intracellular pH, Ca<sup>2+</sup> concentration measurements), immunofluorescent staining, cell transfection, plasmid purification, transformation, fluorescence resonance energy transfer (FRET) measurements, measurement of pancreatic ductal fluid secretion, Western blot analysis, qPCR, induction of acute pancreatitis in animals, measurement of enzyme (amylase, trypsin, myeloperoxidase, lactate dehydrogenase) activities, histological analysis.

### SELECTED PUBLICATIONS

- Maléth, J., Balla, Z., Kui, B., Balázs, A., Katona, M., Judák, L., Németh, I., Pallagi, P., Kemény, L.V., Rakonczay, Jr., Z., Venglovecz, V., Földesi, I., Pető, Z., Somorácz, Á., Borka, K., Perdomo, D., Lukacs, G.L., Gray, M.A., Monterisi, S., Zaccolo, M., Sendler, M., Mayerle, J., Kühn, J.P., Lerch, M.M., Sahin-Tóth, M., Hegyi, P. (2015) Alcohol Disrupts Levels and Function of the Cystic Fibrosis Transmembrane Conductance Regulator to Promote Development of Pancreatitis. *Gastroenterology* **148**: 427-39.e16.**
- Maléth, J., Choi, S., Muallem, S., Ahuja, M. (2014) Translocation Between PI(4,5)P2-Poor and PI(4,5)P2-Rich Microdomains During Store Depletion Determines STIM1 Conformation and Orai1 Gating. *Nat Commun* **17**: 5843.**
- Jha, A., Ahuja, M., Maléth, J., Moreno, C.M., Yuan, J.P., Kim, M.S., Muallem, S. (2013) The STIM1 CTID domain determines access of SARAF to SOAR to regulate Orai1 channel function. *J Cell Biol* **202**: 71-9.**
- Pallagi, P., Venglovecz, V., Rakonczay, Jr., Z., Borka, K., Korompay, A., Ózsvári, B., Judák, L., Sahin-Tóth, M., Geisz, A., Schnúr, A., Maléth, J., Takács, T., Gray, M.A., Argent, B.E., Mayerle, J., Lerch, M.M., Wittman, T., Hegyi, P. (2011) Trypsin reduces pancreatic ductal bicarbonate secretion by inhibiting CFTR Cl<sup>-</sup> channels and luminal anion exchangers. *Gastroenterology* **141**: 2228–2239.e6.**
- Maléth, J., Venglovecz, V., Rázga, Zs., Tiszlavicz, L., Rakonczay, Jr., Z., Hegyi, P. (2011) The non-conjugated chenodeoxycholate induces severe mitochondrial damage and inhibits bicarbonate transport in pancreatic duct cells. *Gut* **60**: 136-8.**

# MÁTÉ MANCZINGER



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## RESEARCH AREA

The adaptive immune system has to differentiate between harmful and non-harmful agents. If differentiation is insufficient, either defense against pathogens is inappropriate or recognition of non-harmful peptides leads to allergy and autoimmunity. All of these indicate, that immune recognition is complex, but finely tuned at the same time. In our research, we examine adaptive immune recognition and its role in the pathogenesis of diseases. We are investigating infectious, autoimmune diseases and asthma at present. Additionally, the role of adaptive immunity in antitumor defense is also being examined. We mainly use bioinformatic tools for our analyses.

## TECHNIQUES AVAILABLE IN THE LAB

Programming in "R" language. Big data analysis, Statistical analysis, database processing, immunoinformatic analysis.

## SELECTED PUBLICATIONS

**Manczinger, M.**, Kemény, L. (2016) Method and non-transitory computer-readable computer program product for identification of effective drugs. **US Patent App 15: 198,366.**

**Manczinger, M.**, Bocsik, A., Kocsis, G.F., Vörös, A., Hegedűs, Z., Ördögh, L., Kondorosi, É., Marton, A., Vízler, C., Tubak, V., Deli, M., Kemény, L., Nagy, I., Lakatos, L. (2015) The absence of N-Acetyl-D-glucosamine causes attenuation of virulence of *Candida albicans* upon interaction with vaginal epithelial cells in vitro. **Biomed Res Int 2015:** 398045.

**Manczinger, M.**, Kemény, L. (2013) Novel factors in the pathogenesis of psoriasis and potential drug candidates are found with systems biology approach. **PLOS ONE 8:** e80751.

**Manczinger, M.**, Szabó, E.Z., Göblös, A., Kemény, L., Lakatos, L. (2012) Switching on RNA silencing suppressor activity by restoring argonaute binding to a viral protein. **J Virol 86:** 8324-7.

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## RESEARCH AREA

My main research interest is the identification of genetic susceptibility factors predisposing to the development of rare (monogenic) and common (multifactorial) skin diseases. Currently I am working on a rare skin disease, Brooke-Spiegler syndrome, characterized by the development of significantly stigmatizing tumors of the skin appendages. These studies would give the basis of the development of future genetic and pharmacogenomics screening tests with diagnostic or therapeutic purposes. Another field of interest is the development and Research area of causative treatment strategies such as cell-, gene-therapy methods.

## TECHNIQUES AVAILABLE IN THE LAB

Basic DNA techniques (genomic and cell free DNA isolation, PCR preparation, gel electrophoresis, sequencing, digital PCR measurements), polymorphism studies in multifactorial diseases, mutation screening in rare diseases, gene and protein expression analysis (Q-RT-PCR, Western blot), isolation and culturing of human cells, using skin organotypic model, transfection into human cell lines, RNA silencing, basic cell biology studies (migration, proliferation assays).

## SELECTED PUBLICATIONS

Koumbaris, G., Kypri, E., Tsangaras, K., Achilleos, A., Mina, P., Neofytou, M., Velissariou, V., Christopoulou, G., Kallikas, I., González-Liñán, A., Benusiene, E., Latos-Bielenska, A., Marek, P., Santana, A., **Nagy, N.**, Széll, M., Laudanski, P., Papageorgiou, E.A., Ioannides, M., Patsalis, P.C. (2016) Cell-Free DNA Analysis of Targeted Genomic Regions in Maternal Plasma for Non-Invasive Prenatal Testing of Trisomy 21, Trisomy 18, Trisomy 13, and Fetal Sex. *Clin Chem* **62**: 848-55.

Rebane, A., Runnel, T., Aab, A., Maslovskaja, J., Ruckert, B., Zimmermann, M., Plaas, M., Kaner, J., Treis, A., Pihlap, M., Haljasorg, U., Hermann, H., **Nagy, N.**, Kemeny, L., Erm, T., Kingo, K., Li, M., Boldin, M.P., Akdis, C.A. (2014) MicroRNA-146a alleviates chronic skin inflammation in atopic dermatitis through suppression of innate immune responses in keratinocytes. *J Allergy Clin Immun* **134**: 836-847.

Rebane, A., Zimmermann, M., Aab, A., Baurecht, H., Koreck, A., Karelson, M., Abram, K., Metsalu, T., Pihlap, M., Meyer, N., Folster-Holst, R., **Nagy, N.**, Kemeny, L., Kingo, K., Vilo, J., Illig, T., Akdis, M., Franke, A., Novak, N., Weidinger, S., Akdis, C.A. (2012) Mechanisms of IFN-gamma-induced apoptosis of human skin keratinocytes in patients with atopic dermatitis, *J Allergy Clin Immun* **129**: 1297-1306.

Tanaka, A., Weinel, S., **Nagy, N.**, O'Driscoll, M., Lai-Cheong, J.E., Kulp-Shorten, C.L., Knable, A., Carpenter, G., Fisher, S.A., Hiragun, M., Yanase, Y., Hide, M., Callen, J., McGrath, J.A. (2012) Germline mutation in ATR in autosomal-dominant oropharyngeal cancer syndrome. *Am J Hum Genet* **90**: 511-517.

**Nagy, N.**, Almaani, N., Tanaka, A., Lai-Cheong, J.E., Techanukul, T., Mellerio, J.E., McGrath, J.A. (2011) HB-EGF induces COL7A1 expression in keratinocytes and fibroblasts: possible mechanism underlying allogeneic fibroblast therapy in recessive dystrophic epidermolysis bullosa. *J Invest Dermatol* **131**: 1771-74.

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## RESEARCH AREA

Human pancreatic ductal epithelial cells (PDEC) produce an alkaline fluid which is essential for normal digestion and crucially important for the maintaining the integrity of the pancreas. These secretory processes are regulated by different intracellular mechanisms in which  $\text{Ca}^{2+}$  plays fundamental role. The function of pancreatic ductal fluid and  $\text{HCO}_3^-$  secretion plays a central role not just in the physiology, but also in the pathophysiology of the pancreas. Impaired pancreatic fluid and  $\text{HCO}_3^-$  secretion can lead to pancreatic damage and to the development of acute pancreatitis. Receptor induced intracellular  $\text{Ca}^{2+}$  release plays fundamental role in the regulation of  $\text{HCO}_3^-$  secretion, however sustained intracellular  $\text{Ca}^{2+}$  elevations in response to toxic factors (such as bile acids, or alcohol metabolites) inhibit secretory processes. The pathological elevation of intracellular  $\text{Ca}^{2+}$  concentration is one of the hallmarks of the development of AP. Therefore, comprehensive analysis of the physiological and pathophysiological  $\text{Ca}^{2+}$  signalling of PDEC is crucially important since it may offer potential therapeutic targets in AP.

## TECHNIQUES AVAILABLE IN THE LAB

Microspectrofluorimetry (intracellular  $\text{H}^+$ ,  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  concentration), microperfusion of pancreatic ducts, measurement of pancreatic ductal fluid secretion, patch clamp technic, FRET technic, induction of acute pancreatitis in animals, isolation of pancreatic acinar and ductal cells, measurement of enzyme (amylase, trypsin, myeloperoxidase, lactate dehydrogenase) activities, confocal microscopy, histological analysis, RT-PCR.

## SELECTED PUBLICATIONS

Maléth, J., Balázs, A., **Pallagi P.**, Balla, Z., Kui, B., Katona, M., Judák, L., Németh, I., Kemény, L.V., Rakonczay, Z. Jr, Venglovecz, V., Földesi, I., Pető, Z., Somorácz, Á., Borka, K., Perdomo, D., Lukacs, G.L., Gray, M.A., Monterisi, S., Zaccolo, M., Sendler, M., Mayerle, J., Kühn, J.P., Lerch, M.M., Sahin-Tóth, M., Hegyi, P. (2015) Alcohol disrupts levels and function of the cystic fibrosis transmembrane conductance regulator to promote development of pancreatitis. **Gastroenterology** **148**: 427-439.

Maléth, J., Madácsy, T., **Pallagi P.**, Balázs, A., Venglovecz, V., Rakonczay, Z. Jr, Hegyi, P. (2015) Pancreatic epithelial fluid and bicarbonate secretion is significantly elevated in the absence of peripheral serotonin. **Gut** **64**: 1497-8.

Kui, B., Balla, Z., Végh, E.T., **Pallagi P.**, Venglovecz, V., Iványi, B., Takács, T., Hegyi, P., Rakonczay, Z. Jr. (2014) Recent advances in the investigation of pancreatic inflammation induced by large doses of basic amino acids in rodents. **Lab Invest** **94**: 138-149.

**Pallagi, P.**, Balla, Z., Singh, A.K., Dósa, S., Iványi, B., Kukor, Z., Tóth, A., Riederer, B., Liu, Y.J., Engelhardt, R., Jármay, K., Szabó, A., Janovszky, Á., Perides, G., Venglovecz, V., Maléth, J., Wittmann, T., Takács, T., Gray, M.A., Gácser, A., Hegyi, P., Seidler, U., Rakonczay Jr, Z. (2014) The role of pancreatic ductal secretion in protection against acute pancreatitis in mice. **Crit Care Med** **42**: e177-88.

**Pallagi, P.**, Venglovecz, V., Rakonczay, Z., Borka, K., Korompay, A., Ózsvári, B., Judák, L., Sahin-Tóth, M., Geisz, A., Schnúr, A., Maléth, J., Takács, T., Gray, M.A., Argent, B.E., Mayerle, J., Lerch, M.M., Wittmann, T., Hegyi, P. (2011) Trypsin reduces pancreatic ductal bicarbonate secretion by inhibiting CFTR  $\text{Cl}^-$  channels and luminal anion exchangers. **Gastroenterology** **141**: 2228-2239.

# ROLAND PATAI



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## RESEARCH AREA

The saying originating from the US at the beginning of the previous century "*A picture is worth a thousand words*" is particularly adequate for the description of the complexity of the brain. A new discipline, called geometrical statistics, is used now by micro-anatomical photography to derive unbiased data characterizing the number, size, specified surface portions, etc. of nerve cells by using tiny samples from an enormously high population ( $\approx 200$  billion) of neurons constituting the brain.

The results of such investigations either may contribute to the interpretation of the industrial amount of data coming from (sometimes) automated molecular biology instruments, or may substitute those, when variations of biological functions should be attributed to distributional instead of quantitative changes in e.g. gene expression. The development of biological microstructural investigations is undoubtedly motivated by a typical human desire expressed by "*seeing is believing*". This is most obvious in the regular need of seeking the structural correlates of the results obtained by another cutting edge technology, electrophysiology.

Our micro-anatomical research is aimed to derive quantitative data characterizing nerve cells in healthy conditions, during disease and ageing, which are also suitable to measure the effect of treatments aimed to halt or reverse disease progression.

## TECHNIQUES AVAILABLE IN THE LAB

Microsurgical methods to induce acute neurodegeneration in experimental animals. Basic methods in structural investigations (light, fluorescent, and electron microscopic techniques), sample preparation methods for biological structural research, labeling techniques for molecular imaging and statistical basis of sampling for unbiased quantitative microscopy, derivation of biological relevant three-dimensional parameters from biological tissue, interactive and automatic computer assisted image analysis, image analysis programming languages.

## SELECTED PUBLICATIONS

**Patai, R., Nógrádi, B., Obál, I., Engelhardt, J.I., Siklós, L.** (2017) Calcium in the pathomechanism of amyotrophic lateral sclerosis – taking center stage? **Biochem Biophys Res Comm** **483**: 1031-1039.

**Paizs, M., Patai, R., Engelhardt, J.I., Katarova, Z., Obál, I., Siklós, L.** (2016) Axotomy leads to reduced calcium increase and earlier termination of CCL2 release in spinal motoneurons with upregulated parvalbumin followed by decreased neighboring microglial activation. **CNS Neur Disord Drug Targets**, in press.

**Patai, R., Nógrádi, B., Meszlényi, V., Obál, I., Engelhardt, J.I., Siklós, L.** (2016) Calcium ion is a common denominator in the pathophysiological processes of amyotrophic lateral sclerosis. **Ideggyogy. Sz.**, in press.

# MARIETTA ZITA POLES



## Institute of Surgical Research University of Szeged

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### RESEARCH AREA

The consequence of ischemia or hypoxia is the emergence of a reductive stress (proton accumulation) in an intracellular level. The following reperfusion or reoxygenation indicates the formation of high amounts of reactive oxygen- (ROS) and nitrogen species (RNS). The onset of oxidative and nitrosative stress aggravates the damages caused by ischemia and reperfusion thereafter. Thus there is a clear interest in developing novel anti-inflammatory therapeutic agents which can specifically attenuate the damages caused by the processes mentioned before in a molecular and cellular level. We have demonstrated the anti-inflammatory effects of inhaled methane ( $\text{CH}_4$ ) however there are many unanswered questions remained of its mechanism of action. Our aim is to investigate the protective role of  $\text{CH}_4$  inhalation on various damaged organs of systemic or local hypoxia and inflammatory processes such as sepsis.

### TECHNIQUES AVAILABLE IN THE LAB

Wide spectrum of performing surgical and microsurgical interventions on anesthetised rats and mice for invasive monitoring (e.g. arterial and venous blood pressure, cardiac output, arterial and venous oxygen levels). *In vivo* monitoring and measurement of microcirculation of various tissues in various conditions (e.g. hypoxia, inflammation) by imaging techniques such as fluorescent laser-scanning endomicroscopy or intravital microscopy. Monitoring and measurement of gastrointestinal motility by electrogastrography. *Ex vivo* monitoring and analysis of cellular and mitochondrial respiration with high-resolution respirometry. Measurements of various biochemical markers including the measurement of different enzyme activities. Preparing tissue sections with cryostat, or by whole-mount preparation, histochemical and immunohistochemical stainings.

### SELECTED PUBLICATIONS

- Bódi, N., Jancsó, Zs., Talapka, P., Pál, A., **Poles, M.Z.**, Bagyánszki, M., Hermesz, E., Fekete, É. (2014) Gut region-specific rearrangement of the cellular and subcellular compartments of nitric oxide synthases isoforms after chronic ethanol consumption in rats. **Histol Histopathol** **29**: 1547-1555.
- Talapka, P., Nagy, L., Pál, A., **Poles, M.Z.**, Berkó, A., Bagyánszki, M., Puskás, L.G., Fekete, É., Bódi, N. (2014) Alleviated mucosal and neuronal damage in a rat model of Crohn's disease. **World J Gastroenterol** **20**: 16690-16697.
- <sup>+</sup>Máté, Z., <sup>+</sup>**Poles, M.Z.**, Szabó, G., Bagyánszki, M., Talapka, P., Fekete, É., Bódi, N. (2013) Spatiotemporal expression pattern of DsRedT3/CCK gene construct during postnatal development of myenteric plexus in transgenic mice. **Cell Tissue Res** **352**: 199-206. <sup>+</sup>equal first authors
- Bódi, N., Talapka, P., **Poles, M.Z.**, Hermesz, E., Jancsó, Zs., Katarova, Z., Izbéki, F., Wittmann, T., Fekete, É., Bagyánszki, M. (2012) Gut region-specific diabetic damage to the capillary endothelium adjacent to the myenteric plexus. **Microcirculation** **19**: 316-326.

# MÁRTA JULIANNA SÁRKÖZY



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## RESEARCH AREA

Cardiovascular diseases and especially acute myocardial infarction are the leading causes of morbidity and mortality in developed countries. Metabolic diseases including hypercholesterolemia, diabetes mellitus, metabolic syndrome and chronic renal failure, are well known risk factors for cardiovascular diseases and their complications (e.g. diastolic dysfunction, left ventricular hypertrophy and fibrosis, heart failure, etc.). Our research group is interested in the investigation of molecular mechanisms playing a role in the development of acute myocardial infarction and cardiac complications of metabolic risk factors. Furthermore, we investigate myocardial adaptation to ischemia (i.e. ischemic preconditioning and postconditioning) in the presence or absence of metabolic risk factors. Our aim is to better understand the molecular mechanisms of heart diseases developing as a consequence of metabolic risk factors, and to discover possible new therapeutic strategies.

## TECHNIQUES AVAILABLE IN THE LAB

Induction and treatment of disease models (hyperlipidemia, diabetes mellitus, metabolic syndrome, chronic renal failure, radiation induced heart disease) in experimental animals, assessment of cardiac function and morphology by transthoracic echocardiography, surgical intervention to induce chronic renal failure, oral glucose tolerance test, Langendorff heart perfusion, induction of acute myocardial infarction, ischemic pre- and postconditioning, determination of infarct size, histological analysis, general biochemical methods (colorimetric assays, RT-PCR, ELISA, etc.) to determine metabolites (e.g. serum glucose, urea, creatinine, etc.), nucleic acids, proteins and enzyme activities (e.g. creatine kinase, lactate dehydrogenase, etc.).

## SELECTED PUBLICATIONS

Sárközy, M., Szűcs, G., Fekete, V., Pipicz, M., Éder, K., Gáspár, R., Sója, A., Pipis, J., Ferdinandy, P., Csonka, C., Csont, T. (2016) Transcriptomic alterations in the heart of non-obese type 2 diabetic Goto-Kakizaki rats. *Cardiovasc Diabetol* 15: 110.

Kicsatári, L., Sárközy, M., Kővári, B., Varga, Z., Gömöri, K., Morvay, N., Leprán, I., Hegyesi, H., Fábián, G., Cserni, B., Cserni, G., Csont, T., Kahán, Z. (2016) High-dose radiation induced heart damage in a rat model. *In Vivo* 30: 623-631.

Sárközy, M., Szűcs, G., Pipicz, M., Zvara, Á., Éder, K., Fekete, V., Szűcs, C., Bárkányi, J., Csonka, C., Puskás, L.G., Kónya, C., Ferdinandy, P., Csont, T. (2015) The effect of a preparation of minerals, vitamins and trace elements on the cardiac gene expression pattern in male diabetic rats. *Cardiovasc Diabetol* 15: 14:85.

Sárközy, M., Zvara, A., Gyémánt, N., Fekete, V., Kocsis, G.F., Pipis, J., Szűcs, G., Csonka, C., Puskás, L.G., Ferdinandy, P., Csont, T. (2013) Metabolic syndrome influences cardiac gene expression pattern at the transcript level in male ZDF rats. *Cardiovasc Diabetol* 12: 16.

Kocsis G.F., Sárközy, M., Bencsik, P., Pipicz, M., Varga, Z.V., Pálóczi, J., Csonka, C., Ferdinandy, P., Csont, T. (2012) Preconditioning protects the heart in a prolonged uremic condition. *Am J Physiol Heart Circ Physiol* 303: H1229-1236.

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## RESEARCH AREA

We work on integrated optical devices combined with microfluidics (design, production and usage). We develop such a label-free integrated optical biosensor that is capable of detecting bacteria via antibody-antigene reaction. Chroomoproteins (eg. Bacteriorhodopsin) are also studied in integrated optical devices as photoactive materials. We also develop a microfluidical model system for biological barriers (for example: blood-brain-barrier).

## TECHNIQUES AVAILABLE IN THE LAB

Creating and designing microfluidical devices and integrated optical devices (consisting of optical waveguides). Skills for usual devices can be found in a Clean Room: mask aligner (standard i-line and g-line photolithography), a maskless photolithography machine, a spincoater with photoresists, a plasma cleaner. Use of an inverted optical microscope, diode lasers and photodetectors. Devices in microfluidics: syringe pumps, peristaltic pumps and work with the PDMS silicone elastomer.

## SELECTED PUBLICATIONS

- Walter, F.R., **Valkai, S.**, Kincses, A., Petneházi, A., Czeller, T., Veszelka, S., Ormos, P., Deli, M.A., Dér, A. (2016) A versatile lab-on-a-chip tool for modeling biological barriers. **Sens Actuators B Chem** **222**: 1209-1219.
- Mathesz, A., **Valkai, S.**, Sipos, O., Stercz, B., Kocsis, B., Szabo, D., Der, A. (2015) Integralt optikai szenzor biológiai mintak gyors analizisehez. **Orvosi Hetilap** **156**: 2116-2119.
- Mathesz, A., Fabian, L., **Valkai, S.**, Alexandre, D., Marques, P.V.S., Ormos, P., Wolff, E.K., Der, A. (2013) High-speed integrated optical logic based on the protein bacteriorhodopsin. **Biosens Bioelectron** **46**: 48-52.
- Nagy, K., Sipos, O., **Valkai, S.**, Gombai, É., Hodula, O., Kerényi, Á., Ormos, P., Galajda, P. (2015) Microfluidic study of the chemotactic response of Escherichia coli to amino acids, signaling molecules and secondary metabolites. **Biomicrofluidics** **9**: Paper 044105.
- Der, A., Valkai, S., Mathesz, A., Ando, I., Wolff, E.K., Ormos, P. (2010) Protein-based all-optical sensor device. **Sens Actuators B Chem** **151**: 26-29.

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## RESEARCH AREA

Pharmaceutical treatment of most disorders of the central nervous system, including neurodegenerative diseases and brain tumors, is restricted due to the poor penetration of drugs across the blood-brain barrier, the major entry route for therapeutic compounds to the central nervous system. The great majority of neuropharmaceutical candidates, hydrophilic molecules, biopharmaceuticals, and efflux transporter ligands have a low permeability across the blood-brain barrier. Biocompatible and biodegradable drug targeting systems, so-called nanocarriers hold a great promise. Nanovesicles which can incorporate drug cargos and present on their surfaces ligands for blood-brain barrier endogenous nutrient transporters achieve increased specificity and efficacy for drug delivery across the blood-brain barrier. Combination of such ligands is a novel and innovative idea which could contribute to develop systems for better treatment of central nervous system diseases.

## TECHNIQUES AVAILABLE IN THE LAB

In vitro cell culture works, isolation of brain endothelial cells (rat/mouse), toxicity measurements (MTT/LDH tests, double cell nuclei staining, real-time cell monitoring assay), resistance measurement, cell uptake and blood-brain barrier transport experiments, immunohistochemistry, confocal microscopy, scanning electron microscopy, spectrofluorometer measurements. Preparation of nanoparticles, zeta potential and size measurements.

## SELECTED PUBLICATIONS

Sántha, P., **Veszalka, S.**, Hoyk, Z., Mészáros, M., Walter, FR., Tóth, AE., Kiss, L., Kincses, A., Oláh, Z., Seprényi, G., Rákely, G., Dér, A., Pákáski, M., Kálmán, J., Kittel, Á., Deli, MA. (2016) Restraint stress-induced morphological changes at the blood-brain barrier in adult rats. *Front Mol Neurosci* 8: Paper 88. 15 p.

Walter, FR., **Veszalka, S.**, Pásztói, M., Péterfi, ZA., Tóth, A., Rákely, G., Cervenak, L., Ábrahám, CS., Deli, MA. (2015) Tesmilifene modifies brain endothelial functions and opens the blood-brain/blood-glioma barrier. *J Neurochem* 134: 1040-1054.

**Veszalka, S.**, Tóth, A.E., Walter, F.R., Datki, Z., Mózes, E., Fülöp, L., Bozsó, Z., Hellinger, É., Vastag, M., Orsolits, B., Környei, Z., Penke, B., Deli, M.A. (2013) Docosahexaenoic acid reduces amyloid  $\beta$ -induced toxicity in cells of the neurovascular unit. *J Alzheimers Dis* 36: 487-501.

**Veszalka, S.**, Kittel, Á., Deli, M.A. (2011) Tools of Modelling Blood-Brain Barrier Penetrability: Chapter 9. In: Tihanyi K , Vastag M (editors), Solubility, Delivery and ADME Problems of Drugs and Drug-Candidates. 232 p., Washington: Bentham Science Publishers Ltd., 2011. pp. 166-188.

**Veszalka, S.**, Pásztói, M., Farkas, AE., Krizbai, I., Ngo, TK., Niwa, M., Abrahám, C., Deli, MA. (2007) Pentosan polysulfate protects brain endothelial cells against bacterial lipopolysaccharide-induced damages. *Neurochem Int* 50: 219-228.

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## RESEARCH AREA

In recent years increasing attention has been paid to neuroscience research, because the pathomechanism of neurological disorders with high socioeconomic burden is only partially revealed and in most cases the therapeutic possibilities are restricted as well. The aim of our studies is to find metabolic alterations with possible prognostic or therapeutic significance via the bioanalytical assessment of certain metabolites (e.g., compounds of the kynurenine pathway of the tryptophan metabolism, antioxidants, some neurotransmitters) from biological samples of neurological patients (e.g., suffering from migraine, pain, stroke, Alzheimer's disease and other neurocognitive disorders, multiple sclerosis, Parkinson's disease, Huntington's disease, and disorders accompanied with ataxia) or from samples obtained from their experimental models.

## TECHNIQUES AVAILABLE IN THE LAB

Induction of neurodegeneration in animals by certain toxins (sodium azide, 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine, 3-nitropropionic acid), the preparation of serum, cerebrospinal fluid and nervous system samples for bioanalytical procedures, HPLC (quantification of tryptophan metabolites, tocopherols, biogenic amines, GABA and glutamate with UV, fluorescent or electrochemical detectors), ELISA (quantification of beta-amyloid, tau and phospho-tau), spectrophotometry and nephelometry.

## SELECTED PUBLICATIONS

- Veres, G., Fejes-Szabó, A., **Zádori, D.**, Nagy-Grócz, G., László, M.A., Bajtai, A., Mándity, I., Szentirmai, M., Bohár, Z., Laborc, K., Szatmári, I., Fülöp, F., Vécsei, L., Párdutz, Á. (2017) A comparative assessment of two kynurenic acid analogs in the formalin model of trigeminal activation: a behavioral, immunohistochemical and pharmacokinetic study. *J Neural Transm* **124**: 99-112.
- Veres, G., Molnár, M., **Zádori, D.**, Szentirmai, M., Szalárdy, L., Török, R., Fazekas, E., Ilisz, I., Vécsei, L., Klivényi, P. (2015) Central nervous system-specific alterations in the tryptophan metabolism in the 3-nitropropionic acid model of Huntington's disease. *Pharmacol Biochem Behav* **132**: 115-124.
- Zádori, D.**, Ilisz, I., Klivényi, P., Szatmári, I., Fülöp, F., Toldi, J., Vécsei, L., Péter, A. (2011) Time-course of kynurenic acid concentration in mouse serum following the administration of a novel kynurenic acid analog. *J Pharm Biomed Anal* **55**: 540-543.
- Zádori, D.**, Nyiri, G., Szőnyi, A., Szatmári, I., Fülöp, F., Toldi, J., Freund, T.F., Vécsei, L., Klivényi, P. (2011) Neuroprotective effects of a novel kynurenic acid analogue in a transgenic mouse model of Huntington's disease. *J Neural Transm* **118**: 865-875.
- Zádori, D.**, Geisz, A., Vámos, E., Vécsei, L., Klivényi, P. (2009) Valproate ameliorates the survival and the motor performance in a transgenic mouse model of Huntington's disease. *Pharmacol Biochem Behav* **94**: 148-153.

# SZENT-GYÖRGYI STUDENTS



"Discovery is seeing what everybody else has seen, and thinking what nobody else has thought."

*Albert Szent-Györgyi*

**Szent-Györgyi Students** can become members of the Szeged Scientists Academy after their successful admission. These students have already achieved successes as secondary school pupils at the national OKTV and at various international natural sciences competitions. They are especially interested in medical and health sciences, including medical and biological research, and they hope for a career in the field of scientific activities. They are thoughtful, creative, open-minded people; driven by insatiable academic curiosity.

**Szent-Györgyi Students** have the opportunity to establish a reliable, internationally recognised and renowned career that rests on a widespread network of international science and research.

**Szent-Györgyi Students** have the ability to join research groups of domestic and foreign mentors so as to systematically achieve their future goals.

In the academic year of 2016/17 33 **Szent-Györgyi Students** participated in the Szeged Scientists Academy program.

# ARMAND RAFAEL BÁLINT



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yes

## SZENT-GYÖRGYI MENTOR:

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## SPECIALTY:

neurophysiology and  
cerebrovascular physiology

## SECONDARY SCHOOL:

Radnóti Miklós Experimental  
Grammar School, Szeged

## NAME OF TEACHER:

Éva Fazekasné Gulyás

## LANGUAGES:

English/intermediate

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Brain injuries as a result of stroke can have devastating effects on the patients' quality of life, and they impose a heavy burden on the health care system. The resultant neurological deficit obviously depends upon the severity and nature of the initial injury, but also upon secondary and progressive deleterious events, such as waves of brain cell malfunction that propagate across the regions surrounding the initial brain lesion. Our research activities focus on various aspects of the pathophysiology of cerebrovascular diseases in experimental models to understand the progression of secondary neuronal injury. Our specific aim is to understand the impact of old age on the severity of ischemic brain injury. This is a highly relevant question, taken that cerebrovascular diseases predominantly occur in the aging population. We rely on a new and powerful experimental strategy: real-time imaging of fluorescent tracers in combination with blood flow imaging to show how spreading depolarization, cellular biochemistry and perfusion evolve within the affected brain region. Our findings are expected to help identifying novel treatment targets in stroke.

## AIMS DURING HIS CAREER

I would like to contribute to an important discovery in neuro- and cerebrovascular physiology during my carrier. Furthermore, I would like to be acknowledged by other researchers working in my field of science. My main motivation is to produce scientific results which can lead to the development of more effective therapies and techniques.

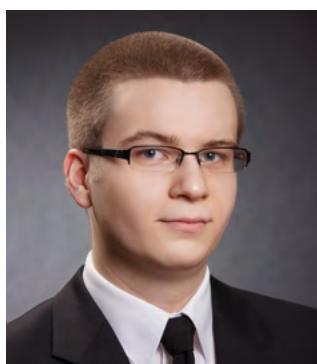
## HONORS AND PRIZES

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## PUBLICATIONS

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# SZABOLCS BENE



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## SZENT-GYÖRGYI PUPIL:

no

## SZENT-GYÖRGYI MENTOR:

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## SPECIALTY:

genetics

## SECONDARY SCHOOL:

Secondary School of  
Economics and Informatics  
of Cegléd

## NAME OF TEACHER:

Ágnes Kotlárné Bíró

## LANGUAGES:

English/intermediate  
French/intermediate

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Stalling of the DNA replication machinery, which takes place as a consequence of encountering unrepaired DNA damage, is a challenge for cells. In certain cases these mutations result in cancerous degeneration of cells. Our research laboratory is interested in the driving forces and molecular mechanisms of mutagenesis and carcinogenesis. We aim to answer the questions of how certain mutations promote tumour development and evolution, which genes are commonly mutated in cancer, and how these mutations contribute to tumour development and drug resistance. To achieve these goals we employ human tissue culture-based reporter systems, next-generation DNA sequencing, and purified proteins in reconstituted reaction pathways.

## AIMS DURING HIS CAREER

Cancerous diseases are among the main causes of death. Thus, understanding the development of tumours and their functional mechanisms is an important aim of biomedical and molecular biological research. Exploring these questions is necessary for medical treatment. Although I am not a medical student I believe I can participate in the development of this research field as a molecular biologist.

## HONORS AND PRIZES

- 2016: National Student Competition Assay – Biology Category I. 16<sup>th</sup> place

## PUBLICATIONS

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# ROLAND FEJES



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## SZENT-GYÖRGYI PUPIL:

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## SZENT-GYÖRGYI MENTOR:

Dr. József Kaszaki

## SPECIALTY:

physiology – circulatory physiology;

pathophysiology – circulatory shock pathophysiology

## SECONDARY SCHOOL:

Radnóti Miklós Experimental Grammar School, Szeged

## NAME OF TEACHER:

Béla Gál

## LANGUAGES:

German/advanced

English/intermediate

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Sepsis is a complex syndrome which attacks the whole body and as a serious uncotrolled inflammation can lead to death. Not only the diagnosing, but also the treating is hard because the sequence of the patomechanism is unknown and in the therapy we have to count with the individual differences. The systemic inflammatory response syndrome (SIRS) leads to polyorgan failure with cardiovascular abnormities and hypoxia. It is proven that SIRS damages the oxidative phosphorylation in mitochondria which means the tapping of the energy balance of the whole cell. We think, if the background of this mechanism is well known the effective therapy of sepsis could be elaborated.

## AIMS DURING HIS CAREER

In this project my first goal is to learn *in vivo* techniques which I could do on small and big laboratory animals. I am interested in OROBOROS system which is a useful equipment to investigate mitochondrial functions. I would like to widen my theoritical and practical knowledge. By the end of the program, I would like to acquire quantitative and qualitative knowledge which I will be able to use bravely either in medical researches or in medical practice.

## HONORS AND PRIZES

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## PUBLICATIONS

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# ANNA GRASSALKOVICH



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## SZENT-GYÖRGYI MENTOR:

Dr. Péter Hegyi

---

## JUNIOR MENTOR

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## SPECIALTY:

gastroenterology

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## SECONDARY SCHOOL:

Berze Nagy János Secondary School, Gyöngyös

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## NAME OF TEACHER:

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## LANGUAGES:

English/advanced

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## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Acute pancreatitis is one of the most frequent gastrointestinal diseases that needs acute treatment in hospital and its mortality in serious cases can reach 30-60%. The specific treatment is still not solved which urges the identification of new drug targets. Earlier we showed that the damaged function of the cystic fibrosis transmembrane conductance regulator chloride channel (CFTR) decreases the pancreatic ductal bicarbonate secretion. We also suggested that the decreased secretion significantly increases the severity of the pancreatic inflammation. In my present research my aim is to correct the function of CFTR during acute pancreatitis which might be a special treatment option in the treatment of acute pancreatitis.

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## AIMS DURING HER CAREER

During my research career, I would like to focus on the identification of basic mechanisms that can be used in the clinical practice. With my results I would like to improve the effectiveness of the clinical treatment and quality of life of patients suffering from inflammatory diseases.

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## HONORS AND PRIZES

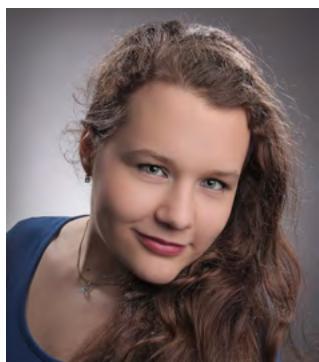
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## PUBLICATIONS

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# SZUZINA GYULAI-NAGY



**Szeged Scientists Academy, 1<sup>st</sup> year**

**University of Szeged,  
Faculty of Medicine, 1<sup>st</sup> year**

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## DATE OF BIRTH:

1997

## SZENT-GYÖRGYI PUPIL:

no

## SZENT-GYÖRGYI MENTOR:

Dr. László Dux

## JUNIOR MENTOR:

Dr. Anikó Keller-Pintér

## SPECIALTY:

skeletal muscle regeneration  
and adaptation

## SECONDARY SCHOOL:

Radnóti Miklós Experimental  
Grammar School, Szeged

## NAME OF TEACHER:

Ádám Zoltán Seres  
Szilveszter Prókai  
Dr. Tamás Mező  
Gábor Ábrahám  
István Tigyi

## LANGUAGES:

English/advanced  
Spanish/intermediate

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

I have always been interested in natural sciences, I always wanted to become a scientist. I am amazed by the complexity and mystery of the human body: understanding how it works from the smallest parts to the whole is one of the most interesting questions I know.

The Szent-Györgyi Research Program gave me an opportunity to join the skeletal muscle adaptation research group of the Department of Biochemistry. The institute follows the muscle research traditions of the Szent-Györgyi school. The aim is to understand the molecular methods of the skeletal muscle regeneration and adaptation, what could have clinical application later.

## AIMS DURING HER CAREER

During my medical career my primary aim is to become a good doctor and meet the high expectations. While researching I am eager to use my obtained knowledge and also widen my scientific learning.

It's subservient to begin the scientists' and doctors' life-long learning as soon as possible.

## HONORS AND PRIZES

- OKTV Biology 37<sup>th</sup> place (2016)
- Young Talent of Szeged Prize (2015)
- OKTV Mathematics 5<sup>th</sup> place (2015)
- Middle European Mathematical Olympiad (MEMO) bronze medal (2014, 2015)
- European Girls' Mathematical Olympiad (EGMO) bronze medal (2014, 2015)
- High School Mathematical Journal (KöMaL) 2013 – 2<sup>nd</sup> place, 2014 – 1<sup>st</sup> place, 2015 – 4<sup>th</sup> place
- Budó Ágoston Physics Competition 2013 – 2<sup>nd</sup> place, 2014 – 1<sup>st</sup> place, 2015 – honorable mention
- International Hungarian Mathematical Competition (NMMV) 2013 – 1<sup>st</sup> place, 2014. – 2<sup>nd</sup> place + special prize
- Szőkefalvi-Nagy Gyula Mathematical Competition 2013 – 2<sup>nd</sup> place, 2014 – 1<sup>st</sup> place, 2015 – 1<sup>st</sup> place
- Arany Dániel Mathematical Competition 2013 – 2<sup>nd</sup> place, 2014 – 3<sup>rd</sup> place
- Star of Mathematics Prize (2012)

## PUBLICATIONS

# DÓRA HANTOSI



**Szeged Scientists Academy, 3<sup>rd</sup> year**

**University of Szeged,  
Faculty of Medicine, 3<sup>rd</sup> year**

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## DATE OF BIRTH:

1995

## SZENT-GYÖRGYI PUPIL:

yes

## SZENT-GYÖRGYI MENTOR:

Dr. Mária Deli

## SPECIALTY:

molecular neurobiology,  
biological barriers

## SECONDARY SCHOOL:

Radnóti Miklós Experimental  
Grammar School, Szeged

## NAME OF TEACHER:

Viktória Gál

## LANGUAGES:

English/advanced

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

In the therapy of neurological diseases the efficient transport of targeted drug delivery across the blood-brain barrier is a crucial question. Due to the presence of the active efflux pumps of brain endothelial cells and tight junctions the transport of potential drug candidates are usually low. As a solution to this problem vesicular and solid nanoparticles serve as promising candidates targeting the physiological transport pathways of the blood-brain barrier. The aim of our experiments was to measure the toxicity, uptake and transport rate of these particles on brain endothelial cells. We tested nano-sized, biocompatible and Evans-blue filled vesicles and solid nanoparticles on brain endothelial cell cultures during our work.

## AIMS DURING HER CAREER

Participating in oncological clinical and research work: I would like to work in a field which is relevant to my current research and also where I will have the opportunity to work in patient-care and laboratory work as well. I am also deeply interested in oncology itself, so I really believe that this is the field that I could reach my goals.

## HONORS AND PRIZES

- University of Szeged, Faculty of Medicine TDK conference; spring 2016 – 2<sup>nd</sup> place
- JPEMS scholarship
- JPEMS symposium – 1<sup>st</sup> place

## PUBLICATIONS

### Poster:

Mészáros, M., Kiss, L., **Hantosi, D.**, Bozsó, Z., Fülöp, L., Szalontai, B., Kóta, Z., Sipos, P., Szabó-Révész, P., Deli, M.A., Veszelka, S. Targeted nanoparticle delivery across brain endothelial cells using nutrient transporter ligands.

(7th Szeged International Workshop on Advances in Nanoscience,  
The 19th International Symposium on Signal Transduction at the Blood-Brain Barriers)

### Articles:

Veszelka, S., Bocsik, A., Walter, F.R., **Hantosi, D.**, Deli, M.A. (2015) Blood-brain barrier co-culture models to study nanoparticle penetration: focus on co-culture systems. *Acta Biol Szeged* 59: 157-168.

# MÁRK HARANGOZÓ



**Szeged Scientists Academy, 1<sup>st</sup> year**

**University of Szeged,  
Faculty of Medicine, 1<sup>st</sup> year**

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## DATE OF BIRTH:

1998

## SZENT-GYÖRGYI PUPIL:

yes

## SZENT-GYÖRGYI MENTOR:

Dr. Antal Berényi

## SPECIALTY:

neuroscience

## SECONDARY SCHOOL:

Radnóti Miklós Experimental Grammar School, Szeged

## NAME OF TEACHER:

Sándor Bán

## LANGUAGES:

English/advanced  
French/intermediate

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Anxiety and depression are responsible for one of the largest societal and individual burdens amongst the neuropsychiatric disorders and in many cases drug treatments cannot maintain an asymptomatic state. Former investigations showed that the mechanism of the transformation of concrete fear reactions into generalized anxiety is similar to that of the learning, although the exact neuronal mechanisms in the background are still unknown. Successful animal experiments and clinical investigations proved that the depression and anxiety can be made asymptomatic by electrical stimulation, although this effect is rather diffuse. The aim of my work is to explore the neuronal networks and cell-type specific chokepoints which are responsible for the efficacy of the electrical therapies. In our experiments we use different transgenic animal models in which cell-type specific optoproteins are expressed, making their selective excitation or inhibition feasible. Fear reactions are going to be evoked by using *lege artis* electrical footshock and we attempt to prevent their generalization into anxiety by optical stimulation. The efficacy of the stimulation will be evaluated by measuring the level of anxiety after re-exposure to a similar environment by standard psychophysiological methods (e.g. freezing). The long-term goal of my work is to develop non-pharmaceutical methods to treat drug-resistant anxiety and post-traumatic stress disorder.

## AIMS DURING HIS CAREER

After obtaining my medical degree, I would like to become an internationally known physicist and researcher. I would like to get a PhD and a postdoctoral degree, too. In order to get experience, I would like to work abroad, mainly either in the US or in the UK as a member of an international team.

## HONORS AND PRIZES

- 2014 iGEM HS division: Best Experimental Measurement (as the member of team HUNGENIOUS)
- 2015 EUSO: silver medal (as the member of the Hungarian team)

## PUBLICATIONS

# ANDRÁS KISPÁL



**Szeged Scientists Academy, 1<sup>st</sup> year**

**University of Szeged,  
Faculty of Science and Informatics, 1<sup>st</sup> year**

**E:** kispala92@gmail.com

**T:** +36 30/536-8644

## DATE OF BIRTH:

1992

## SZENT-GYÖRGYI PUPIL:

no

## SZENT-GYÖRGYI MENTOR:

Dr. Antal Berényi

## SPECIALTY:

neuroscience

## SECONDARY SCHOOL:

Dózsa György Secondary School, Budapest

## NAME OF TEACHER:

Sára Szentpéteri

## LANGUAGES:

English/advanced  
German/intermediate

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Every movement, activity and thought is due to our brain, the complexity of which cannot be compared to anything except for the structure of the Universe itself. Nevertheless, no system can operate perfectly, but the understanding and the termination of the disfunctions is a huge challenge. That is why my research is built around the revealing of the depression/anxiety/fear oscillatory biomarkers and their modification with radiofrequency and ultrasound waves.

## AIMS DURING HIS CAREER

I want to help the work of doctors and widen the borders of medicine with my research. My research goals include a more in-depth study and understanding of different brain structures and functions. In addition, my long-term aim is to develop new technological equipment.

## HONORS AND PRIZES

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## PUBLICATIONS

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# LILIÁNA KISS



**Szeged Scientists Academy, 3<sup>rd</sup> year**

**University of Szeged,  
Faculty of Medicine, 3<sup>rd</sup> year**

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## DATE OF BIRTH:

1995

## SZENT-GYÖRGYI PUPIL:

yes

## SZENT-GYÖRGYI MENTOR:

Dr. József Kaszaki

## JUNIOR MENTOR:

Dr. Marietta Zita Poles

## SPECIALTY:

physiology-pathophysiology, circulation and circulatory shock research

## SECONDARY SCHOOL:

Bethlen Gábor Secondary School, Hódmezővásárhely

## NAME OF TEACHER:

Ildikó Linda Csorba,  
Ilona Tünde Bereczné Szép

## LANGUAGES:

English/intermediate  
Arabic/intermediate (oral language exam)

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Currently, I work on the beneficial effects of methane inhalation under mild and strong hypoxic circumstances on systemic hemodynamic parameters and local tissue damage markers. The anti-inflammatory and antioxidant effects of methane inhalation has been proven in case of ischaemia/reperfusion diseases. However, the effect of methane under systemic hypoxia has remained unclear. We plan to answer this question with our recent *in vivo* research. Systemic hypoxia is a frequent consequence or component of many diseases, among others affects patients who suffer from chronic pulmonary disease. The significance of our research is to provide a possibility of a treatment against the hypoxia induced tissue damage. Our recent results show that methane inhalation alleviates the hypoxia caused nitrosative stress in the small intestine and lung, and based on indirect data (a decrease in tissue myeloperoxidase level) it may reduce tissue damage as well. Our future aim is to expand our research and to examine the effects of methane on the microcirculatory and morphological changes (with intravital microscopy and *in vivo* confocal laser scanning endomicroscopy, respectively) under septic shock induced hypoxia.

## AIMS DURING HER CAREER

Apart from clinical work, I would like to continue research in a subject related to my future specialization because I would like to know the exact causes of my future patients' disease. With my research I would like to serve my future patients and medicine as well.

## HONORS AND PRIZES

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## PUBLICATIONS

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# ANNA GEORGINA KOPASZ



**Szeged Scientists Academy, 1<sup>st</sup> year**

**University of Szeged,  
Faculty of Medicine, 1<sup>st</sup> year**

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## DATE OF BIRTH:

1998

## SZENT-GYÖRGYI PUPIL:

yes

## SZENT-GYÖRGYI MENTOR:

Dr. Tamás Csont

## SPECIALTY:

experimental cardiology

## SECONDARY SCHOOL:

Radnóti Miklós Experimental Grammar School, Szeged

## NAME OF TEACHER:

Viktória Gál

## LANGUAGES:

English/intermediate

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Cardiovascular diseases, especially acute myocardial infarction, are the leading causes of death in industrialized countries. Chronic kidney disease (CKD) increases the risk of acute myocardial infarction. Our research group investigates the morphological and functional consequences of CKD in the heart. Besides, we look at the cellular and molecular alterations in the heart in CKD (e.g. changes in gene and miRNA expression, or signaling). We also study how CKD affects acute myocardial infarction. Moreover, we examine the effect of CKD on the endogenous adaptive mechanisms of the heart leading to cardioprotection. We hope that we will be able to identify and modulate molecular mechanisms that are role players in the harmful cardiac effects of CKD.

## AIMS DURING HER CAREER

My main aim is to investigate the molecular background of metabolic diseases. I would like to study the adaptive cardioprotective mechanisms of the heart such as ischaemic or chemical preconditioning. Moreover, I am interested in the connection between metabolic diseases and ischaemic preconditioning because several metabolic diseases have been shown to attenuate the cardioprotective effect of ischaemic preconditioning, however, in CKD ischaemic preconditioning remains cardioprotective.

## HONORS AND PRIZES

- 16<sup>th</sup> National Research Student Conference (TUDOK), Medical Sciences Section, First Prize
- National High-School Competition in biology (OKTV) 7<sup>th</sup> place (2015), 17<sup>th</sup> place (2016)

## PUBLICATIONS

16<sup>th</sup> National Research Student Conference (TUDOK) abstract: **Kopasz Anna Georgina**, Az iszkémiás prekondícionálás csökkenti a kamrai aritmiakat, 2016

TDK Conference, 2016. Autumn, abstract: **Kopasz Anna Georgina**, Az iszkémiás prekondícionálás hatása a reperfúzió indukálta kamrai aritmáakra krónikus veseelégtelenségben, 2016. Évi Őszi Tudományos Diákköri Konferenciája, ISBN 978- 963-306-511-2

# DÉNES PÉTER KOVÁCS



**Szeged Scientists Academy, 1<sup>st</sup> year**

**University of Szeged,  
Faculty of Medicine, 2<sup>nd</sup> year**

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## DATE OF BIRTH:

1994

## SZENT-GYÖRGYI PUPIL:

no

## SZENT-GYÖRGYI MENTOR:

Dr. Zoltán Rakonczay

## JUNIOR MENTOR:

Dr. Lóránd Kiss

## SPECIALTY:

gastroenterology

## SECONDARY SCHOOL:

Árpád Secondary School,  
Budapest

## NAME OF TEACHER:

Róbert Kiss

## LANGUAGES:

English/advanced

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Our team investigates the pathogenesis of acute pancreatitis (AP), a sudden inflammatory disorder of the pancreas. This disorder of the gastrointestinal system affects thousands of people in our country each year, and has a significant mortality rate. The causes of AP include biliary disease related to gall stones, improper alcohol or food intake, genetic defects, as well as high serum triglyceride level.

We model the disease in rodents (mice, rats) using retrograde intraductal infusion of bile acids, or intraperitoneal injections of the cholecystokinin analogue cerulein or basic amino acids (L-arginine or L-ornithine). After the induction of AP, we isolate ducts or acinar cells from the pancreas and observe them. We investigate the mRNA expression of ion transporters with immunohistochemistry, Polymerase Chain Reaction (PCR) and Western blot technique. By intracellular pH measurement and patch clamp technique, we study the functions of ion channels. Our main goals are to understand the role of these transport proteins, their changes caused by AP, and to use this knowledge to work out novel treatments.

## AIMS DURING HIS CAREER

My goal is to improve and extend my knowledge, this is the reason I applied to this program. My long-term intentions are to become an unexceptional expert, and to see my efforts bring success. I hope that through these achievements, treatment of the disease will advance.

## HONORS AND PRIZES

Attendance at:

- OKTV Biology 2011, 2012
- Sándor Mikola Physics competition 2009, 2010

## PUBLICATIONS

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# SÁRA NOÉMI MAGYAR



**Szeged Scientists Academy, 2<sup>nd</sup> year**

**University of Szeged,  
Faculty of Medicine, 2<sup>nd</sup> year**

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**T:** +36 30/4456-434

## DATE OF BIRTH:

1996

## SZENT-GYÖRGYI PUPIL:

yes

## SZENT-GYÖRGYI MENTOR:

Dr. László Vígh

## JUNIOR MENTOR:

Bálint Csoboz

## SPECIALTY:

molecular stressbiology

## SECONDARY SCHOOL:

Berze Nagy János Secondary School, Gyöngyös

## NAME OF TEACHER:

Katalin Molnárné Borbás

## LANGUAGES:

English/intermediate

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Ionizing radiation combined with chemotherapy and surgery are the key current therapeutic approaches to cancer. Despite enormous progress made in the instrumentation for delivery of radiotherapy the clinical outcome still remains unsatisfactory. The damage of the surrounding non-cancerous tissues upon radiation limits the efficacy of radiation therapy. In order to be able to circumvent these limitations molecular factors and mechanisms that could alleviate tissue damage upon radiation have come to the focus of oncological research. From the wide array of such possible candidates a family of proteins termed as heat shock proteins (HSPs) has gained more and more attention in recent years in the context of cellular survival upon radiation damage. Heat shock protein are general stress proteins activated upon a great variety of stress conditions including gamma irradiation. In this study we are aiming to understand the induction kinetics of HSPs in non-cancerous and cancerous cells upon radiation therapy. In order to characterize a possible point of interference where HSP inducing treatments could be utilized to enhance radiation induced survival in non-malignant tissues without the side effect of inducing tumor survival. The data gained from this study could possibly further the limits of currently used anti-cancer radiation therapies.

## AIMS DURING HER CAREER

I have not decided whether to become a doctor or researcher. Both of them are great choices, have lots of chances and have an effect on the medical system. I would like to experience both and afterwards I can make the perfect decision.

## HONORS AND PRIZES

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## PUBLICATIONS

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# SÁNDOR MÁRKI



**Szeged Scientists Academy, 4<sup>th</sup> year**

**University of Szeged,  
Faculty of Medicine, 4<sup>th</sup> year**

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## DATE OF BIRTH:

1995

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## SZENT-GYÖRGYI PUPIL:

no

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## SZENT-GYÖRGYI MENTOR:

Dr. Márta Széll

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## JUNIOR MENTOR:

Dr. Anikó Göblös

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## SPECIALTY:

genetics

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## SECONDARY SCHOOL:

Horváth Mihály Secondary School, Szenetesz

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## NAME OF TEACHER:

Mónika Kátai

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## LANGUAGES:

English/intermediate

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## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Currently, we examine the predisposing mutations that are related to Parkinson's disease. This disease is one of the most frequent neurodegenerative disease which we cannot cure yet. We are trying to identify nucleotide-differences of long non-coding RNAs which could be related to this disease. We examine genes which show different expression pattern in neurodegenerative diseases. The importance of the technique is that these could be targeted molecular targets to an already existing or to be discovered gene-therapy proceedings. One of the polymorphisms of the BC200-gene has shown significant difference between the Parkinson's disease and the control group. Later we plan to do the functional analysis of this polymorphism.

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## AIMS DURING HIS CAREER

I would like to know more about the genetics of neurological diseases. By understanding the pathomechanisms of these neurodegenerative diseases and the improvement of the gene therapy we could finally cure these diseases. Apart from that, I am interested in the cognitive and affective operation of the human brain and I would like to understand it more deeply.

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## HONORS AND PRIZES

- 2016 Fall Annual TDK Conference, 3<sup>rd</sup> place, Special prize of the Clinical Neurogenetics Association

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## PUBLICATIONS

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# FANNI MAGDOLNA MÁRVÁNYKÖVI



**Szeged Scientists Academy, 1<sup>st</sup> year**

**University of Szeged,  
Faculty of Medicine, 2<sup>nd</sup> year**

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## DATE OF BIRTH:

1996

## SZENT-GYÖRGYI PUPIL:

no

## SZENT-GYÖRGYI MENTOR:

Dr. Tamás Csont

## JUNIOR MENTOR:

Dr. Márta Sárközy

## SPECIALTY:

biochemistry

## SECONDARY SCHOOL:

BMSZC Petrik Lajos Secondary School, Budapest

## NAME OF TEACHER:

György Láng  
Dr. Pálné Golopencza

## LANGUAGES:

English/advanced

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

In developed countries, the leading causes of death are cardiovascular diseases. Several conditions with metabolic alterations (e.g. hypercholesterolemia, diabetes mellitus, metabolic syndrome, etc.) increase the risk for cardiovascular diseases. Our research interest includes investigation of acute myocardial infarction, and the molecular mechanisms of cardiac complications of metabolic risk factors. Furthermore, we investigate adaptation to ischemia in the heart (i.e. ischemic preconditioning and postconditioning) in the presence or absence of metabolic risk factors. The abovementioned diseases are set up in *ex vivo* and *in vivo* models in our lab. The techniques we use include for instance echocardiography, Langendorff heart perfusion, measurement of the size of tissue necrosis, qPCR, and Western blot. We hope to understand better the mechanism of heart diseases developing as a consequence of metabolic risk factors, and to discover possible therapeutic treatment options.

## AIMS DURING HER CAREER

Beyond my university studies, this program gives me an opportunity to get closer to different aspects of science as a student. I hope that later in my career this knowledge can also be used in the clinics and in my further research. My aim is to translate the newly discovered research results into the clinical practice, thereby improving medical therapy.

## HONORS AND PRIZES

- 2015 – SZKTV (Basic Industrial Chemistry) participation in the final
- 2015 – OKTV (Biology) participation
- 2015 – OKTV (Chemistry) participation

## PUBLICATIONS

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# VALÉRIA ÉVA MESZLÉNYI



**Szeged Scientists Academy, 1<sup>st</sup> year**

**University of Szeged,  
Faculty of Medicine, 2<sup>nd</sup> year**

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## DATE OF BIRTH:

1996

## SZENT-GYÖRGYI PUPIL:

no

## SZENT-GYÖRGYI MENTOR:

Dr. László Siklós

## SPECIALTY:

neuroscience

## SECONDARY SCHOOL:

Petőfi Sándor Secondary School, Bonyhád

## NAME OF TEACHER:

Andrea Nagy

## LANGUAGES:

English/intermediate  
German/intermediate

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Our research unit is devoted to study the operation of the nervous system in physiological and pathological conditions. There are many neurodegenerative diseases, however, we focus on the amyotrophic lateral sclerosis which is the most common degenerative disease of the motor neuron system.

Our main goal is to understand the complex mechanism and consequences of the disease furthermore to find possible therapeutic approaches. In our current experiments we would like to investigate the changes in communication of motor neurons and their neighboring non-neuronal cells in their natural environment with the acute and chronic neurodegenerative animal models *in vivo*. From methodological point of view we rely on geometrical statistically derived biologically relevant three-dimensional parameters acquired by basic structural investigations (light, fluorescent, and electron microscopic techniques), and biological structural research, labeling techniques for molecular imaging.

## AIMS DURING HER CAREER

In the course of my scientific career I would like to study and understand the primary factors leading to the wide spectra of neurodegeneration and pathomechanisms of neuronal death. My aim is to accumulate proper knowledge that can serve the human society and medical science. I hope it will give me a possibility to contribute to development of novel therapeutic approaches.

## HONORS AND PRIZES

- 2015. Medallion of János Lotz (Silver Prize)
- 2015. 8<sup>th</sup> Dürer Competition in Chemistry (2<sup>nd</sup> Prize)
- 2014. SZTE Szent-Györgyi Educational Competition (3<sup>rd</sup> Prize)
- 2014. 7<sup>th</sup> Dürer Competition in Chemistry (3<sup>rd</sup> Prize)
- 2010. Talentum Prize obtained from Tolna County

## PUBLICATIONS

Patai, R., Nográdi, B., Meszlényi, V., Obál, I., Engelhardt, J.I., Siklós, L. (2017) Calcium ion is a common denominator in the pathophysiological processes of amyotrophic lateral sclerosis. **Clin Neurosci** (in press)

Meszlényi, V., Patai, R., Nográdi, B., Engelhardt, J.I., Siklós, L. (2017) Commentary: Calcium in the pathomechanism of amyotrophic lateral sclerosis - Taking center stage? **J Neurol Neuromed** (under review)

# ZSÓFIA FLÓRA NAGY



**Szeged Scientists Academy, 1<sup>st</sup> year**

**University of Szeged,  
Faculty of Medicine, 1<sup>st</sup> year**

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## DATE OF BIRTH:

1998

## SZENT-GYÖRGYI PUPIL:

yes

## SZENT-GYÖRGYI MENTOR:

Dr. Márta Széll

## JUNIOR MENTOR:

Dr. Nikoletta Nagy

## SPECIALTY:

genetics

## SECONDARY SCHOOL:

Városmajori Secondary  
School, Budapest

## NAME OF TEACHER:

Dr. Anna Solt Dr. Jánossyné

## LANGUAGES:

English/advanced

German/advanced

Latin/intermediate

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Amiotrophic lateral sclerosis (ALS) is a neurodegenerative disorder which cannot be cured efficiently up to this day. ALS significantly decreases the quality of life of the patient, and 3-5 years after the diagnosis leads to death. There are two forms of this disorder: familial and sporadic. Through sequencing the genome of patients scientists were able to detect some SNPs and genetic variability. The aim of our research is to further investigate the genetic background of amiotrophic lateral sclerosis. If we get to know the genetic background of ALS we could offer more targeted, more personal therapy.

## AIMS DURING HER CAREER

After finishing the medical school, I would like to get my PhD degree. I would like to work overseas or somewhere in Europe and I would like to pursue a career in research as a full time scientist.

## HONORS AND PRIZES

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## PUBLICATIONS

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# ANNA NÁSZAI



**Szeged Scientists Academy, 3<sup>rd</sup> year**

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Faculty of Medicine, 3<sup>rd</sup> year**

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## DATE OF BIRTH:

1996

## SZENT-GYÖRGYI PUPIL:

no

## SZENT-GYÖRGYI MENTOR:

Dr. Mihály Boros

## JUNIOR MENTOR:

Dr. László Juhász

## SPECIALTY:

biochemistry, physiology,  
pathophysiology

## SECONDARY SCHOOL:

Radnóti Miklós Experimental  
Grammar School, Szeged

## NAME OF TEACHER:

Sándor Bán

## LANGUAGES:

English/advanced

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

My research project is focused on the *in vitro* effects of methane on xanthine oxidoreductase (XOR) enzyme and peroxynitrite (PN). XOR is the main source of reactive oxygen species (ROS) in ischaemia/reperfusion (IR), while in hypoxic circumstances it can play a role nitric oxide (NO) production due to its nitrite and nitrate reductase activity. NO and superoxide can form PN which causes lipid peroxidation and protein nitration. It has been shown that exogenous methane decreases the oxidative and nitrosative stress. Our aim was to find the mechanisms through which methane can influence inflammatory processes. Our hypotheses on one hand were that methane due to its protein conformation modifying activity can influence the enzyme activity of XOR, and on the other hand it can decrease nitrosative stress by reacting with PN. In our present studies we use fluorometry for measuring the kinetic activity of XOR, chemiluminescence for measuring the amount of ROS produced by XOR, photometry for measuring the changes in nitrate/nitrite levels and enzyme-linked immunosorbent assay (ELISA) for measuring the amount of PN. In the future we would like to use gas chromatography-mass spectrometry (GC-MS) and NO trapping methods to precisely the exact reaction between methane and PN.

## AIMS DURING HER CAREER

I hope my research career will lead to a PhD degree and I do hope that I can witness that methane is used in clinics as a bioactive gas in decreasing IR injuries.

## HONORS AND PRIZES

- 2013 - European Union Science Olympiad (EUSO) - gold medal
- 2014 - OKTV Biology, II category, 19<sup>th</sup> place
- 2016 - Joint Program for European Medical Studies (JPEMS) scholarship

## PUBLICATIONS

-

# BERNÁT NÓGRÁDI



**Szeged Scientists Academy, 2<sup>nd</sup> year**

**University of Szeged,  
Faculty of Medicine, 2<sup>nd</sup> year**

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## DATE OF BIRTH:

1997

## SZENT-GYÖRGYI PUPIL:

no

## SZENT-GYÖRGYI MENTOR:

Dr. László Siklós

## JUNIOR MENTOR:

Dr. Roland Patai

## SPECIALTY:

neuroscience

## SECONDARY SCHOOL:

Deák Ferenc Secondary School, Szeged

## NAME OF TEACHER:

Jennifer Tusz

## LANGUAGES:

German/intermediate  
English/advanced  
Chinese/basic

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Our research group studies the etiology and the complex pathomechanisms of neuronal degeneration and other malicious events which can lead to neuronal death. Amongst degenerative diseases that take place in the central nervous system we focus on amyotrophic lateral sclerosis, one of the most common pathological conditions that can be characterized by the progressive loss of motor neurons. Our aim is to reveal and understand the complex pathological mechanisms from the level of the nervous circuits to the level of a single motor neuron, moreover, find possible therapeutic approaches. Last but not least our micro-anatomical research is aimed to derive quantitative data characterizing nerve cells in healthy conditions, during disease and ageing, which are also suitable to measure the effect of treatments aimed to halt or reverse disease progression.

## AIMS DURING HIS CAREER

My aim is to elucidate the pathomechanisms of acute and chronic neuronal degeneration that can open new therapeutic approaches in the long run. As for my scientific approach, I share my mentors' point of view that a scientist must sit down to a microscope and stand next to a patient with the same determination and enthusiasm, because in both cases the most important is to give hope to the people who suffer from the disease.

## HONORS AND PRIZES

- 2013 – “Experiments in fluid and gas dynamics” – Competition in Applied Physics for High School Students (2<sup>nd</sup> Prize)
- 2013 – Katalin Varga Scientific Symposium (3<sup>rd</sup> Prize)

## PUBLICATIONS

Patai, R., Nógrádi, B., Obál, I., Engelhardt, J.I., Siklós, L. (2016) Calcium in the pathomechanism of amyotrophic lateral sclerosis – taking center stage? **Biochem Biophys Res Commun** **483**: 1031-1039.

Meszlényi, V., Patai, R., Nógrádi, B., Engelhardt, J.I., Siklós, L. (2017) Commentary: Calcium in the pathomechanism of amyotrophic lateral sclerosis - Taking center stage? **J Neurol Neuromed** (under revision)

Patai, R., Nógrádi, B., Meszlényi, V., Obál, I., Engelhardt, J.I., Siklós, L. (2017) Az amiotrófikus lateráliszklerózis patofiziológiai tényezőinek központi kapcsolóeleme, a kalcium. **Idegy Szle** (in press)

# TÍMEA ÓVÁRI



## DATE OF BIRTH:

1994

## SZENT-GYÖRGYI PUPIL:

no

## SZENT-GYÖRGYI MENTOR:

Dr. Lajos Haracska

## SPECIALTY:

genetics

## SECONDARY SCHOOL:

Radnóti Miklós Experimental Grammar School, Szeged

## NAME OF TEACHER:

Sándor Bán

## LANGUAGES:

English/intermediate

**Szeged Scientists Academy, 4<sup>th</sup> year**

**University of Szeged,  
Faculty of Medicine, 4<sup>th</sup> year**

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## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Breast and ovarian cancer are the most frequent tumorous diseases in women. More than 22% of patients have BRCA gene mutation. Efficient targeted therapy has been discovered recently. Allelic loss (Loss-of-Heterozygosity) is the most frequent type of somatic inactivation of BRCA. In Hungary, there is no applicable method for detecting LOH. So, our aim is to develop a routine genetic test to detect allelic loss, which is based on next-generation sequencing.

## AIMS DURING HER CAREER

As a doctor I always wanted to cure my patients as efficiently as possible. I would like to apply the new diagnostic methods and therapies which means a lifetime learning and research.

## HONORS AND PRIZES

- University of Szeged, Annual Student Research Conference, 2016 Spring, 3<sup>rd</sup> prize
- University of Szeged, Annual Student Research Conference, 2016 Spring, 2<sup>nd</sup> prize
- University of Szeged, Annual Student Research Conference, 2016 Autumn, 2<sup>nd</sup> prize
- Korányi Frigyes Student Competition Assay, 2015, 1<sup>st</sup> prize

## PUBLICATIONS

Poster:

Study of loss of heterozygosity (LOH) in the BRCA1-2 tumor suppressor genes, Straub days, 2016

# BENJAMIN TAMÁS PAPP



**Szeged Scientists Academy, 3<sup>rd</sup> year**

**University of Szeged,  
Faculty of Medicine, 4<sup>th</sup> year**

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**T:** +36 20/367-5262

## DATE OF BIRTH:

1995

## SZENT-GYÖRGYI PUPIL:

no

## SZENT-GYÖRGYI MENTOR:

Dr. Lajos Kemény

## JUNIOR MENTOR:

Dr. Máté Manczinger

## SPECIALTY:

dermatology,  
immunology,  
bioinformatics

## SECONDARY SCHOOL:

Dobó Katalin Secondary  
School, Esztergom

## NAME OF TEACHER:

Zoltán Lampert

## LANGUAGES:

English/advanced  
Russian/basic

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

In our research, by bioinformatical methods, we try to identify possible correlations between the immune system, the personal commensal flora and different autoimmune, dermatological and cancerous diseases. We use methods of machine learning in the interest of exploring the different HLA-genotypes, using large, clinically relevant databases. In order to find the role of the alleles we also involve allele frequency databases. We think that we can find clinically relevant correlations in the promiscuity of different HLA-DRB alleles, and immunmediated diseases, e.g. allergy, asthma, acne. If we understand the personal immune mechanisms in case of melanoma patients it will lead us steps forward in the treatment of this disease.

## AIMS DURING HIS CAREER

I think that the development of medical sciences is strictly bound to the development of technology in general. During my career, I would like to be up to date with the most recent bioinformatical methods and I would like to see the use of them in the field of clinical researches. I would like to take part and contribute to the development of modern, personalized medicine.

## HONORS AND PRIZES

- 2016 Scientific Student's conference in Tírgu Mures, special prize, immunology

## PUBLICATIONS

-

# GERGŐ PORKOLÁB



**Szeged Scientists Academy, 1<sup>st</sup> year**

**University of Szeged,  
Faculty of Science and Informatics, 2<sup>nd</sup> year**

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## DATE OF BIRTH:

1996

## SZENT-GYÖRGYI PUPIL:

no

## SZENT-GYÖRGYI MENTOR:

Dr. Mária Deli

## JUNIOR MENTOR:

Dr. Szilvia Veszelka

## SPECIALTY:

cell biology, pharmacology

## SECONDARY SCHOOL:

Tömörkény István Secondary School

## NAME OF TEACHER:

Ildikó Vadászné Horváth

## LANGUAGES:

English/advanced

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

The blood-brain barrier (BBB) is a dynamic interface between the central nervous system (CNS) and the blood circulation. The main role of the BBB is to provide the most adequate environment for the CNS, to protect it from harmful substances and pathogens, and provide nutrients. This high selectivity of the BBB is a „mixed blessing”, however – it also prevents the majority of pharmaceutical drugs to enter the CNS, thus making it a challenge to treat diseases like brain tumours, Alzheimer’s disease, Parkinson’s disease or epilepsy. In many cases, potential neuropharmaceuticals are available, but the problem is they cannot reach their target because of the BBB.

The Biological Barriers Research Group of the BRC, Hungarian Academy of Sciences, which I had the opportunity to join, focuses on this problem. Drugs to be delivered to the CNS are loaded in nanovesicles. The surface of these nanovesicles are labelled with targeting molecules recognised by the transport proteins of brain capillary endothelial cells, thus helping the drug cargo to cross the BBB. As part of the team, I participate in the preparation, characterization and testing of these nanovesicles on cell culture-based models of the BBB. The long-term goal of our research group is to develop a nanovesicle system to effectively deliver neuropharmaceuticals into the CNS.

## AIMS DURING HIS CAREER

As a Szent-Györgyi Student my goal is to acquire the knowledge, skills, methods and experience necessary to conduct independent research work. My further aim is to carry on biomedical research with my own topic as a PhD student. As a scientific researcher I would like to find solutions for relevant problems of society, and achieve results to make peoples’ lives better.

## HONORS AND PRIZES

- Kazinczy-medal, 2015

## PUBLICATIONS

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# BÁLINT SOÓS



**Szeged Scientists Academy, 2<sup>nd</sup> year**

**University of Szeged,  
Faculty of Medicine, 2<sup>nd</sup> year**

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## DATE OF BIRTH:

1996

## SZENT-GYÖRGYI PUPIL:

yes

## SZENT-GYÖRGYI MENTOR:

Dr. István Andó

## JUNIOR MENTOR:

Dr. Gyöngyi Cinege

## SPECIALTY:

immunology

## SECONDARY SCHOOL:

Dobó Katalin Secondary School, Esztergom

## NAME OF TEACHER:

Mária Lampert  
Zoltán Lampert

## LANGUAGES:

English/advanced  
French/intermediate

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

The subject of my research is the primary, innate immunity. We use Drosophila as a model organism for the examinations, especially the members of the melanogaster and the ananassae subgroup. The specialities of the ananassae subgroup are the multinucleated giant hemocytes (MGHs) which can be formed during the immune induction of the larvae by, for example, endoparasitoid wasps. This kind of cells highly resemble to the cells of the human granulomata. The importance of better understanding these structures is that the diseases that cause them, like the tuberculosis, are still quite common. One of our purposes is the development of a novel granuloma model in Drosophila from which we can deduce the formation and function of the granulomata of the human diseases. The MGHs are a widespread defense mechanisms in nature thus we want to examine these in other species. By testing multiple species we can draw a conclusion of the evolution of this type of immunity.

## AIMS DURING HIS CAREER

I would like to be an acknowledged researcher. I would like to expand my knowledge in a laboratory abroad. I would like to work in the medical field in parallel with work in research.

## HONORS AND PRIZES

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## PUBLICATIONS

-

# FRANCISKA SZABÓ



**Szeged Scientists Academy, 1<sup>st</sup> year**

**University of Szeged,  
Faculty of Medicine, 1<sup>st</sup> year**

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## **DATE OF BIRTH:**

1997

## **SZENT-GYÖRGYI PUPIL:**

no

## **SZENT-GYÖRGYI MENTOR:**

Dr. István Krizbai

## **SPECIALTY:**

molecular neurobiology

## **SECONDARY SCHOOL:**

Secondary School, Balatonalmádi

## **NAME OF TEACHER:**

Dr. Anna Várkuti

## **LANGUAGES:**

English/advanced  
Italian/intermediate

## **IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH**

The topic of our research group is to describe the molecular biology of the function of the blood-brain barrier. Precisely, we examine the operation of it in case of different tumorous and inflammatory diseases. Although I have only started to do researches recently I can see that it is a very popular area of science which is in a quick and constant progress and development. The aim is to understand the function of the elements of the neurovascular unit and to map the differences between the various parts of the central nervous system including both the operation and the structure of the blood-brain barrier within physiological and pathological conditions. If we understand of these processes the doctors can have better understanding of neurological diseases and more effective treatments can be developed in the future.

## **AIMS DURING HER CAREER**

My aim is to be successful both as a researcher and a practising doctor. I want to help the development of the science of medicine and the work with other doctors using my results.

## **HONORS AND PRIZES**

-

## **PUBLICATIONS**

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# MÁRTON SZENTIRMAI



**Szeged Scientists Academy, 4<sup>th</sup> year**

**University of Szeged,  
Faculty of Medicine, 4<sup>th</sup> year**

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## DATE OF BIRTH:

1993

## SZENT-GYÖRGYI PUPIL:

no

## SZENT-GYÖRGYI MENTOR:

Dr. László Vécsei

## JUNIOR MENTOR:

Dr. Dénes Zádori

## SPECIALTY:

neurology

## SECONDARY SCHOOL:

Radnóti Miklós Experimental Grammar School, Szeged

## NAME OF TEACHER:

Sándor Bán

## LANGUAGES:

English/advanced

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

I perform my current researches at the Neurology Department of the University of Szeged. Our main focus is on the molecular pathology of different neurodegenerative disorders. We examine progression of symptoms causing central nervous system malfunctions in rat and mouse models and we search for possible therapeutic solutions. Currently, we are measuring the alterations of concentrations of molecules synthesised in the kynurenic pathway – especially the neuroprotective kynurenic acid - of the tryptophan metabolism in the brain in the azide model of rats which is a widely accepted model for Alzheimer's disease. In a parallel study, we measure tocopherol (vitamin E) concentrations in serum and brain samples of mice applying high performance liquid chromatographic (HPLC) method. Our goal is to validate a robust method which we can use with high confidence for our future measurements. Our results could help to understand more profoundly the progression of particular neurodegenerative disorders and the effect of some potentially therapeutic drugs.

## AIMS DURING HIS CAREER

1. Intense understanding of neurological disorders and investigate neurology.
2. Acquisition of different measurement methods during laboratory work and the generation of useful, publishable results in the field of neurology.

## PUBLICATIONS

Veres, G., Fejes-Szabó, A., Zádori, D., Nagy-Grócz, G., László, AM., Bajtai, A., Mányi, I., **Szentirmai, M.**, Bohár, Z., Laborc, K., Szatmári, I., Fülöp, F., Vécsei, L., Párdutz, Á. (2017) A comparative assessment of two kynurenic acid analogs in the formalin model of trigeminal activation: a behavioral, immunohistochemical and pharmacokinetic study. *J Neural Transm (Vienna)* **124**: 99-112.

Veres, G., Molnár, M., Zádori, D., **Szentirmai, M.**, Szalárdy, L., Török, R., Fazekas, E., Illisz, I., Vécsei, L., Klivényi, P. (2015) Central nervous system-specific alterations in the tryptophan metabolism in the 3-nitropropionic acid model of Huntington's disease. *Pharmacol Biochem Behav* **132**: 115-124.

Fejes-Szabó, A., Bohár, Z., Vámos, E., Nagy-Grócz, G., Tar, L., Veres, G., Zádori, D., **Szentirmai, M.**, Tajti, J., Szatmári, I., Fülöp, F., Toldi, J., Párdutz, Á., Vécsei, L. (2014) Pre-treatment with new kynurenic acid amide dose-dependently prevents the nitroglycerine-induced neuronal activation and sensitization in cervical part of trigemino-cervical complex. *J Neural Transm (Vienna)* **121**: 725-38.

# PETRA ÉVA SZILI



**Szeged Scientists Academy, 4<sup>th</sup> year**

**University of Szeged,  
Faculty of Science and Informatics,  
Biologist MSc, 2<sup>nd</sup> year**

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## DATE OF BIRTH:

1993

## SZENT-GYÖRGYI PUPIL:

no

## SZENT-GYÖRGYI MENTOR:

Dr. Csaba Pál

## SPECIALTY:

evolutionary genome engineering

## SECONDARY SCHOOL:

Munkácsy Mihály Secondary School, Kaposvár

## NAME OF TEACHER:

Gabriella Dávidné Varga

## LANGUAGES:

English/advanced  
German/intermediate

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Pathogenic bacteria tend to gain resistance against currently available antibiotics, which trend causes problems in the clinics worldwide. We believe that understanding the underlying molecular mechanisms of antibiotic resistance evolution will eventually lead to finding new, more efficient drugs or therapeutic perspectives.

The aim of my work is to utilize genome engineering and a method, developed in our lab. With its ability to incorporate mutations at an unprecedented speed and accuracy we gained an opportunity to model evolutionary processes faster and with an unprecedented accuracy. Based on my unpublished, preliminary data, my findings have a direct potential to advance both clinical and biotechnological research.

## AIMS DURING HER CAREER

My short term goal is to learn as much as possible about state-of-the-art, high throughput methods in biology and the bioinformatics of data analysis. With this knowledge in hand I hope to participate in researches that can be utilized in the clinics. My main motivation besides scientific curiosity is the wish to serve others with my work.

## HONORS AND PRIZES

- Student Competition of the University of Szeged for Medical Students, Spring of 2015 - 3<sup>rd</sup> place
- Student Competition of the University of Szeged for Medical Students, Fall of 2016 - Honorable Mention
- Student Competition of the University of Szeged for Biology Students, Fall of 2016 - 2<sup>nd</sup> place
- Sófi József Scholarship – Special Prize
- Sófi József Scholarship for Biologists – 3<sup>rd</sup> place
- Special Fund of the Hungarian Prime Minister
- Annual Fund of the Hungarian Government
- 'Új Nemzeti Kiválóság Program' - Governmental Fellowship for Student Research
- Special Fund of the City of Szeged
- 23<sup>rd</sup> International Biology Olympiad, Singapore – Bronze Medalist

## PUBLICATIONS

# KRISZTINA SZÓKE



**Szeged Scientists Academy, 1<sup>st</sup> year**

**University of Szeged,  
Faculty of Medicine, 2<sup>nd</sup> year**

**E:** krisztajung@gmail.com

**T:** +36 30/596-5854

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## DATE OF BIRTH:

1991

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## SZENT-GYÖRGYI PUPIL:

no

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## SZENT-GYÖRGYI MENTOR:

Dr. Mónika Kiricsi

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## SPECIALTY:

molecular biology, cell biology, nanotechnology

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## SECONDARY SCHOOL:

Radnóti Miklós Experimental Grammar School, Szeged

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## NAME OF TEACHER:

Sándor Bán

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## LANGUAGES:

English/advanced

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## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Our research group has been studying the effects of silver nanoparticles on ABC transporters and their enhancing effect on chemotherapy in multidrug resistant cancer. We found that silver nanoparticles inhibit the efflux activity and also the expression of ABC transporters which feature can be exploited in combinational drug therapy. Currently, we study the combined effect of gold nanoparticles and radiotherapy on breast cancer cells. Our aim is to find nanoparticles that can be used as combinational partners in chemotherapy.

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## AIMS DURING HER CAREER

I want to continue my studies in medicine and proceed with my academic training at the Faculty of Medicine of the University of Szeged. Upon graduation, I would like to become a practicing physician as well as a researcher in the field of immunology.

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## HONORS AND PRIZES

- University of Szeged, Scientific Students' Association Conference, 2016. March, 2<sup>nd</sup> Prize

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## PUBLICATIONS

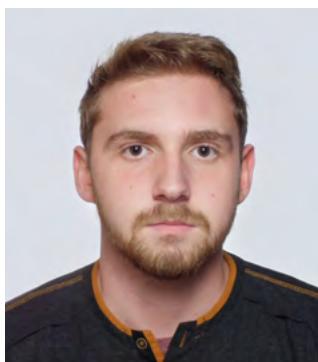
### Abstract:

Kovács, D., Igaz, N., Keskeny, C., Szőke, K., Rigó, R., Tóth, T., Spengler, G., Kónya, Z., Boros, IM., Kiricsi, M. (2015) Resistance Mechanisms in Silver-Citrate Nanoparticle Treated Cancer Cells In: Róbert Hohol, Zsuzsanna Heiszler, Nőra Éles-Etele (ed.) **Hungarian Molecular Life Sciences 2015: Program & Book of Abstracts.** 304 p. Place and date of conference: Eger, Hungary, 2015.03.27-2015.03.29. Budapest: Diamond Congress Ltd. Paper P-062. (ISBN:978-615-5270-15-4)

### Article:

Kovács, D., Szőke, K., Igaz, N., Spengler, G., Molnár, J., Tóth, T., Madarász, D., Rázga, Z., Kónya, Z., Boros. IM., Kiricsi, M. (2016) Silver nanoparticles modulate ABC transporter activity and enhance chemotherapy in multidrug resistant cancer. **Nanomed Nanotech Biol Med** 12: 601-10.

# MARTIN GYÖRGY TANNER



**Szeged Scientists Academy, 1<sup>st</sup> year**

**University of Szeged,  
Faculty of Medicine, 1<sup>st</sup> year**

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**T:** +36 20/444-2296

## DATE OF BIRTH:

1998

## SZENT-GYÖRGYI PUPIL:

yes

## SZENT-GYÖRGYI MENTOR:

Dr. András Dér

## JUNIOR MENTOR:

Dr. Sándor Valkai

## SPECIALTY:

bioelectronics

## SECONDARY SCHOOL:

Bonyhádi Petőfi Sándor  
Evangélikus Gimnázium

## NAME OF TEACHER:

János Pápai

## LANGUAGES:

English/intermediate  
German/basic

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

In our project, we deal with improvement and adaptation of chiplaboratory methods (based on specific recognition) which give us opportunity for quick protein and cell component analysis of biological samples (blood, liquor, urine). Nowadays many research teams work on biosensors which are reliable and sensitive, able to provide quick results. At the same time they are cheap and can be used without the assistance of doctors, in the patient's home. At present the most sensitive biosensors are based on marking (e.g. fluorescence, radioactive or magnetic), by following the marking material, so a molecule can be detected in the examined space or surface. Besides the advantages these methods have also disadvantages. The chemical methods of marking make the examination difficult, slow and expensive. The marking materials have an effect on the marked molecule. A new marking-free technologies attract the scientists, mainly the optical methods are becoming preferred. The integrated optical biosensors represent an important direction in this area, scientists work on interferometrical discipline. Interference-occurrence-based sensors have a great benefit: they are very sensitive to change of refraction index on their surface. The purpose of our work is to develop a biosensor based integrated optical interferometer which can be used for analytical purposes.

## AIMS DURING HIS CAREER

I would like to become a good doctor and scientist. I hope I will be able to achieve useful and applicable results in my research work as a creative, open thinking and acknowledged specialist.

## HONORS AND PRIZES

- 2015/16 Biology OKTV category II., final, 38<sup>th</sup> place
- 2014/15 Vermes Miklós International Competition of Physics, 7<sup>th</sup> place
- 2013/14 Budó Ágoston National Competition of Physics, Szeged, 3<sup>rd</sup> place
- Wigner Jenő Competition of Physics, Békéscsaba, 2<sup>nd</sup> place

## PUBLICATIONS

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# DÁVID TÁLAS



**Szeged Scientists Academy, 2<sup>nd</sup> year**

**University of Szeged,  
Faculty of Medicine, 2<sup>nd</sup> year**

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## DATE OF BIRTH:

1997

## SZENT-GYÖRGYI PUPIL:

no

## SZENT-GYÖRGYI MENTOR:

Dr. Péter Hegyi

## JUNIOR MENTOR:

Dr. Petra Pallagi

## SPECIALTY:

gastroenterology

## SECONDARY SCHOOL:

Andrássy Gyula Secondary School, Békéscsaba

## NAME OF TEACHER:

Klára Stefanik

## LANGUAGES:

English/advanced

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Chronic pancreatitis (CP) is a progressive inflammatory disease which decreases the life quality and life expectancy of patients. A serious difficulty is that CP does not have a specific therapy, therefore it leaves treatment options limited to treating symptoms and pain relief. Smoking and alcohol consumption are two of the greatest risk factors in the development of CP. It is known that pancreatic ductal fluid and bicarbonate secretion play a crucial role in the function of this organ. A previous research conducted by our research group has found that alcohol disrupts fluid and bicarbonate secretion. One of the most important membrane proteins playing a central role in these functions is the cystic fibrosis transmembrane conductance regulator (CFTR) protein, a CFTR Cl<sup>-</sup> channel. Since we already know that cigarette smoking is one of the greatest risk factors in the development of CP, we want to know the effects of smoking on CFTR function and expression on clinical patients and human tissue samples. Furthermore, we long to characterize the effects of smoking on pancreatic ductal fluid and HCO<sub>3</sub><sup>-</sup> secretion using *in vivo* and *in vitro* physiological and biochemical methods. Understanding the pathophysiology of the disease could create new therapeutic targets leading to more effective treatments for chronic pancreatitis.

## AIMS DURING HIS CAREER

I would like to do active research during and after my medical studies. My main goal is to contribute to developing new treatments for patients by describing the pathomechanisms of the diseases. Passing on my knowledge and experience to new generations via teaching, mentoring or leading a research group would be a pleasure.

## HONORS AND PRIZES

- 2016 - New National Excellence Program Scholarship

## PUBLICATIONS

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# DÁVID TÓTH



**Szeged Scientists Academy, 2<sup>nd</sup> year**

**University of Szeged,  
Faculty of Medicine, 2<sup>nd</sup> year**

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## DATE OF BIRTH:

1996

## SZENT-GYÖRGYI PUPIL:

no

## SZENT-GYÖRGYI MENTOR:

Dr. János Szabad

## SPECIALTY:

developmental genetics,  
autophagy

## SECONDARY SCHOOL:

Táncsics Mihály Secondary  
School, Orosháza

## NAME OF TEACHER:

László Francziszti, László Kiss

## LANGUAGES:

English/intermediate  
German/advanced

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

The center of our research is the role of the autophagy (self-eating process) during the development of an individual. The Nobel Prize in 2016 was awarded in this topic, which shows the importance of the autophagy. Our aim is to know what the role of 3 autophagy genes (Atg9, Atg14 and Syx17) are during the egg development. To answer our questions we made transplantational experiments. Our work proved that the mutant ovaries showed mutant phenotype in wild type circumstances so the function of the studied autophagy genes is essential in the ovary. Our future aim is to understand in which cell types of the ovary the function of the observed autophagy genes are essential.

## AIMS DURING HIS CAREER

Learn genetics on high level and teach others.

I would like to participate in the work of foreign labs to develop my skills.

## HONORS AND PRIZES

- 2016 Autumn: University of Szeged Faculty of Medicine - Scientific Student Conference 1<sup>st</sup> prize

## PUBLICATIONS

-

# RÉKA TÓTH



## DATE OF BIRTH:

1995

## SZENT-GYÖRGYI PUPIL:

yes

## SZENT-GYÖRGYI MENTOR:

Dr. Eszter Farkas

## SPECIALTY:

neurology

## SECONDARY SCHOOL:

SZTE Ságvári Endre Secondary School, Szeged

## NAME OF TEACHER:

István Csigér

## LANGUAGES:

English/advanced  
French/intermediate

## Szeged Scientists Academy, 3<sup>rd</sup> year

**University of Szeged,  
Faculty of Medicine, 3<sup>rd</sup> year**

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## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Stroke is the third most common cause of death in Hungary and Europe coming only after heart disease and cancer. Recurrent spreading depolarizations (SDs) spontaneously occur in the cerebral cortex after experimental induction of focal ischemia. SDs generate consistently and repeatedly in the injured human brain for at least over a week after the initial trauma, and contribute to lesion progression by worsening the perfusion of penumbra tissue. The central goal of our research is to understand the mechanisms that mediate the SD-coupled cerebral blood flow response and SD related neurodegeneration. Ultimately, we aim to identify targets to counteract the evolution of injurious spreading depolarizations and limit the progression of secondary injury. Our methodological approach includes classic electrophysiology, the use of ion selective microelectrodes, cerebral blood flow monitoring, and novel, experimental, optical neuroimaging.

## AIMS DURING HER CAREER

I would like to use the experience and knowledge that I acquire during my work, regardless of whether I will be working in fundamental research or clinical research. After finishing the university I would also like to start working on my PhD degree.

## HONORS AND PRIZES

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## PUBLICATIONS

Varga, D.P., Puskás, T., Menyhárt, Á., Hertelendy, P., Zölei-Szénási, D., **Tóth, R.**, Ivánkovits-Kiss, O., Bari, F., Farkas, E. (2016) Contribution of prostanoid signaling to the evolution of spreading depolarization and the associated cerebral blood flow response. *Sci Rep* **10**: 31402.

Puskás, T., **Tóth, R.**, Menyhárt, Á., Ivánkovits-Kiss, O., Bari, F., Farkas, E. *In vitro* examination of spreading depolarizations: establishing a new experimental setup and protocol. *Poszter, IBRO* 2016.

# ZSÓFIA EDIT TÓTH



**Szeged Scientists Academy, 1<sup>st</sup> year**

**University of Szeged,  
Faculty of Science and Informatics,  
Biology, 1<sup>st</sup> year**

**E:** zsofid98@gmail.com

**T:** +36 20/777-1271

## DATE OF BIRTH:

1998

## SZENT-GYÖRGYI PUPIL:

yes

## SZENT-GYÖRGYI MENTOR:

Dr. Lajos Haracska

## SPECIALTY:

genetics

## SECONDARY SCHOOL:

Radnóti Miklós Experimental Grammar School, Szeged

## NAME OF TEACHER:

Sándor Bán

## LANGUAGES:

English/advanced  
Spanish/basic

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Our genome which consists of approximately 3 billion DNA base pairs often contains unrepaired DNA damage, which may result in the stalling of the replication fork. To repair this DNA damage, different DNA damage bypass mechanisms have evolved that promote either error-free or error-prone replication through DNA lesions. Error-prone replications may lead to mutations.

Our research laboratory is interested in the driving forces and molecular mechanisms of mutagenesis and strives to give more insight into the molecular events of genome instability and carcinogenesis. We perform our analyses using human tissue culture-based reporter systems, next-generation DNA sequencing, and purified proteins in reconstituted reaction pathways.

## AIMS DURING HER CAREER

Cancer can be overcome without serious consequences if the tumor is diagnosed in time and adequate personal therapy is used. In the course of my research I would like to participate in the development of cancer treatment directed at molecular targets and to improve diagnostic and therapeutic procedures.

## HONORS AND PRIZES

- 2012- Kitaibel Pál Biology Competition - 17<sup>th</sup> place
- 2013- Árokszállásy Zoltán Biology Competition -18<sup>th</sup> place
- 2016- National Student Competition Assays 33<sup>rd</sup> place

## PUBLICATIONS

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# MIHÁLY ÚJHÁZI



**Szeged Scientists Academy, 3<sup>rd</sup> year**

**University of Szeged,  
Faculty of Medicine, 3<sup>rd</sup> year**

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## DATE OF BIRTH:

1996

## SZENT-GYÖRGYI PUPIL:

yes

## SZENT-GYÖRGYI MENTOR:

Dr. József Mihály

## SPECIALTY:

developmental genetics

## SECONDARY SCHOOL:

Radnóti Miklós Experimental Grammar School, Szeged

## NAME OF TEACHER:

Viktória Gál  
Károly Hancsák

## LANGUAGES:

English/intermediate  
German/basic

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

The main theme of our research group is the genetic analysis of *Drosophila melanogaster*. Within this topic we carry out neural, skeletal muscle and cytoskeleton developmental research. One particular gene, the *Drosophila DAAM* gene can be assigned to all these functions. During my project I examined different alternative transcripts of this gene which are thought to have different functions in different tissues during development. I created deletion mutants to observe functions of the specific transcripts. Developmental genetic experiments with *Drosophila* as a model animal could be useful since numerous methods and techniques are available nowadays which could ensure the rapid and accurate analysis. These experiments can be helpful for example in examining human genetic defects because the human proteins show about 50% homology to the fly proteins. In my research project I could not observe evident specific functions to these alternative transcripts, however, mild mutant phenotype was found. Further investigations are needed to complete description of the DAAM gene mutants.

## AIMS DURING HIS CAREER

In the near future I would like to participate in the Conference of Scientific Students' Associations (Tudományos Diákköri Konferencia, TDK) in order to present my results and my scientific work. Later on, I plan to write own and joint scientific articles to substantiate my PhD degree.

## HONORS AND PRIZES

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## PUBLICATIONS

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# PETRA VARGA



**Szeged Scientists Academy, 1<sup>st</sup> year**

**University of Szeged,  
Faculty of Medicine, 1<sup>st</sup> year**

**E:** vpetra9998@gmail.com

**T:** +36 20/379-9819

## DATE OF BIRTH:

1998

## SZENT-GYÖRGYI PUPIL:

yes

## SZENT-GYÖRGYI MENTOR:

Dr. Mihály Boros

## SPECIALTY:

circulation physiology and pathophysiology

## SECONDARY SCHOOL:

Radnóti Miklós Experimental Grammar School, Szeged

## NAME OF TEACHER:

Sándor Bán

## LANGUAGES:

English/advanced  
German/intermediate

## IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Tissue ischemia developing upon vascular occlusion and subsequent reperfusion often leads to severe organ damage and inflammation, but there is no effective prevention and treatment available to date. Our goal is to precisely characterize the above processes in order to develop new therapeutic strategies. Biologically active gases modulate crucial steps in such disorders, with nitric oxide and its metabolites playing a principal role. Generation and beneficial effects of methane were repeatedly proven in various animal models of ischemia-reperfusion and inflammation in our laboratory, thus demonstrating biological activity of the molecule. However, the mechanism of action of methane still needs to be clarified. Our research focuses on the interplay of methane and nitric oxide in various models of oxidative stress. Methane might exert its effects by modulating generation of peroxynitrite, which is an extremely reactive oxygen and nitrogen containing molecule or alternatively, methane may influence protein nitration by peroxynitrite. We use photoacoustic spectroscopy to assess generation of gaseous compounds and among others fluorescence and chemiluminescence to measure generation of reactive oxygen and nitrogen species.

## AIMS DURING HER CAREER

After graduation I would like to work in a hospital as a doctor. In addition, I plan to take part in the development of medicine with research work. I think it is important to spread the modern tools and methods of medicine.

## HONORS AND PRIZES

- International Biology Olympiad: silver medal
- European Union Science Olympiad: gold medal
- International Genetically Engineered Machine: Best Experimental Measurement
- National Biology Competition: 4<sup>th</sup> place, 15<sup>th</sup> place
- Dr. Árokszállásy Zoltán Biology Competition: 3<sup>rd</sup> place, 9<sup>th</sup> place
- Arany Dániel Mathematics Competition: 3<sup>rd</sup> place
- Szécsi Szilveszter Prize (for the best female student in the grammar school)

## PUBLICATIONS

## **Imprint**

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Responsible: Managing director of Foundation for the Future of Biomedical Sciences in Szeged

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