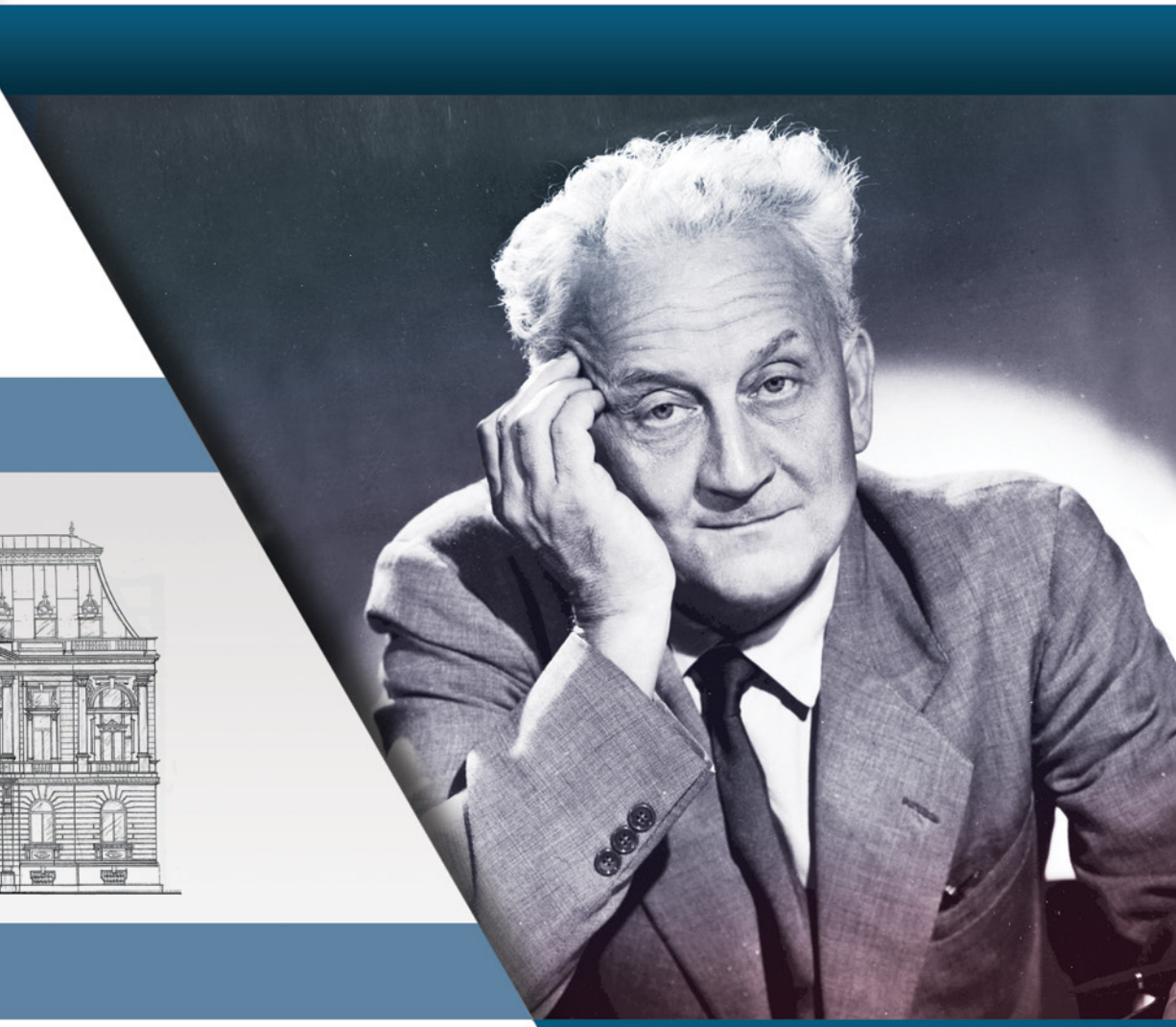
SZEGED SCIENTISTS ACADEMY

YEARBOOK 2017/18



SZEGEDI TUDÓS AKADÉMIA
SZEGED SCIENTISTS ACADEMY

TABLE OF CONTENTS

PRESENT MEMBERS OF THE BOARD OF TRUSTEES OF THE FOUNDATION FOR THE FUTURE OF BIOMEDICAL SCIENCES IN SZEGED

DR. ANDRÁS VARRÓ

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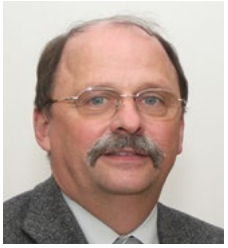

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Doctor of HAS, representative of the Dean of the Faculty of Medicine,
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DIRECTOR OF EDUCATION

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

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Doctor of HAS, Professor of Faculties of Medicine,
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CHAIRMAN OF THE FOUNDATION'S BOARD OF TRUSTEES

Doctor of Hungarian Academy of Sciences (HAS), Professor and Head of Department of Pharmacology and Pharmacotherapy at the Faculty of Medicine, University of Szeged

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 Faculty of Medicine, University of Szeged

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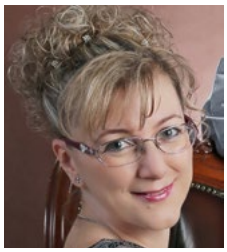

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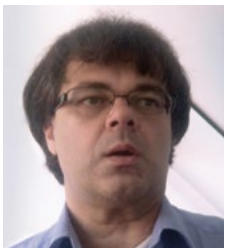
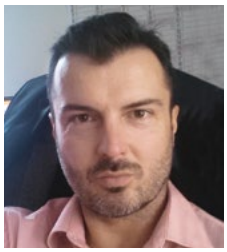


DR. ZOLTÁN GYENGE
LEGAL ADVISOR



DR. TAMÁS NAGYMIHÁLY
PUBLIC PROCUREMENT
EXPERT

DR. JÓZSEF TOLNAI
WEBSITE DEVELOPER

JÁNOS JÁNOSI
WEBMASTER

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SZEGED SCIENTISTS ACADEMY

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 4 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)*

FÖLDES 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)*

Photo: Gábor Magyar

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)*

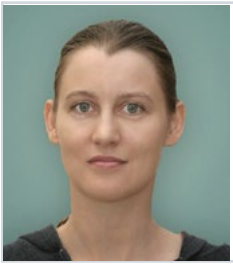
GÖDÖLLŐ REFORMED SECONDARY SCHOOL

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



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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 Renovanda 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 Radnóti Miklós Experimental 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 Hódmenzővásárhely 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

Radnóti Miklós Experimental Grammar School Szeged

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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 4th 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

ELTE Bolyai János Practice Primary and Secondary Grammar School

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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 Gábriel, 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, 1st 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, 1st 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 amd 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 Biológia II. és Biológia III. Tankönyvéről [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, 4th place*

Magdolna Gaál
dermatologist, associate professor
Dermotology 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, 17th place*

JULIANNA ERŐS-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 signficant 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 (OFI), and I also contribute to the work of the Matura examination, as assigned by the Office of Education.

PUBLICATIONS

Mihók B, Erős-Honti Zs, Gálhidy 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.

SUCCESSFUL STUDENTS

Csaba Szilágyi
university student
Semmelweis Medical University, Budapest
- *National Secondary School Competition (OKTV) biology, category II, 2013, 2nd place*

Eszter Székely
university student – chemistry
Faculty of Sciences,
Eötvös Loránd University, Budapest
- *OKTV biology, category I, 2012, 6th place*

Dániel Zahemszky
university student – biology
University of York
- *Dr. Árokszállásy Zoltán National Biology and Environmental Protection Competition 2013, 5th–7th place*

DR. ZSOLT ERŐS-HONTI

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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 methodolgy 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 (OFI), 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

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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 lépésre [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, 2nd prize*

György Varga
university student
Faculty of Sciences,
Eötvös Loránd University, Budapest
- *Herman Competition 2010, 2nd prize - Árokszállásy Competition 2011, 1st prize EUSO XI, 2012, silver*

Anna Uzonyi
university student
Technische Universität München
- *Árokszállásy Competition 2014, 1st prize OKTV 2014, 1st 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, Dombóvári 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 Pálya
university student
Faculty of Medicine, Semmelweis University, Budapest
- *National Secondary School Competition (OKTV) Biology 2015, 1st prize*
- *Curie Environmental Protection Competition 2014, 8th place*
- *Szentágothai Competition 2016, 1st prize*

Dr. Orsolya Gresits
physician
Orthopedic Clinic,
Semmelweis University, Budapest
- *OKTV Biology 2008, 11th place*

Huba Szebik
university student – biology
Eötvös Loránd University, Budapest
- *OKTV Biology 2013, 9th place*
- *OKTV Biology 2014, 31st place*
- *IBO national selection finals 2014*

Bence Domokos
university student
Faculty of Medicine,
Semmelweis University, Budapest
- *OKTV biology 2015, 11th place*
- *OKTV Biology 2016, 28th place*
- *Szentágothai Competition 2016, 5th place*

JÓZSEF GŐZ

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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.

PUBLICATIONS

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

SUCCESSFUL STUDENTS

Hédi Árva
university student
University of Szeged, Szeged
- *Szent-Györgyi Competition 2012, 1st prize*
- *Bugát Pál Competition 2014, 1st prize*
- *Georgikon Competition 2014, 4th place*

Anna Erdei
PhD student
Eötvös Loránd University, Budapest
- *National Secondary School Competition (OKTV) Biology 2008, 21st place*
- *Árokszállásy Competition 2008, 7th place*

Tamás Kun
pharmacist
Faculty of Pharmacy,
University of Debrecen
- *National Secondary School Competition (OKTV) Biology 2010, 30st place*
- *Árokszállásy Competition 2009, 19th place*

ZSOLT HORVÁTH

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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.

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 kenyerünk 1-2 [Our daily bread 1–2]. ÉLET ÉS TUDOMÁNY 71: 468-470.

SUCCESSFUL STUDENTS

Éva Hamar
PhD student
Vegetable Crop Research Department, National Agricultural Research and Innovation Center

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

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 Geniusz in-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. Pilisjászfalu: 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, 4th place*
- *OKTV Biology 2013, 12th place*
- *IBO national selection, 3rd place*

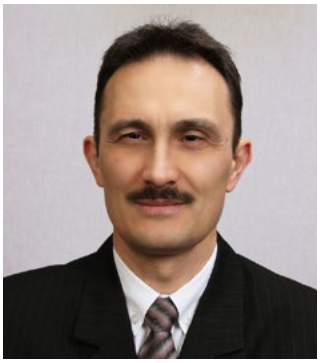
Flóra Takács
university student
University College London
- *OKTV Biology 2014, 8th place*
- *IBO 2015, silver medal*
- *ICYS 2015, silver medal*

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

István Krisztofer Tóth
Bartók Conservatory, Liszt Academy
- *Hlavay József National Environmental Science Students Conference 2014, 1st 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, 1st prize*
- *Avram Hershko Science Competition 2014 and 2015, 1st prize*

RÓBERT KERTÉSZ



Táncsics Mihály Secondary Grammar School of Kaposvár

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TEACHING CAREER IN BRIEF

I earned my secondary school teaching degree in biology and chemisry 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 competions 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

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SUCCESSFUL STUDENTS

Ábel Perjés
research fellow
National Institute for Sports Medicine
• *National Secondary School Competition (OKTV) Biology 2009, 9th 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

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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, 11th place; 2008, 6th place; 2009, 4th pl ace*

Sára Vasana Morapitiye
physician – Faculty of Medicine, Semmelweis University, Budapest
- *National Secondary School Competition (OKTV) Biology 2008, 7th place*

Nóra Koch
pharmacy student – Faculty of Pharmacy, Semmelweis University, Budapest
- *Árokszállásy 2010, 16th place ; 2011, 3rd prize; 2012, 7th place*
- *OKTV Biology 2012, 11th place; 2013, 14th place*
- *Fodor 2013, 1st prize*
- *2013 Richter Gedeon Talentum Foundation Grant*

Bence Bajzik
medical student – Faculty of Medicine, University of Pécs
- *Árokszállásy 2011, 5th place*
- *OKTV Biology 2013, 34th place*
- *Fodor 2013, 2nd prize*

Adél Kiss
medical student – Faculty of Medicine, University of Pécs
- *Fodor 2013, 3rd prize*

Eszter Kovács
medical student – Faculty of Medicine, Semmelweis University, Budapest
- *Árokszállásy 2017, 4th place*
- *OKTV Biology (II) 2017, 7th place*

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

–

SUCCESSFUL STUDENTS

Borbála Bognár
psychologist
- *National Secondary School Competition (OKTV) biology 2007, 13th place*

Susanne Prokop
medical researcher – KatonaLab – Momentum Laboratory of Molecular Neurobiology
- *Irinyi János National Chemistry Competition 2008, 25th place*
- *National Secondary School Competition (OKTV) chemistry 2010, 30th place (could not participate in the finals)*

Eszter Tóth
doctor
- *National Secondary School Competition (OKTV) biology 2010, 2nd place*

Anna Baumann
student
- *National Secondary School Competition (OKTV) chemistry 2017, 25th place*
- *Dürer Chemistry Competition 2017, 1st place*

Péter Kalapos
student
- *Irinyi János National Chemistry Competition 2015, 10th place*
- *Oláh György National Chemistry Competition 2015, 2nd place*
- *National Secondary School Competition (OKTV) chemistry 2016, 13th; 2017, 7th place*
- *Dürer Chemistry Competition 2017, 1st place*
- *Baltic Chemistry Competition, 8th place*
- *Member of the Mengyelejev International Students Olympics Team*
- *International Chemistry Students Olympics 2017, silver medallion*

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, 12th place*

Sándor Szabó
medical student
Faculty of Medicine, Semmelweis Medical University, Budapest
- *OKTV Biology 2010, 14th place*
- *Árokszállásy Zoltán Biology Competition 2010, 20th place*

Viktória Kornélia Takács
biologist
Department of Pathology, University of Pécs, Pécs
- *Kitabel Pál Biology Competition 2008, 23rd place*
- *OKTV biology 2010, 9th 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, 12th place*
- *Árokszállásy Zoltán Biology Competition*
- *2014 national finals, 21st place*

Bence Szélig
medical student
Faculty of Medicine, University of Pécs, Pécs
- *OKTV biology 2015, 11th place*
- *Árokszállásy Zoltán Biology Competition 2016, 7th place*

TÜNDE SZALAINÉ TÓTH

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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). Tapasztaltok és motiváltság: magyar középiskolások véleménye az egészségnevelő 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 génjeinkben 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 Kepes
physician, anaesthesiology resident
St. Anna-Virngrund-Klinik, Ellwangen, Germany
- *National Secondary School Competition (OKTV) biology 2006, 1st place*
  Kitaibel Pál Biology and Environmental Protection Competition 2003, 7th place
  Kitaibel Pál Biology and Environmental Protection Competition 2004, 4th place

Dr. Bence Szalai
postdoctoral medical researcher
Joint Research Center for Computational Biomedicine, RWTH Aachen Uniklinik, Germany
- *OKTV biology 2001, 6th place*
- *OKTV biology 2000, 12th place*
- *Kitaibel Pál Biology and Environmental Protection Competition 1999, 3rd place*

Dr. Tamás Radovits
internist, lecturer – Semmelweis University Heart Center, Budapest
- *OKTV biology 1998, 4th 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, 2nd place*
- *OKTV biology 2011, 17th place*

Krisztina Molnár
university student – Faculty of Medicine, Semmelweis University, Budapest
- *OKTV biology 2011, 6th place*
- *OKTV biology 2010, 19th place*
- *Kitaibel Pál competition 2008, 14th place*

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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.

PUBLICATIONS

Szentesi Cs. (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

SUCCESSFUL STUDENTS

Bálint Lakatos
PhD student
Semmelweis Medical University, Budapest
- *National Secondary School Competition (OKTV) Biology 2010, 45th place*

Lukács Lesinszki
demonstrator
Semmelweis Medical University, Budapest
- *OKTV Biology 2014, 5th place*
- *Árokszállásy Competition 2014, 2nd prize*

Ábel Major
student
Semmelweis Medical University, Budapest
- *National Secondary School Competition (OKTV) Biology 2017, 10th place*

Mátyás Sajgó
student
- *National Secondary School Competition (OKTV) Biology 2017, 16th place*

ADRIEN VARGÁNÉ LENGYEL

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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.

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.

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

SUCCESSFUL STUDENTS

Andor Kenyeres
medical student at SZOTE
• *OKTV Biology 2010. 35th place*

Emese Klément
medical student at Semmelweis University
• *OKTV Biology 2012. 30th place*

Márk Svévis
doctor at the Honvéd Hospital Budapest
• *ORKV Chemistry 2001. 1st place*

SZEGEDI TUDÓS AKADÉMIA
SZEGED SCIENTISTS ACADEMY

UNIVERSITY PROGRAM

RESEARCH CENTERS

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)

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, lacatate dehydrogenase) activities, confocal microscopy, histological analysis, ELISA, microspectrofluorimetry (intracellular H^+, Ca^{2+} concentration), microperfusion of pancreatic ducts, measurement of pancreatic ductal fluid secretion, Western blot analysis, RT-PCR.

SELECTED PUBLICATIONS

Biczó, G., Végh, E.T., Shalbueva, N., Mareninova, O.A., Elperin, J., Lotshaw, E., Gretler, S., Lugea, A., Malla, S.R., Dawson, D., Ruchala, P., Whitelegge, J., French, S.W., Wen, L., Husain, S.Z., Gorelick, F.S., Hegyi, P., **Rakonczay Jr., Z.**, Gukovsky, I., Gukovskaya, A.S. (2018) Mitochondrial dysfunction, through impaired autophagy, leads to endoplasmic reticulum stress, deregulated lipid metabolism, and pancreatitis in animal models. **Gastroenterology 154:** 689-703.

Pallagi, P., Hegyi, P., **Rakonczay Jr., Z.** (2015) The physiology and pathophysiology of pancreatic ductal secretion: the background for clinicians. **Pancreas 44:** 1211-1233.

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., Shalbuyeva, N., Berczi, S., Sinervirta, R., Hracskó, 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., Takács T., McCarroll J., Saluja A.K. (2008) The role of NF-κB activation in the pathogenesis of acute pancreatitis. **Gut 57:** 259-267.

ISTVÁN ANDÓ

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Institute of Genetics,
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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 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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RESEARCH AREA

Adequate and continuous blood supply of the brain requires a very precise regulatory mechanism. Investing 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 inthe 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

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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:** 10-18.

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-Csörgõ, 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

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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 relese 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.

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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 IR-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 gasotransmitter? **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., Tőkés, 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.

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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 pharmacautical 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., Rákhely, 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-β induced toxicity in cells of the neurovascular unit. **J Alzheimers Dis 36:** 487-501.

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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.

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Dér, A., Keszthelyi, L. (2001) Charge motion during the photocycle of bacteriorhodopsin. **Biochemistry (M) 66:** 1234-1248.

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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 enyzme 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 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., Ozsvari, 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.

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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© 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

Menyhárt, Á., Zölei-Szénási, D., Puskás, T., Makra, P., M.Tóth, O., Szepes, B.É., Tóth, R., Ivánkovits-Kiss, O., Obrenovitch, T.P., Bari, F., **Farkas, E.** (2017) Spreading depolarization remarkably exacerbates ischemia-induced tissue acidosis in the young and aged rat brain. **Sci Rep 7(1):** 1154.

Hertelendy, P., Menyhárt, Á., Makra, P., Süle, Z., Kiss, T., Tóth, G., Ivánkovits-Kiss, O., Bari, F., **Farkas., E**. (2016) 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(5): 1763-1775.**

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(12):** 3269-3277.

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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(2):** 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, primer 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 formig 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., **Gácser, A.** (2017) Specific pathways mediating inflammasome activation by Candida parapsilosis. **Sci Rep 7:** 43129.

Pryszcz, L.P., Nemeth, T., Saus, E., Ksiezopolska, E., Hegedusova, E., Nosek, J., Wolfe, K.H., **Gácser, 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., **Gácser, A.** (2015) Different Candida parapsilosis clinical isolates and lipase deficient strain trigger an altered cellular immune response. **Front Microbiol 6:** 1102. 11 p.

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Lázár-Molnár, E., **Gácser, 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

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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.

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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, JP., 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.

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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 Heliopsis helianthoides var. scabra and Lepidium meyenii. **J Nat Prod 77:** 1663-1669.

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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 techniqes 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 approaces and software and hardware infrastructure.

SELECTED PUBLICATIONS

Pfisterer, S., Gateva, G., **Horvath, P.**, Pirhonen, J., Salo, V., Karhinen, 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.

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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.

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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.

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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.

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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., **Juhasz, 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., **Juhasz, G.** (2013) Myc-Driven Overgrowth Requires Unfolded Protein Response-Mediated Induction of Autophagy and Antioxidant Responses in Drosophila melanogaster. **Plos Genet 9:** e1003664.

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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

Poles, M.Z., Bódi, N., Bagyánszki, M., Fekete, É., Mészáros, A.T., Varga, G., Szűcs S,, Nászai, A., Kiss, L., Kozlov, A.V., Boros, M., **Kaszaki, J.** (2018) Reduction of nitrosative stress by methane: Neuroprotection through xanthine oxidoreductase inhibition in a rat model of mesenteric ischemia- reperfusion. **Free Radic Biol Med 120:** 160-169.

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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.

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RESEARCH AREA

Trillions of bacteria, fungi and viruses colonize the skin surface, collectively comprising the skin microbiome. There is a continous interaction in between the microbas 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 in between commensal and pathogenic bacterias? 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 maintenace of chronic inflammatory skin diseases, such as acne, rosacea or psoriasis. 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.

TECHNIQUES AVAILABLE IN THE LAB

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

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., **Kemeny, 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.

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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.

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Deák, F., Mátés, L., Korpos, E., Zvara, A., Szénási, T., **Kiricsi, M.**, Mendler, 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 (brain endothelial cells, pericytes, astrocytes) 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, cell culture, *in vitro* model systems including disease models, barrier permeability studies, biochemical and molecular biology methods, ELISA, fluorescence and confocal microscopy, *in vivo* two-photon and superresolution (STED) microscopy.

SELECTED PUBLICATIONS

Wilhelm, I., Fazakas, C., Molnár, K., Végh, A.G., Haskó, J., **Krizbai, I.A. (**2018) Foe or friend? Janus- faces of the neurovascular unit in the formation of brain metastases. **J Cereb Blood Flow Metab 38:** 563-587.

Nyúl-Tóth, Á., Kozma, M., Nagyőszi, P., Nagy, K., Fazakas, C., Haskó, J., Molnár, K., Farkas, A.E., Végh, A.G., Váró, G., Galajda, P., Wilhelm, I., **Krizbai, I.A**. (2017) Expression of pattern recognition receptors and activation of the non-canonical inflammasome pathway in brain pericytes. **Brain Behav Immun 64:** 220-231.

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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 programd. 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 artifical self-organizing protein mimetics to modulate protein interactions, to develop diagnostic tools and novel antibacterial materials.

TECHNIQUES AVAILABLE IN THE LAB

Foldamers are synthetised 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 β-sheet folding. **Chem Commun 52:** 1819.

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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 β-Amyloid Oligomers. **Plos One 7:** e39485.

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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 19th 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 knockdown 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.

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Mátés, L., Chuah, M.K., Belay, E., Jerchow, B., Manoj, N., Acosta-Sanchez, 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., Izsvak, Z. (2009) Molecular evolution of a novel hyperactive Sleeping Beauty transposase enables robust stable gene transfer in vertebrates. **Nature Genet 41:** 753-761.

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

Mátés, L., Izsvak, 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.

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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

Szikora, S., Földi, I., Tóth, K., Migh, E., Vig, A., Bugyi, B., Maléth, J., Hegyi, P., Kaltenecker, P., Sanchez-Soriano, N., **Mihály, J.** (2017) The formin DAAM is required for coordination of the actin and microtubule cytoskeleton in axonal growth cones. **J Cell Sci 130(15):** 2506-2519.

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(28):** 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.

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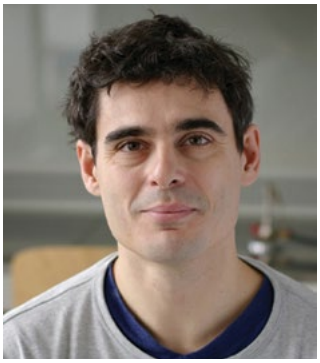
CSABA PÁL



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RESEARCH AREA

Evolution is central to our undestanding 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 batceria. Here, we are keen to develop novel therapeutic strategies.

For more details, see *www.brc.hu/sysbiol/* and *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.

Pal, 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.

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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

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

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

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.

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

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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 dieases 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., Vígh, 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.

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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 (≈ 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

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 identifi es 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 identifi ed 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 specifi c 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 routinly in our research work. Data provided by NGS are analized by various bioinformatics tools.

SELECTED PUBLICATIONS

Tripolszki, K., Csányi, B., Nagy, D., Ratti, A., Tiloca, C., Silani, V., Kereszty, É., Török, N., Vécsei, L., Engelhardt, J.I., Klivényi, P.(5), Nagy, N., **Széll, M.** (2017) Genetic analysis of the SOD1 and C9ORF72 genes in Hungarian patients with amyotrophic lateral sclerosis. **Neurobiol Aging 53:** 195.e1-195.e5

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) Identifi cation 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., Polyánkam, H., Szeg, C., Gaál, M., Dobozy, A., Kemény, L. (2004) Proliferating keratinocytes are putative sources of the psoriasis susceptibility related EDA+ oncofoeltal fibronectin. **J Investigat Dermotol 123:** 537-546.

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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 (acustooptical 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.

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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 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.

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

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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 kynurenine 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) Kynurenine system and multiple sclerosis, pathomechanism and drug targets with an emphasis on lauqinimod. **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, Z.T., Párdutz, A., Tóth, E., Szok, D., Csete, G., **Vécsei, L.** (2013) White matter disintegration in cluster headache. **J Headache Pain 24:** 14:64.

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Vécsei, L. (ed.) (2012) Kynurenines and the nervous system: therapeutic perspectives. **J Neural Transm 119:** 107-296.

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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. SNORAC analysis, RIA.

SELECTED PUBLICATIONS

Gönczi, M., Kovács, M., Seprényi, Gy., **Végh, Á.** (2012) The involvement of gap junctions in the delayed phase of the ptotection 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 aminoguanidine sensitive: possible involvement of nitric oxide. **Clin Sci 102:** 435-445.

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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.

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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., Pénzes, 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. **Nat Med 3:** 1150-1154.

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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.

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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 16α-triazolylestrone 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-13α-methyl-17-estradiol diastereomers and the effects of structural modifications on their *in vitro* antiproliferative activities. **J Steroid Biochem Mol Biol 150:** 123-34.

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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.

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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.

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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), mitochondrial reactive oxygen species (HRP/Amplex UltraRed assay) and calcium-flux (Calcium Green-5N fluorescence). Assesement of oxidative and nitrosative stress markers.

SELECTED PUBLICATIONS

Mészáros, AT., Szilágyi, Á.L., **Juhász, L.**, Tuboly, E., Érces, D., Varga, G., Hartmann, P. (2017) Mitochondria as sources and targets of methane. **Front Med (Lausanne) 4:** 1-7.

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-arrhytmic effects of preconditioning and peroxynitrite infusion in anaesthetized dogs. **Br J Pharmacol 160:** 1263-1272.

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RESEARCH AREA

Skeletal muscle is constantly renewed in response to injury, exercise, or muscle diseases. During the regeneration process, the quiescent satellite stem cells are activated and form myoblasts that will subsequently migrate, differentiate, and then fuse to form muscle fibers. 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.

About 90% of insulin-stimulated glucose uptake occurs in skeletal muscle. The translocation of GLUT4 glucose transporter from the cytosol to the plasma membrane is deficient in type-2 diabetes. Our further aim is to study the signalling mechanisms regulating the translocation of GLUT4.

TECHNIQUES AVAILABLE IN THE LAB

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

SELECTED PUBLICATIONS

Keller-Pinter, A., Ughy, B., Domoki, M., Pettko-Szandtner, A., Letoha, T., Tovari, J., Timar, J., Szilak, L. (2017) The phosphomimetic mutation of syndecan-4 binds and inhibits Tiam1 modulating Rac1 activity in PDZ interaction-dependent manner. **PLoS One 12**: e0187094.

Kocsis, T., Trencsenyi, G., Szabo, K., Baán, J.A., Müller, G., Mendler, L., Garai, I., Reinauer, H., Deak, F., Dux, L., **Keller-Pintér, A.** (2016) 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-Pinter, 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.

Keller-Pinter, 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.

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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 ductals 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 thechniques, isolation of pancreatic acinar and ductal cells, measurement of enzyme (amylase, trypsin, myeloperoxidase, lacatate dehydrogenase) activities, immunhistochemistry, 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., Rákhely, 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., Rákhely, 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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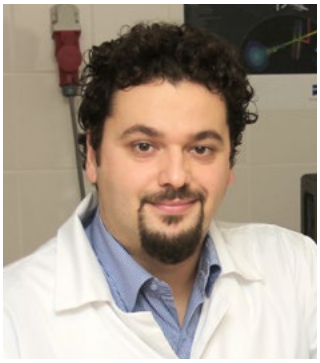

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RESEARCH AREA

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^{2+} 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.

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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.

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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., Bodnár, V., Papp, B. T., Bolla, B. Sz., Szabó, K.,Balázs, B., Csányi, E., Szél, E., Erős, G.,Kemény, L. (2018) Drug repurposing by simulating flow through protein–protein interaction networks. **Clin Pharmacol Ther 103**: 511-520.

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

Glutamate excitotoxicity and cellular calcium overload stand in the background of various neurological disorders such as cerebral stroke, traumatic brain injury, epilepsy or Parkinson's disease. While neurons are highly sensitive to ischemic injury, their more resistant protectors, astrocytes are essential to restore glutamatergic signaling to the physiological range. Astrocytes modulate neural excitability and minimize brain damage through spatial buffering of extracellular K+ and clearance of surplus neurotransmitters. The most important trait of astrocytes is probably the formation of an anatomical and functional "syncytium", a network created by cells attached to each other to communicate by gap junctions (GJs). The anatomical continuity of the main GJ proteins; Cx43 and Cx30, is essential to/for the formation of the functional syncytium of astrocytes. Phosphorylation of Cx43 essentially reduces the conductance of GJs, and thereby affects interastrocytic communication by altering gating and trafficking properties of the channels.

Spreading depolarization (SD) is a slowly propagating wave of neuronal and glial depolarization that occurs in the injured brain and contributes to lesion expansion after ischemic stroke. We have recently found impaired extracellular potassium clearance during spreading depolarization under simulated ischemic conditions. According to our working hypothesis; SD causes CX43 phosphorylation, reduces astrocytic spatial buffering capacity, and impairs glutamate clearance and excitotoxicity in the ischemic brain. Therefore, the major goals of our research are;

1. To demonstrate that astrocyte Cx43 phosphorylation co-occurs with impaired spatial buffering and glutamate clearance in global cerebral ischemia;

2. To improve cellular viability and achieve better outcome from cerebral ischemic injury.

TECHNIQUES AVAILABLE IN THE LAB

Application of the Biopac© and LabChart© systems 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, computer programming (MATlab) voltage-sensitive and pH-sensitive dye imaging of cellular trans-membrane potential.

SELECTED PUBLICATIONS

Menyhárt, Á., Zölei-Szénási, D., Puskás T., Makra, P., Bari, F., Farkas, E. (2017) Age or ischemia uncouples the blood flow response, tissue acidosis, and direct current potential signature of spreading depolarization in the rat brain. **Am J Physiol Heart Circ Physiol 313(2):** H328-H337.

Menyhárt, Á., Zölei-Szénási, D., Puskás, T., Makra, P., Orsolya, M.T., Szepes, B.É., Tóth, R., Iványkovits-Kiss, O., Obrenovitch, T.P., Bari, F., Farkas, E. (2017) Spreading depolarization remarkably exacerbates ischemia-induced tissue acidosis in the young and aged rat brain. **Sci Rep 7(1):** 1154.

Varga, D.P., Puskás, T., **Menyhárt, Á.**, Hertelendy, P., Zölei-Szénási, D., Tóth, R., Iványkovits-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., Tóth, O.M., 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(12):** 3269-3277.

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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 Ca^{2+} plays fundamental role. The function of pancreatic ductal fluid and HCO_3^- secretion plays a central role not just in the physiology, but also in the pathophysiology of the pancreas. Impaired pancreatic fluid and HCO_3^- secretion can lead to pancreatic damage and to the development of acute pancreatitis. Receptor induced intracellular Ca^{2+} release plays fundamental role in the regulation of HCO_3^- secretion, however sustained intracellular Ca^{2+} elevations in response to toxic factors (such as bile acids, or alcohol metabolites) inhibit secretory processes. The pathological elevation of intracellular Ca^{2+} concentration is one of the hallmarks of the development of AP. Therefore, comprehensive analysis of the physiological and pathophysiological Ca^{2+} signalling of PDEC is crucially important since it may offer potential therapeutic targets in AP.

TECHNIQUES AVAILABLE IN THE LAB

Microspectrofluorimetry (intracellular H^+, Ca^{2+} and 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, lacatate 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 Cl^- channels and luminal anion exchangers. **Gastroenterology 141:** 2228-2239.

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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 (≈ 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., Paizs, M., Tortarolo, M., Bendotti, C., Obál, I., Engelhardt, J.I., Siklós, L. (2017) Presymptomatically applied AMPA receptor antagonist prevents calcium increase in vulnerable type of motor axon terminals of mice modeling amyotrophic lateral sclerosis. **Biochim Biophys Acta 1863:** 1739–1748.

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. (2017) 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 16:** 356–367.

Patai, R., Nógrádi, 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. **Ideggy Sz 70:** 247–257.

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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 (CH_4) however there are many unanswered questions remained of its mechanism of action. Our aim is to investigate the protective role of 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 measuerement 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

Poles, M.Z., Bódi, N., Bagyánszki, M., Fekete, É., Mészáros, A.T., Varga, G., Szűcs, S., Nászai, A., Kiss, L., Kozlov, A.V., Boros, M., Kaszaki, J. (2018) Reduction of nitrosative stress by methane: Neuroprotection through xanthine oxidoreductase inhibition in a rat model of mesenteric ischemia- reperfusion. **Free Radic Biol Med 120:** 160-169.

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 synthaes 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.

[+]Máté, Z., [+]**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. [+]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.

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RESEARCH AREA

Left ventricular hypertrophy, fibrosis, and diastolic dysfunction are characteristic features of heart failure with preserved ejection fraction (HFpEF) which is common in the early phase of chronic heart failure. General causes of HFpEF are arterial hypertension, chronic kidney disease (CKD), and diabetes mellitus (DM), etc. It also develops in radiation-induced heart disease (RIHD) which is a late consequence of radiotherapy of thoracic tumors. We aim to investigate and compare the molecular mechanisms of left ventricular hypertrophy and fibrosis developed as a consequence of different underlying diseases. The identification of the early predictors and prevention of hypertrophy and fibrosis by the administration of protective agents are relevant research perspectives both experimentally and clinically. In our experiments, we investigate the heart function and morphology, the molecular changes in the cardiac microRNA/mRNA profiles and down-stream targets as well as the circulating microRNAs, and we test new agents for the prevention of fibrosis and left ventricular hypertrophy. Moreover, the hypertrophic heart is more prone to ischemia. In the industrialized countries, the acute myocardial infarction is the leading cause of mortality. Therefore, the ischemic adaptation of the hypertrophic heart is also in the focus of our research group. We investigate the effects of ischemic preconditioning, postconditioning, and remote conditioning on the infarct size in our hypertrophy and fibrosis models.

TECHNIQUES AVAILABLE IN THE LAB

Induction and treatment of disease models (e.g. CKD, DM, RIHD) in experimental animals, assessment of cardiac function and morphology by transthoracic echocardiography, oral glucose tolerance test, Langendorff heart perfusion, induction of acute myocardial infarction, ischemic conditioning techniques, determination of infarct size, histological analysis, general biochemical and molecular biology methods (colorimetric assays, qRT-PCR, ELISA, etc.) to determine metabolites (e.g. serum glucose, urea, creatinine, urine protein, etc.), microRNA, mRNA, proteins and enzyme activities (e.g. creatine kinase, lactate dehydrogenase, etc.)

SELECTED PUBLICATIONS

Sárközy, M., Kahán, Z., Csont T. (2018) A myriad of roles of miR-25 in health and disease. **Oncotarget 9:** x. In press.

Pavo, N., Lukovic, D., Zlabinger, K., Zimba, A., Lorant, D., Goliasch, G., Winkler, J., Pils, D., Auer, K., Jan-Ankersmit H., Giricz, Z., Baranyai, T., **Sárközy, M.**, Jakab, A., Garamvölgyi, R., Emmert, M.Y., Hoerstrup, S.P., Hausenloy, D.J., Ferdinandy, P., Maurer, G., Gyöngyösi, M. (2017) Sequential activation of different pathway networks in ischemia-affected and non-affected myocardium, inducing intrinsic remote conditioning to prevent left ventricular remodeling. **Sci Rep 7:** 43958.

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.

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

Intensively developing imaging and electrophysiological methods have an increasing role in investigation of neurological diseases, like primary headache disorders, neurodegenerative diseases, epilepsy, stroke. These non-invasive techniques are feasible to detect *in vivo* functional and structural changes of the central nerve system. Structural and functional MRI sequences and neurophysiological methods have an impact on understanding the underlying pathomechanism and might serve as a biomarker to evaluate therapeutic effect of new treatments.

TECHNIQUES AVAILABLE IN THE LAB

Neuroimaging methods, like detection of brain functional networks, micro-and macrostructural analyses of the gray- and white matter. Neurophysiological techniques as visual evoked potentials (VEP), transcranial magnetic (TMS) and direct current (tDCS) stimulation, heat evoked potentials (CHEPS), pain threshold investigation and EEG.

SELECTED PUBLICATIONS

Szabó, N., Faragó, P., Király, A., Veréb, D., Csete, G., Tóth, E., Kocsis, K., Kincses, B., Tuka, B., Párdutz, Á., Szok, D., Tajti, J., Vécsei, L., Kincses, ZT. (2018) Evidence for Plastic Processes in Migraine with Aura: A Diffusion Weighted MRI Study. **Front Neuroanat 11:** 138.

Rektor, I., Svátková, A., Vojtíšek, L., Zikmundová, I., Vaníček, J., Király, A., **Szabó, N.** (2018) White matter alterations in Parkinson's disease with normal cognition precede grey matter atrophy. **PLoS One 13(1):** e0187939.

Király, A., **Szabó, N.**, Párdutz, Á., Tóth, E., Tajti, J., Csete, G., Faragó, P., Bodnár, P., Szok, D., Tuka, B., Pálinkás, É., Ertsey, C., Vécsei, L., Kincses, ZT. (2017) Macro- and microstructural alterations of the subcortical structures in episodic cluster headache. **Cephalalgia 38(4):** 662-673.

Khairnar, A., Ruda-Kucerova, J., **Szabó, N.**, Drazanova, E., Arab, A., Hutter-Paier, B., Neddens, J., Latta, P., Starcuk, Z. Jr., Rektorova, I. (2016) Early and progressive microstructural brain changes in mice overexpressing human α-Synuclein detected by diffusion kurtosis imaging. **Brain Behav Immun 61:** 197-208.

Szabó, N., Kincses, ZT., Párdutz, A., Tajti, J., Szok, D., Tuka, B., Király, A., Babos, M., Vörös, E., Bomboi, G., Orzi, F., Vécsei, L. (2012) White matter microstructural alterations in migraine: a diffusion-weighted MRI study. **Pain 153(3):** 651-6.

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RESEARCH AREA

Amyotrophic lateral sclerosis (ALS) is a fatal neurodegenerative disease characterised by the degeneration of upper and lower motor neurons in the motor cortex, brain stem, and spinal cord with life expectancy of 3-5 years from symptom onset. This disease is being studied worldwide to better understand the mechanisms of the disease and develop better methods for detection and intervention. Familial forms account for about 5-10% of ALS cases, although higher levels have been reported in certain geographical regions. Regarding its genetic background, more than 20 major genes have been implicated in the Mendelian ALS forms and further about 100 genes have been associated as predisposing factors, however the exact cause is still unknown. Genetic factors play a key role in all types of ALS, therefore, the goal of the project is to investigate disease causing genes in order to identify causative mutations in Hungarian patients with ALS. We are using various PCR and sequencing techniques in our investigations. Our study provides further insight into the genetic etiology of this heterogenous disease.

TECHNIQUES AVAILABLE IN THE LAB

IDNA extraction (blood and tissue samples), DNA quantitation (NanoDrop spectrophotometer and Quantus fluorometer), primer design, different PCR techniques (Repeat-Primed PCR, Real-Time PCR, Digital PCR), agarose gel electrophoresis, Sanger sequencing and amplicon fragment length analysis. Next generation sequencing (target region/panel and exome sequencing) and bioinformatic analysis of NGS data. Clinical and mutation database management and variant effect prediction.

SELECTED PUBLICATIONS

Tripolszki, K., Csányi, B., Nagy, D., Ratti, A., Tiloca, C., Silani, V., Kereszty, É., Török, N., Vécsei, L., Engelhardt, J.I., Klivényi, P., Nagy, N., Széll, M. (2017) Genetic analysis of the SOD1 and C9ORF72 genes in Hungarian patients with amyotrophic lateral sclerosis. **Neurobiol Aging 53:** 195.e1-195.e5.

Tripolszki, K., Török, D., Goudenège, D., Farkas, K., Sulák, A., Török, N., Engelhardt, J.I., Klivényi, P., Procaccio, V., Nagy, N., Széll, M. (2017) High-throughput sequencing revealed a novel SETX mutation in a Hungarian patient with amyotrophic lateral sclerosis. **Brain Behav 7:** e00669.

Tripolszki, K., Knox, R., Parker, V., Semple, R., Farkas, K., Sulák, A., Horváth, E., Széll, M., Nagy, N. (2016) Somatic mosaicism of the PIK3CA gene identified in a Hungarian girl with macrodactyly and syndactyly. **Eur J Med Genet 59:** 223-6.

Tripolszki, K., Farkas, K., Sulák, A., Szolnoky, G., Duga, B., Melegh, B., Knox, R.G., Parker, V.E.R., Semple, R.K., Kemény, L., Széll, M., Nagy, N. (2017) Atypical neurofibromatosis type 1 with unilateral limb hypertrophy mimicking overgrowth syndrome. **Clin Exp Dermatol 42:** 763-766.

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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. Chromoproteins (eg. Bacteriorhodopsin) are also studied in integrated optical devices as photoactive materials. We also develope 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 biologiai 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

Thrombolysis stands in the focus of ischemic stroke therapy, yet the majority of patients cannot benefit from thrombolysis because of the limited time window to initiate the procedure. In order to develop a therapy that improves the chances of successful recovery of all patients affected, understanding and limiting the mechanisms of injury progression are essential. The occurrence of spreading depolarization (SD) originating from the border of the lesion, considerably contributes to the progression of ischemic neuronal-loss. Recurrent SDs perturb the ionic homeostasis of the brain, and are also often associated with pathophysiological cerebral blood flow (CBF) responses. As a result, harmful metabolic supply-demand mismatch is created. Therefore, the prevention of SD occurrence and the normalization of the associated CBF response appear to be crucial to limit neurodegeneration subsequent to the onset of ischemic stroke. We aim to understand the regulation of various CBF responses related to SD in a rodent *in vivo* ischemic stroke model. We explore the exact share of the prostaglandin signaling, one of the key contributors in neurovascular coupling, during SD with pharmacological manipulation. Our results are expected to be integrated into the therapy of ischemic stroke.

TECHNIQUES AVAILABLE IN THE LAB

Application of the Biopac© and LabChart© systems 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, computer programming (MATlab) voltage-sensitive and pH-sensitive dye imaging of cellular trans-membrane potential.

SELECTED PUBLICATIONS

Varga, D.P., Menyhárt, Á., Puskás, T., Bari, F., Farkas, E., Kis, Z., Vécsei, L., Toldi, J., Gellért, L. (2017) Systemic administration of L-kynurenine sulfate induces cerebral hypoperfusion transients in adult C57Bl/6 mice. **Microvasc Res 114:** 19-25.

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.

Varga, D., Herédi, J., Kánvási, Z., Ruszka, M., Kis, Z., Ono, E., Iwamori, N., Iwamori, T., Takakuwa, H., Vécsei, L., Toldi, J., Gellért, L. (2015) Systemic L-Kynurenine sulfate administration disrupts object recognition memory, alters open field behavior and decreases c-Fos immunopositivity in C57Bl/6 mice. **Front Behav Neurosci 9**: 1-15.

Gellért, L., Knapp, L., Németh, K., Herédi, J., **Varga, D.**, Oláh, G., Kocsis, K., Menyhárt, A., Kis, Z., Farkas, T., Vécsei, L., Toldi, J. (2013) Post-ischemic treatment with L-kynurenine sulfate exacerbates neuronal damage after transient middle cerebral artery occlusion. **Neuroscience 247**: 95-101.

Gellért, L., **Varga, D.**, Ruszka, M., Toldi, J., Farkas, T., Szatmári, I., Fülöp, F., Vécsei, L., Kis, Z. (2011) Behavioural studies with a newly developed neuroprotective KYNA-amide. **J Neural Trans 119:** 165-72.

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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 encorporate 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., **Veszelka, S.**, Hoyk, Z., Mészáros, M., Walter, FR., Tóth, AE., Kiss, L., Kincses, A., Oláh, Z., Seprényi, G., Rákhely, 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., **Veszelka, S.**, Pásztói, M., Péterfi, ZA., Tóth, A., Rákhely, 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.

Veszelka, 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 β-induced toxicity in cells of the neurovascular unit. **J Alzheimers Dis 36:** 487-501.

Veszelka, 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.

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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-tetra-hydropyridine, 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.

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YEAR OF BIRTH:

1997

FORMER SZENT-GYÖRGYI PUPIL:

no

SZENT-GYÖRGYI MENTOR:

Dr. Lajos Kemény

SPECIALIZATION:

dermatology, immunology, bioinformatics

SECONDARY SCHOOL:

Zrenjaninska Gimnazija (Zrenjanin High School)

NAME OF TEACHER:

Angéla Lázár

LANGUAGES:

English/advanced
German/intermediate
Serbian/native speaker

IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

In our research, we are currently looking for correlations between the immune recognition of cancer patients and their response to treatments. Human leukocyte antigen (HLA) molecules are outstandingly important in adaptive immunity. These molecules show an exceptional variability, and the different variants can bind a different number of protein-sequences (i.e. different promiscuity). We hypothesize that HLA promiscuity has an effect on response to cancer immunotherapy, and thus could be an important biomarker. In addition to immunotherapy, we also investigate the relation between promiscuity and susceptibility to tumours, autoimmune and infectious diseases. In our laboratory, we analyse large and reliable databases which contain information about thousands of patients. We use up-to-date bioinformatic methods for the statistical analysis of these data.

AMBITIONS AND CAREER GOALS

As a medical student, what I find immensely important is having the most up-to- date information in the field of medicine. The Szent-Györgyi Programme is a great opportunity for me to acquire a deeper insight into the latest research, while also learning to make use of scientific literature and improving my problem solving ability through research work. Additionally, my work can contribute to a deeper understanding of pathophysiological processes and to choosing the most appropriate way of treating them.

HONORS AND PRIZES

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PUBLICATIONS

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yes

SZENT-GYÖRGYI MENTOR:

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JUNIOR MENTOR:

Dr. Dániel Varga

SPECIALIZATION:

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.

AMBITIONS AND CAREER GOALS

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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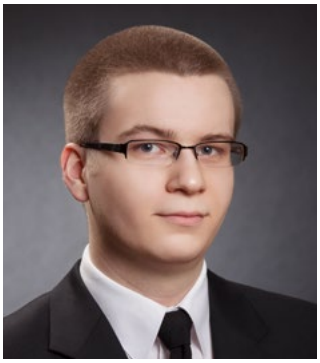
SZABOLCS BENE



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SPECIALIZATION:

genetics

SECONDARY SCHOOL:

Secondary School of Economics and Informatics of Cegléd

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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.

AMBITIONS AND CAREER GOALS

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. 16th place

PUBLICATIONS

–

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FORMER SZENT-GYÖRGYI PUPIL:

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SZENT-GYÖRGYI MENTOR:

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SPECIALIZATION:

genetic engineering, experimental evolutionary biology

SECONDARY SCHOOL:

Városmajori High School

NAME OF TEACHER:

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LANGUAGES:

English/advanced
Spanish/advanced
German/intermediate
Latin/intermediate

IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Pathogens seem invariably to attempt to survive the immune system of the invaded host or the pressures of applied therapies. During this accommodation process, DNA-level changes and mutations occur in the cells. These invisible, but important evolutionary processes lead to one of our biggest clinical challenges: antimicrobial resistance. Thanks to scientific advances of recent decades, it has become possible to manipulate the DNA in a precise manner, which enables a rapid and targeted examination of these very mutations. This approach offers a breakthrough in the investigation of antimicrobial resistance.
In our work we use the toolbox of evolutionary genome engineering and try to predict preclinically how resistance can evolve against an antimicrobial. A technique developed in the laboratory of my mentor, Csaba Pál, makes the rapid examination and manipulation of evolution possible with unprecedented accuracy. Our aim is the further development and utilization of this method. We also strive to be able to fully understand the evolutionary processes of accommodation, and this way to develop more resistance proof antibiotics.

AMBITIONS AND CAREER GOALS

During my university years I would like to study the field of molecular and synthetic biology and evolutionary genome engineering in as much depth as possible in order to be able to master and develop clinical applications with a special emphasis on the problem of antimicrobial resistance. As a member of the Szeged Scientists' Academy, my aim is to better myself not only in my academic skills, but also to become an open-minded research scientist ready to explore new ideas. In further stages of my career, what I hope to do is not only to follow in the footsteps of other great minds but rather to shape science myself.

HONORS AND PRIZES

- Stockholm Junior Water Prize – national winner of Hungary (2015)
- University of Szeged, Szent-Györgyi Competition - 1st place (2015)
- Hungarian Research Student Association, Essay Competition - 2nd place (2016)
- Hungarian Research Student Association, Poster Competition, Molecular Biology, Medicine and Health Section - 1st place (2016)
- Certificate of appreciation from the President of Hungary, János Áder on the occasion of the Budapest Water Summit 2016
- National Secondary School Academic Competition (OKTV) in Biology, 16th place (2017)
- Ministry of Human Resources: 8th Junior Bolyai Competition, 1st prize (2017)

ROLAND FEJES

Szeged Scientists Academy, 3rd year

**University of Szeged,
Faculty of Medicine, 3rd year**

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YEAR OF BIRTH:

1997

FORMER SZENT-GYÖRGYI PUPIL:

yes

SZENT-GYÖRGYI MENTOR:

Dr. József Kaszaki

SPECIALIZATION:

Pathophysiology of circulation, sepsis

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 one of the biggest challenges in medicine because of its rapidly proliferating nature. On account of the complexity of its pathomechanism, sepsis is hard to diagnose, and amongst the countless therapeutic possibilities used (e.g. anti-inflammatory therapy), there is no perfect solution yet. A common feature of septic multiorgan failure (MOF) is microcirculatory dysfunction, which leads to tissue hypoperfusion and necrosis. Thus, resuscitation of the microcirculation seems to be a promising therapeutic target. In our previous studies we have shown that one of the subcellular consequences of sepsis is mitochondrial failure. An impairment in the energy supply of the cell also leads to the formation of increased amounts of reactive oxygen species (ROS), which further raise the level of cellular failure. Our aim is to investigate the effects of selective receptor activation or blockage of the potent vasoactive, hypoxia-sensitive mediator, the endothelin-1 (ET-1) peptide on macrohemodynamics, microcirculation and mitochondrial respiration.

AMBITIONS AND CAREER GOALS

In this project my first goal is to learn *in vivo* techniques which I can perform on rodents and minipigs. I am interested in the technique of high-resolution respirometry, which is a useful tool to investigate mitochondrial functions. I would like to expand both my theoretical and practical knowledge, which I will be able to use either in medical research or in medical practice.

HONORS AND PRIZES

- Student Scientific Conference, Pharmacology section II: 1st prize (2017)
- Student Scientific Conference, Operative Research section I: 3rd prize (2017)

PUBLICATIONS

–

ANNA GRASSALKOVICH

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YEAR OF BIRTH:

1997

FORMER SZENT-GYÖRGYI PUPIL:

yes

SZENT-GYÖRGYI MENTOR:

Dr. Péter Hegyi

JUNIOR MENTOR

Dr. József Maléth

SPECIALIZATION:

gastroenterology

SECONDARY SCHOOL:

Berze Nagy János Secondary School, Gyöngyös

NAME OF TEACHER:

Katalin Molnárné Borbás

LANGUAGES:

English/advanced

IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Acute pancreatitis is one of the most frequent gastrointestinal diseases that calls for an acute treatment in a hospital, and its mortality rate in serious cases may reach 30-60%. Despite this, a specific treatment still has not been found, which makes the identification of new drug targets urgent. In an earlier study we showed that the damaged function of the cystic fibrosis transmembrane conductance regulator (CFTR) chloride channel decreases pancreatic ductal bicarbonate secretion. We also suggested that decreased secretion significantly increases the severity of pancreatic inflammation. In my present research my aim is to correct the function of the CFTR channel during acute pancreatitis, which might later prove to be a special treatment option in curing AP.

AMBITIONS AND CAREER GOALS

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

HONORS AND PRIZES

- University of Szeged, Faculty of Medicine TDK conference – 3rd place (2017)

PUBLICATIONS

–

SZUZINA GYULAI-NAGY

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YEAR OF BIRTH:

1997

FORMER SZENT-GYÖRGYI PUPIL:

no

SZENT-GYÖRGYI MENTOR:

Dr. László Dux

JUNIOR MENTOR:

Dr. Anikó Keller-Pintér

SPECIALIZATION:

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 knew from the start that I wanted to do research later. I have always been 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 mechanisms of the skeletal muscle regeneration and adaptation, and our findings could have clinical applicability later.

AMBITIONS AND CAREER GOALS

During my medical career my primary aim is to become a good doctor and meet the highest scientific expectations. While researching, I am eager to use my obtained knowledge and also widen my scientific perspective. I believe it is desirable to begin the scientists' and doctors' lifelong learning as early as possible.

HONORS AND PRIZES

- 2018 - XXV. Scientific Student Conference Targu Mures, special award
- 2018 - Korányi Frigyes Scientific Forum: 1st prize
- 2017 - Scientific Student Conference, Szeged: 1st prize
- 2016 - OKTV Biology 37th place
- 2015 - OKTV Mathematics 5th place
- 2015 - Young Talent of Szeged Prize
- 2015 - High School Mathematical Journal (KöMaL): 4th place
- 2015 - Szőkefalvi-Nagy Gyula Mathematical Competition: 1st prize
- 2015, 2014 - Middle European Mathematical Olympiad (MEMO) bronze medal
- 2015, 2014 - European Girls' Mathematical Olympiad (EGMO) bronze medal
- 2014 - High School Mathematical Journal (KöMaL): 1st prize
- 2014 - Budó Ágoston Physics Competition: 1st prize
- 2014 - International Hungarian Mathematical Competition: 2nd place + special award
- 2014 - Szőkefalvi-Nagy Gyula Mathematical Competition: 1st prize
- 2014 - Arany Dániel Mathematical Competition: 3rd prize
- 2013 - High School Mathematical Journal (KöMaL): 2nd prize
- 2013 - Budó Ágoston Physics Competition: 2nd prize
- 2013 - International Hungarian Mathematical Competition: 1st prize

DÓRA HANTOSI

Szeged Scientists Academy, 4th year

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YEAR OF BIRTH:

1995

FORMER SZENT-GYÖRGYI PUPIL:

yes

SZENT-GYÖRGYI MENTOR:

Dr. Ferenc Bari

SPECIALIZATION:

cerebral circulation and metabolism

SECONDARY SCHOOL:

Radnóti Miklós Experimental Grammar School, Szeged

NAME OF TEACHER:

Viktória Gál

LANGUAGES:

English/advanced

IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Ischaemic stroke is the third leading cause of death among the Hungarian population. The presence of recurring spreading depolarisations (SD) and impaired neurovascular coupling under ischemic conditions significantly decreases the perfusion of the injured area resulting in neuronal cell death and spreading of the infarcted lesion. The aim of our research is to restore the function of neurovascular coupling and to prevent the damage caused by SDs using a new, non-invasive, targeted drug delivery system, thus providing a new therapeutic opportunity in stroke treatment

AMBITIONS AND CAREER GOALS

During my medical carreer I would like to work in the field of radiology (neuroradiology) as this field serves as the basis of almost every clinical diagnosis and treatment and also provides me an opportunity to invest my aquired knowledge both in research and patient care. In addition, radiology is a rapidly and dynamically developing area, where it is always a requirement to follow and learn new techniques.

HONORS AND PRIZES

- 2016. JPEMS Scholarship
- 2017. National Scientific Student Research Conference, Pécs – special award
- 2017. Annual Scientific Student Research Conference, Faculty of Medicine, University of Szeged, Pharmacology section – 1st place
- 2017. Annual Scientific Student Research Conference, Faculty of Medicine, University of Szeged, Epidemiology and Preventive Medicine section – 3rd place
- 2018. RECOOP Frigyes Korányi Student Conference, Budapest – 1st place
- 2018. SZTE Talent Scholarship – bronze degree

PUBLICATIONS

Szabó, Í., M. Tóth, O.; Török, Zs.; Varga, D.P.; Menyhárt,Á.; Frank, R.; **Hantosi, D.;** Horváth, I.; Bari, F.; Vigh, L.; Farkas, E. The impact of dihydropyridine derivatives on the cerebral blood flow response to somatosensory stimulation and spreading depolarization in the intact and ischemic rat cerebral cortex. **In preparation**

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.

MÁRK HARANGOZÓ

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YEAR OF BIRTH:

1998

FORMER SZENT-GYÖRGYI PUPIL:

yes

SZENT-GYÖRGYI MENTOR:

Dr. Antal Berényi

SPECIALIZATION:

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 neuropsychiatric disorders, and in many cases drug treatments cannot maintain an asymptomatic state. Former investigations have shown that the mechanism of the transformation of concrete fear reactions into generalized anxiety is similar to that of learning, although the exact neuronal mechanisms in the background are still unknown. Successful animal experiments and clinical investigations have proven that depression and anxiety can be made asymptomatic by means of electrical stimulation. This effect is rather diffuse, though. The aim of my work is to explore the neuronal networks and cell-type specific chokepoints which are responsible for the efficacy of 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 evoked by using lege artis electrical footshock, and we attempt to prevent their generalization into anxiety with optical stimulation. The efficacy of the stimulation is evaluated by measuring the level of anxiety after re-exposure to a similar environment with 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.

AMBITIONS AND CAREER GOALS

After obtaining my medical degree, I would like to become an internationally recognized physician and researcher. Naturally, I intend to earn a PhD and a postdoctoral degree, too. In order to acquire some professional experience, I hope to be able to work abroad as a member of an international team, possibly in the US or the UK.

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

–

KÁLMÁN HORVÁTH

Szeged Scientists Academy, 1st year

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YEAR OF BIRTH:

1996

FORMER SZENT-GYÖRGYI PUPIL:

no

SZENT-GYÖRGYI MENTOR:

Dr. Csaba Pál

SPECIALIZATION:

systems and synthetic biology

SECONDARY SCHOOL:

Boronkay György Technical High School

NAME OF TEACHER:

Anita Bíró-Sturcz

LANGUAGES:

English/advanced

IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Nearly a century ago, Alexander Fleming, with the discovery of penicillin, laid the foundation for a major part of modern medicine. Now, antibiotic resistance has become one of the key health hazards in today's world and is endangering modern medicine. Bacterial strains that are resistant to most or all conventional antibiotics are continuously being isolated. As other antimicrobials are only in the stage of drug development, the understanding of drug interactions could provide a solution to multidrug resistance. Our aim is to map these interactions between conventional as well as newly developed antibacterial drugs and to understand the underlying patterns. The understanding of these general patterns enables us to identify promising novel drug combinations that could stop the spread of multidrug-resistant bacteria.

AMBITIONS AND CAREER GOALS

My goal during my career is to contribute effectively to the research that is being done for the welfare of humankind, be it work to improve general health or efforts to reduce the risk of infections during surgery. I find it very useful that I can get to know the methodics and dynamics of a lab and learn how to work effectively as a team before I finish university. This way I can get direct work experience in the field of science.

HONORS AND PRIZES

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PUBLICATIONS

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MÁRTON HORVÁTH

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YEAR OF BIRTH:

1998

FORMER SZENT-GYÖRGYI PUPIL:

no

SZENT-GYÖRGYI MENTOR:

Dr. Attila Gácser

SPECIALIZATION:

microbiology

SECONDARY SCHOOL:

Bilingual Secondary Grammar School of Balatonalmadi

NAME OF TEACHER:

Dr. Anna Várkuti

LANGUAGES:

English/ advanced
German/intermediate
Italian/ intermediate

IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Throughout the last few decades, invasive fungal infection has been posing a growing threat to patients with a suppressed immune status in hospital environments. Species from the genus *Candida* are frequently isolated from such infections, and among them it is *Candida* parapsilosis that threatens neonates most and is thus in the centre of our attention. In our research we aim to better understand the interaction between fungal cells and the host by investigating immune responses. We intend to examine pathogen recognition and potentially activated signal transduction pathways in a healthy mucosal environment during *C. parapsilosis* interaction by using various approaches. These include the investigation of the role of pattern recognition receptors (PRRs) in the immunological recognition of *C. parapsilosis* as well as the activated signal transduction pathways, which lead to the development of immunological tolerance. Our further ambitions include finding yet undiscovered mechanism involved in the discrimination between elimination and tolerogenic responses induced by fungal species as we hypothesize that these mechanisms might contribute to the progression of other, non-microbial diseases as well.

AMBITIONS AND CAREER GOALS

During my scientific career I aspire to acquire a deeper insight into immunology in order to fully understand the bases of fundamental immune responses, for which the understanding of host-pathogen interactions is absolutely necessary. As a member of the Candida research group, my long-term goal is to contribute to the expansion of our current knowledge on commensal and pathogen microbe-induced immune responses.

HONORS AND PRIZES

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PUBLICATIONS

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ANDRÁS KISPÁL

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YEAR OF BIRTH:

1992

FORMER SZENT-GYÖRGYI PUPIL:

no

SZENT-GYÖRGYI MENTOR:

Dr. Antal Berényi

SPECIALIZATION:

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.

AMBITIONS AND CAREER GOALS

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, 4th year

University of Szeged, Faculty of Medicine, 4th year
Institute of Surgical Research

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YEAR OF BIRTH:

1995

FORMER SZENT-GYÖRGYI PUPIL:

yes

SZENT-GYÖRGYI MENTOR:

Dr. József Kaszaki

JUNIOR MENTOR:

Dr. Marietta Zita Poles

SPECIALIZATION:

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 am studying the beneficial effects of methane inhalation on systemic hemodynamic parameters and local tissue damage markers under mild and strong hypoxic circumstances. The anti-inflammatory and antioxidative effects of methane inhalation have been proven in the case of ischaemia/reperfusion diseases. However, the impact of methane under systemic hypoxia remains unclear. We plan to shed light on this matter with our recent *in vivo* research. Systemic hypoxia is a frequent consequence or component of many diseases, and among others it affects patients who suffer from a chronic pulmonary disease. The significance of our research is to provide a possible treatment for hypoxia induced tissue damage. Our recent results have shown that methane inhalation alleviates hypoxia caused nitrosative stress in the small intestine and lungs, 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 sepsis induced hypoxia .

AMBITIONS AND CAREER GOALS

Apart from clinical work, I would like to continue research in a subject related to my future specialization because I am determined to find out exactly what causes diseases in humans. With my research I intend to serve my future patients and medicine in general at the same time.

HONORS AND PRIZES

- Scholarship of New National Excellence Program 2017/2018
- Student Scientific Conference 2017, Operative Research section I: 3rd prize
- Student Scientific Conference 2017, Pharmacology section II: 1st prize

PUBLICATIONS

Poles, M.Z., Bódi, N., Bagyánszki, M., Fekete, É., Mészáros, A.T., Varga, G., Szűcs, S., Nászai, A., **Kiss, L.**, Kozlov, A.V., Boros, M., Kaszaki, J. (2018) Reduction of nitrosative stress by methane: Neuroprotection through xanthine oxidoreductase inhibition in a rat model of mesenteric ischemia-reperfusion. **Free Radic Biol Med. 120:** 160-169. doi: 10.1016/j.freeradbiomed.2018.03.024.

ANNA GEORGINA KOPASZ

Szeged Scientists Academy, 2nd year

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YEAR OF BIRTH:

1998

FORMER SZENT-GYÖRGYI PUPIL:

yes

SZENT-GYÖRGYI MENTOR:

Dr. Lajos Mátés

SPECIALIZATION:

biotechnology

SECONDARY SCHOOL:

Radnóti Miklós Experimental Grammar School, Szeged

NAME OF TEACHER:

Viktória Gál

LANGUAGES:

English/advanced

IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Nowadays cancer is the leading cause of death in economically developed countries. The contraction of cancer can be considered as an evolutionary process within our bodies. The tumor genome sequence data collected so far show that there are tens or even hundreds of thousands of mutations in each tumor sample, and the spontaneous mutation rate observed in normal cells is not sufficient to account for the high number of mutations found in cancers. However, it is this very instability of their genetic material that may allow cancer cells to generate an enormous number of mutations. The long-term objective of our laboratory is to explore genetic alterations fueling malignant transformation by undermining the stability of the genome.

AMBITIONS AND CAREER GOALS

After obtaining my MSc degree, I plan to continue my studies and my research work as a PhD student. By earning my PhD degree, I would like to master a broad range of molecular biological techniques and their biological bases. As a postdoctoral researcher, I hope I will have the chance to spend some years abroad in order to be able to gain some professional experience before I can establish my own research topics and head my own research team. I am particularly interested in biotechnology and so very eager to further improve the currently available biotechnological toolbar

HONORS AND PRIZES

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

PUBLICATIONS

Kopasz, A.G. (2016) Az iszkémiás prekondícionálás hatása a reperfúzió indukálta kamrai aritmiákra krónikus veseelégtelenségben, SZTE Tudományos Diákköri Konferenciája, **ISBN 978- 963-306-511-2**

Kopasz, A.G. (2017) Az iszkémiás prekondicionálás csökkenti az iszkémia indukálta kamrai aritmiákat, **XXXIII. OTDK, Orvosképzés, XCII. Évfolyam, 2. Szám**

Kopasz, A.G. , Fehérné Juhász, E., Nagy, A., Ocsovszki, I., Mátés, L., Extension of the mammalian biotechnology toolbar with a well-balanced bidirectional promoter, **poszter**

DÉNES PÉTER KOVÁCS

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YEAR OF BIRTH:

1994

FORMER SZENT-GYÖRGYI PUPIL:

no

SZENT-GYÖRGYI MENTOR:

Dr. Zoltán Rakonczay

JUNIOR MENTOR:

Dr. Lóránd Kiss

SPECIALIZATION:

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.

AMBITIONS AND CAREER GOALS

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

- Student Scientific Conference 2017 – 1st place

Attendance at:

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

PUBLICATIONS

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KRISTÓF KÁROLY KOVÁCS

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YEAR OF BIRTH:

1998

FORMER SZENT-GYÖRGYI PUPIL:

no

SZENT-GYÖRGYI MENTOR:

Dr. László Vécsei

JUNIOR MENTOR:

Dr. Nikoletta Szabó

SPECIALIZATION:

neurology - radiology

SECONDARY SCHOOL:

Radnóti Miklós Experimental Grammar School Szeged

NAME OF TEACHER:

Sándor Bán

LANGUAGES:

English/advanced
German/basic

IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Primary headache disorders impair a patient's quality of life: during headache the working capacity of patients is decreased, and the number of days out of work is high. Migraine has a privileged position since it affects 15% of the population. The pathomechanism of the disease is still unclear, but it seems peripheral and central mechanisms might also play a role in it. For this reason, it is essential to improve the new molecular and non-invasive biomarkers for monitoring the disease and possibly to develop novel therapeutic approaches. In a migraineur's blood NSE, S100b and CGRP are increased compared to controls. The serum level PACAP-83 is also increased during migraine and a cluster headache attack, while neuroimaging methods describe functional and structural brain alterations in headache disorders. A growing number of molecular and imaging biomarkers show the significance of these methods, yet a combination of these techniques is rare. Our aim is to improve and fuse in vivo markers and this way to create more sensitive biomarkers as well as to develop a potential treatment involving the kynurenine analogues we are currently studying.

AMBITIONS AND CAREER GOALS

I would like to contribute to the development of a proper treatment for migraine, which would be based on the kynurenine molecule family we are currently studying, thus helping to make patients' lives better. I also want to acquire the skills and qualities it takes for one to be a competent researcher, such as an ability to work in a team, to write scientific articles and also to propose new models and theories.

HONORS AND PRIZES

- 2016: National Secondary School Academic Competition in Physics: Category I - 28th place
- 2017: National Secondary School Academic Competition in Biology: Category II - 34th place

PUBLICATIONS

–

SÁNDOR MÁRKI

Szeged Scientists Academy, 5th year

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YEAR OF BIRTH:

1995

FORMER SZENT-GYÖRGYI PUPIL:

no

SZENT-GYÖRGYI MENTOR:

Dr. Márta Széll

JUNIOR MENTOR:

Dr. Anikó Göblös

SPECIALIZATION:

genetics

SECONDARY SCHOOL:

Horváth Mihály Secondary School, Szentes

NAME OF TEACHER:

Mónika Kátai

LANGUAGES:

English/intermediate

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 RNSs 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.

AMBITIONS AND CAREER GOALS

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.

HONORS AND PRIZES

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

PUBLICATIONS

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FANNI MAGDOLNA MÁRVÁNYKÖVI

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YEAR OF BIRTH:

1996

FORMER SZENT-GYÖRGYI PUPIL:

no

SZENT-GYÖRGYI MENTOR:

Tamás Csont, MD PhD

JUNIOR MENTOR:

Márta Sárközy, MD PhD

SPECIALIZATION:

biochemistry,
experimental cardiology

SECONDARY SCHOOL:

BMSZC Petrik Lajos Secondary School, Budapest

NAME OF TEACHER:

György Láng
Dr. Pálné Golopencza MD

LANGUAGES:

English/advanced

IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

In developed countries, the leading causes of death are cardiovascular diseases. Several metabolic diseases including e.g. hyperlipidemia, diabetes mellitus, chronic kidney disease (CKD) increase the risk for cardiovascular diseases. Recently, we have started to investigate the mechanisms of cardiac hypertrophy and fibrosis associated with CKD in a rat model. Furthermore, we investigate ischemic stress adaptation (i.e. ischemic preconditioning and postconditioning) of the heart in the presence of hypertrophy and fibrosis developed in CKD. Our aim is to investigate the molecular mechanisms (microRNA, mRNA, downstream targets, circulating miRNAs) in the development of CKD-associated hypertrophy and fibrosis. We also would like to test new agents for the prevention of fibrosis and left ventricular hypertrophy in CKD. Moreover, we hope to understand better the effects of gender difference on the development of hypertrophy and fibrosis, and ischemic stress adaptation in CKD.
We set up a CKD model in vivo and we investigate ischemic adaptation ex vivo in our lab. The techniques used by our lab include transthoracic echocardiography, Langendorff heart perfusion, measurement of the infarct size by planimetry, histology, standard biochemical and molecular biology methods (e.g. colorimetric assays, PCR, ELISA, etc.).

AMBITIONS AND CAREER GOALS

In my view, research is one of the key elements in medical studies, because we can use research data to save human life. I hope that later in my career this knowledge could be used in the clinics and in my further research, too. My aim is to translate the newly discovered research results into the clinical practice, thereby improving medical therapy.

HONORS AND PRIZES

- 2017 - SZTE ÁOK, TDK Conference, Szeged, 2nd prize (co-author)
- 2017 - SZTE ÁOK, TDK Conference, Szeged, 3rd prize
- 2018 - XXIII. Korányi Frigyes Scientific Forum, Budapest, 2nd prize

PUBLICATIONS

–

VALÉRIA ÉVA MESZLÉNYI

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University of Szeged,
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YEAR OF BIRTH:

1996

FORMER SZENT-GYÖRGYI PUPIL:

no

SZENT-GYÖRGYI MENTOR:

Dr. László Siklós

SPECIALIZATION:

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.

AMBITIONS AND CAREER GOALS

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

- 2017. SZTE Talent Prize

PUBLICATIONS

Patai, R., Nógrádi, B., **Meszlényi, V.**, Obál, I., Engelhardt, J.I., Siklós, L. (2017) Az amiotrófiás laterálszklerózis patofiziológiai tényezőinek központi kapcsolóeleme, a kalcium. I**ddeggy Szle 70(7- 8):** 247-257.

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 2(4):** 1-4.

Obál, I., Nógrádi, B., **Meszlényi, V.**, Patai, R., Siklós, L., Kovács, G.G., Engelhardt, J.I.: Chronic intraperitoneal administration of serum from patients with amyotrophic lateral sclerosis causes weakness and loss of spinal motor neurons in mice. I**n preparation**

ZSÓFIA FLÓRA NAGY

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YEAR OF BIRTH:

1998

FORMER SZENT-GYÖRGYI PUPIL:

yes

SZENT-GYÖRGYI MENTOR:

Dr. Márta Széll

JUNIOR MENTOR:

Dr. Kornélia Tripolszki

SPECIALIZATION:

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 leads to death 3-5 years after the diagnosis. There are two forms of this disorder: familial and sporadic. Through sequencing the genome of patients scientists have been able to detect genetic variants that might be responsible for the development of ALS. The aim of our research is to further investigate the genetic background of amyotrophic lateral sclerosis through the genetic analysis of Hungarian patients affected by ALS. The knowledge of the genetic background of ALS could provide an opportunity to develop efficient diagnostic techniques and personalized therapy.

AMBITIONS AND CAREER GOALS

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

HONORS AND PRIZES

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PUBLICATIONS

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ANNA NÁSZAI

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YEAR OF BIRTH:

1996

FORMER SZENT-GYÖRGYI PUPIL:

no

SZENT-GYÖRGYI MENTOR:

Dr. Mihály Boros

JUNIOR MENTOR:

Dr. László Juhász

SPECIALIZATION:

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 the xanthine oxidoreductase (XOR) enzyme. XOR plays an important physiological role in purine metabolism as xanthine dehydrogenase (XDH), however, following ischaemia/reperfusion XDH is converted to xanthine oxidase (XO) isoform, and generates an excessive amount of reactive oxygen species (ROS). Under hypoxic circumstances, XOR is responsible for nitric oxide (NO) production due to both its nitrite and nitrate reductase activity. We have demonstrated that methane influences the substrate specificity of XOR by shifting XO to XDH, and thus it decreases pathological NO production under ischaemia and XO-derived ROS production as well as oxidative stress under reperfusion. Furthermore, methane does not inhibit the physiological function of this enzyme in purine catabolism.

AMBITIONS AND CAREER GOALS

I hope my research career will eventually amount to a PhD degree, and I would like to live to see methane 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, 19th place
- 2016 - Joint Program for European Medical Studies (JPEMS) scholarship
- 2017 – University of Szeged, Annual Student Research Conference (TDK Conference) – 2nd place

PUBLICATIONS

Poles, M.Z., Bódi, N., Bagyánszki, M., Fekete, É., Mészáros, A.T., Varga, G., Szűcs, Sz., **Nászai, A.**, Kiss, L., Kozlov, A.V., Boros, M., Kaszaki, J. (2018) Reduction of nitrosative stress by methane: Neuroprotection through xanthine oxidoreductase inhibition in a rat model of mesenteric ischemia-reperfusion. **Free Radic Biol Med 120:** 160-169.

BERNÁT NÓGRÁDI

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YEAR OF BIRTH:

1997

FORMER SZENT-GYÖRGYI PUPIL:

no

SZENT-GYÖRGYI MENTOR:

Dr. László Siklós

JUNIOR MENTOR:

Dr. Roland Patai

SPECIALIZATION:

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 as well as to find possible therapeutic approaches.

AMBITIONS AND CAREER GOALS

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

- 2017 – University of Szeged, Talent prize
- 2017 – University of Szeged, Faculty of Medicine, Annual Student Research Conference, 2nd prize

PUBLICATIONS

Obál, I., **Nógrádi, B.**, Meszlényi, V., Patai, R., Siklós, L., Kovács, G.G., Engelhardt, J.I.: Chronic intraperitoneal administration of serum from patients with amyotrophic lateral sclerosis causes weakness and loss of spinal motor neurons in mice. In preparation

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**

Patai, R., **Nógrádi, B.,** Meszlényi, V., Obál, I., Engelhardt, J.I., Siklós, L. (2017) Az amiotrófiás laterálszklerózis patofiziológiai tényezőinek központi kapcsolóeleme, a kalcium. **Ideggy Szle**

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 Comm**

BENJAMIN TAMÁS PAPP

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YEAR OF BIRTH:

1995

FORMER SZENT-GYÖRGYI PUPIL:

no

SZENT-GYÖRGYI MENTOR:

Dr. Lajos Kemény

JUNIOR MENTOR:

Dr. Máté Manczinger

SPECIALIZATION:

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 folra 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 threatment of this disease.

AMBITIONS AND CAREER GOALS

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 Tirgu Mures, special prize, immunology
- 2017 Scientific Student's conference in Szeged, 1st prize, biochemistry-microbiology- immunology

PUBLICATIONS

Manczinger, M., Bodnár, V.Á., **Papp, B.T.**, Bolla S.B., Szabó, K., Balázs, B., Csányi, E., Szél, E., Erős, G., Kemény, L. (2017) Drug Repurposing by Simulating Flow Through Protein–Protein Interaction Networks. **Clinical Pharmacology and Therapeutics 103:** 511-520.

Papp, B.T. Adaptation to pathogen load by increasing the size of MHC II peptide-binding repertoire. Poszter, **World Immune Regulation Meeting XI,** 15-18 March 2017, Davos Switzerland

GERGŐ PORKOLÁB

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YEAR OF BIRTH:

1996

FORMER SZENT-GYÖRGYI PUPIL:

no

SZENT-GYÖRGYI MENTOR:

Dr. Mária Deli

JUNIOR MENTOR:

Dr. Szilvia Veszelka

SPECIALIZATION:

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.

AMBITIONS AND CAREER GOALS

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, 3rd year

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Faculty of Medicine, 3rd year**

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YEAR OF BIRTH:

1996

FORMER SZENT-GYÖRGYI PUPIL:

yes

SZENT-GYÖRGYI MENTOR:

Dr. István Andó

JUNIOR MENTOR:

Dr. Gyöngyi Cinege

SPECIALIZATION:

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

Our research group works on the analysis of cell-mediated innate immunity in different *Drosophila* species. In the species of the ananassae subgroup of the *Drosophila* genus we have identified multinucleated giant hemocytes which are responsible for the encapsulation of larger foreign particles, such as parasitoid wasp eggs. Multinucleated giant hemocytes highly resemble multinucleated cells present in human granulomas. Diseases associated with granuloma formation, such as tuberculosis, are still widespread. According to the WHO's 2015 report, approximately one third of the world's population is suspected to be infected with Mycobacterium tuberculosis. The aim of our research is to identify *Drosophila* factors which would then enable us to better understand the molecular mechanisms of granuloma formation and function.

AMBITIONS AND CAREER GOALS

During my career, I would like to decipher the mechanisms of innate immunity among physiologic and pathologic conditions as fully as possible. As a medical researcher, I can help patients both directly and indirectly, while working in a hospital ward or in the laboratory, as well. Obtaining a PhD degree and expanding my knowledge in a research centre abroad are also among my goals.

HONORS AND PRIZES

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PUBLICATIONS

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BALÁZS JÓZSEF SZENCI

Szeged Scientists Academy, 1st year

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YEAR OF BIRTH:

1999

FORMER SZENT-GYÖRGYI PUPIL:

no

SZENT-GYÖRGYI MENTOR:

Dr. László Dux

SPECIALIZATION:

muscle biochemistry

SECONDARY SCHOOL:

Teleki Blanka Secondary and Primary School

NAME OF TEACHER:

Péter Sűdy

LANGUAGES:

English/advanced

IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

In developed countries insulin resistance (which may give rise to type 2 diabetes mellitus) has become a major public health issue because of sedentary lifestyle, rapidly increasing average age and inappropriate diet. The system of skeletal muscle with its vast glucose uptake is one of the most important regulators of the glucose homeostasis. Under physiological conditions insulin stimulus gives rise to the translocation of vesicles storing GLUT4 glucose transporter to the plasma membrane, which contributes to normal uptake of glucose molecules into the cell. In conditions like insulin resistance, the above described process of GLUT4 translocation is damaged since the underlying essential signalling pathways are perturbed. Our research aims at the investigation of the role of particular proteoglycans and small GTPases in the pathobiochemical alterations during insulin resistance. We make use of both *in vitro* and *in vivo* models, utilising the techniques of biochemistry and molecular biology. I firmly believe that the results of our group may open up new horizons in the development of novel antidiabetic drugs.

AMBITIONS AND CAREER GOALS

After getting MD degree I would like to participate in a doctorate course and acquire academic degree. Subsequently, I am planning to be employed in the field of clinical endocrinology. My personal aim is to conduct research into subjects that could be implemented into everyday clinical practice one day.

HONORS AND PRIZES

- Szent-Györgyi Academic Competiton (2016) 1st place
- Participation in the National Secondary School Academic Competition (OKTV): Biology (2015, 2016: 1st round), Chemistry (2015: 1st round, 2016: 2nd round)
- 'Talent of Teleki' (award of Teleki Blanka Secondary Grammar School, Székesfehérvár; 2017)

PUBLICATIONS

–

MÁRTON SZENTIRMAI

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YEAR OF BIRTH:

1993

FORMER SZENT-GYÖRGYI PUPIL:

no

SZENT-GYÖRGYI MENTOR:

Dr. László Vécsei

JUNIOR MENTOR:

Dr. Dénes Zádori

SPECIALIZATION:

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 am currently participating in a research project that takes place at the Department of Neurology, University of Szeged. Our main focus is on the molecular pathology of different neurological disorders. We examine the progression of these disorders of the central nervous system in rat and mouse models in addition to human samples with a view to finding potential therapeutic options. Currently, we are developing a method for the measurement of certain molecules of the kynurenine pathway, neuroprotective kynurenic acid, in particular. We perform our measurements on four different biological matrices: human plasma, human cerebrospinal fluid, murine plasma and murine brain samples. During these measurements we validate our methods, and we have even introduced and are testing an internal standard which has not been used before. Our results could help to understand in more detail the progression of particular neurodegenerative disorders and the effects of some drugs with a therapeutic potential.

AMBITIONS AND CAREER GOALS

Profound understanding of neurological disorders and participation in the rapidly developing world of brain research. To achieve this goal, I am currently focusing on the acquirement of different measurement methods with a view to finding real and fascinating connections while working in a laboratory and to generating useful, publishable results in the field of neurology.

PUBLICATIONS

Veres, G., Fejes-Szabó, A., Zádori, D., Nagy-Grócz, G., László, AM., 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 (Vienna) 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.

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.

KRISZTINA SZŐKE

Szeged Scientists Academy, 2nd year

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YEAR OF BIRTH:

1991

FORMER SZENT-GYÖRGYI PUPIL:

no

SZENT-GYÖRGYI MENTOR:

Dr. Mónika Kiricsi

SPECIALIZATION:

molecular biology, cell biology, nanotechnology

SECONDARY SCHOOL:

Radnóti Miklós Experimental Grammar School, Szeged

NAME OF TEACHER:

Sándor Bán

LANGUAGES:

English/advanced

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 chemoterapy.

AMBITIONS AND CAREER GOALS

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.

HONORS AND PRIZES

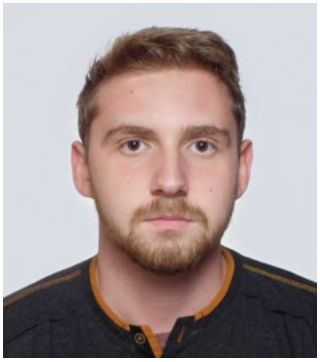
- University of Szeged, Scientific Students' Association Conference, 2016. March, 2nd Prize

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, Nóra 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, 2nd year

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YEAR OF BIRTH:

1998

FORMER SZENT-GYÖRGYI PUPIL:

yes

SZENT-GYÖRGYI MENTOR:

Dr. András Dér

JUNIOR MENTOR:

Dr. Sándor Valkai

SPECIALIZATION:

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, scietists work on interferometrical discipline. Interference-occurance-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 analitical purposes.

AMBITIONS AND CAREER GOALS

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, 38th place
- 2014/15 Vermes Miklós International Competition of Physics, 7th place
- 2013/14 Budó Ágoston National Competition of Physics, Szeged, 3rd place
- Wigner Jenő Competition of Physics, Békéscsaba, 2nd place

PUBLICATIONS

–

DÁVID TÁLAS

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YEAR OF BIRTH:

1997

FORMER SZENT-GYÖRGYI PUPIL:

no

SZENT-GYÖRGYI MENTOR:

Dr. Péter Hegyi

JUNIOR MENTOR:

Dr. Petra Pallagi

SPECIALIZATION:

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^- 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_3^- 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.

AMBITIONS AND CAREER GOALS

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

- 2016/17 – New National Excellence Program Scholarship
- 2017/18 – New National Excellence Program Scholarship
- 2017 – 49th Conference of the European Pancreatic Club: Travel Grant
- 2017 – 25th United European Gastroenterology Week: Travel Grant
- 2017 Fall: University of Szeged, Scientific Students' Association Conference 1st Prize in Physiology/Pathophysiology 5th category

PUBLICATIONS

–

DÁVID TÓTH

Szeged Scientists Academy, 3rd year

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YEAR OF BIRTH:

1996

FORMER SZENT-GYÖRGYI PUPIL:

no

SZENT-GYÖRGYI MENTOR:

Dr. Gábor Juhász

SPECIALIZATION:

developmental genetics, autophagy

SECONDARY SCHOOL:

Táncsics Mihály Secondary School, Orosháza

NAME OF TEACHER:

László Franciszti, László Kiss

LANGUAGES:

English/intermediate
German/advanced

IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

The role of autophagy (i.e. the self-eating processes of cells) during the development of individual organisms is in the center of our research The fact that the Nobel Prize was awarded to scientists researching this very topic in 2016 shows the importance of autophagy. In our research our aim is to find out what the specific role of the Atg9 autophagy gene is during the egg cell production of drosophila flies. In order to be able to answer this question, we have been conducting transplantational experiments. Our work so far has proven that mutant ovaries display a mutant phenotype even in wild type circumstances, therefore the function of the studied autophagy genes must be essential in the ovary. Our future goal is to fully understand which cell types of the ovary the function of the observed autophagy genes plays a vital part in.

AMBITIONS AND CAREER GOALS

My principal goal is to master genetics at the highest level possible and to impart my knowledge to others. I also intend to expand my expertise by working in leading research labs abroad.

HONORS AND PRIZES

- 2016 Autumn: University of Szeged Faculty of Medicine - Scientific Student Conference 1st prize
- 2017. – XXXIII. National Scientific Student Conference 2nd prize

PUBLICATIONS

–

RÉKA TÓTH

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YEAR OF BIRTH:

1995

FORMER SZENT-GYÖRGYI PUPIL:

yes

SZENT-GYÖRGYI MENTOR:

Dr. Eszter Farkas

JUNIOR MENTOR:

Ákos Menyhárt

SPECIALIZATION:

neurology

SECONDARY SCHOOL:

SZTE Ságvári Endre Secondary School, Szeged

NAME OF TEACHER:

István Csigér

LANGUAGES:

English/advanced
French/intermediate

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.

AMBITIONS AND CAREER GOALS

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

- 2017 – 33. National Scientific Students' Associations Conference, 1. prize
- 2017 – Regional Scientific Students' Associations Conference, Section of Morphology, Pathology and Imaging diagnostics 2, 1. prize
- 2017 – Regional Scientific Students' Associations Conference, Section of Physiology, Pathophysiology 3., Main prize
- 2017 – Regional Scientific Students' Associations Conference, Audience award.
- 2016 - Regional Scientific Students' Associations Conference, 1. prize

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

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YEAR OF BIRTH:

1998

FORMER SZENT-GYÖRGYI PUPIL:

yes

SZENT-GYÖRGYI MENTOR:

Dr. Lajos Haracska

SPECIALIZATION:

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.

AMBITIONS AND CAREER GOALS

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 - 17th place
- 2013- Árokszállásy Zoltán Biology Competition -18th place
- 2016- National Student Competition Assays 33rd place

PUBLICATIONS

–

MIHÁLY ÚJHÁZI

Szeged Scientists Academy, 4th year

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YEAR OF BIRTH:

1996

FORMER SZENT-GYÖRGYI PUPIL:

yes

SZENT-GYÖRGYI MENTOR:

Dr. József Mihály

SPECIALIZATION:

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.

AMBITIONS AND CAREER GOALS

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

–

PETRA VARGA

Szeged Scientists Academy, 2nd year

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YEAR OF BIRTH:

1998

FORMER SZENT-GYÖRGYI PUPIL:

yes

SZENT-GYÖRGYI MENTOR:

Dr. Mihály Boros
Dr. Eszter Tuboly

SPECIALIZATION:

biological gases

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

Biotic methane has traditionally been considered as a product of methanogenic bacteria exclusively, but new evidence has shown that with certain procedures eukaryotes can also be enabled to produce methane. These processes usually involve an oxido-reductive burst with a subsequent mitochondrial dysfunction. The exact biochemical background of non-microbial methanogenesis is still unclear, but recent research suggests that the presence of organosulphur compounds is essential for this process to take place. Apart from that, it has been brought to light that exogenous methane possesses anti- oxidant features. Bearing these findings in mind, the question arises whether we might be able to identify biomolecules with a methanogenic capacity that is suitable for human consumption, and also whether that molecule is able to have a positive effect on the harmful consequences of oxido-reductive stress through methane formation. In addition, the detection of endogenous non-microbial methane generation by means of our laser-based photoacoustic spectroscopy (in collaboration with the MTA- SZTE Photoacoustic Research Group) could be a promising diagnostic approach.

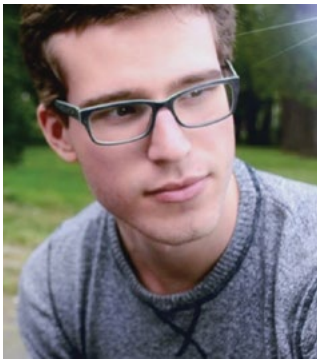
AMBITIONS AND CAREER GOALS

After finishing my studies, I would like to work in a hospital as a doctor as I am mostly interested in pediatrics. However, after graduation I am planning to enroll for a PhD course besides my resident training since I am committed to contributing to the progress of medicine with my research work. Also, I firmly believe it is absolutely essential that a professional like myself should facilitate the spread of novel methods in a clinical environment, as well.

HONORS AND PRIZES

- 2017 – Student Research Conference Biochemistry, Microbiology, Immunology II.: 3rd place
- 2017 – Student Research Conference Biochemistry, Microbiology, Immunology I.: 2nd place
- 2016 – International Biology Olympiad: silver medal
- 2015 – European Union Science Olympiad: gold medal
- 2014 – International Genetically Engineered Machine: Best Experimental Measurement
- 2015, 2016 – National Biology Competition: 4th place, 15th place
- 2014, 2016 – Dr. Árokszállásy Zoltán Biology Competition: 3rd place, 9th place
- Arany Dániel Mathematics Competition: 3rd place

BENEDEK ATTILA VERBURG



Szeged Scientists Academy, 1st year

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Faculty of Medicine, 2nd year

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YEAR OF BIRTH:

1996

FORMER SZENT-GYÖRGYI PUPIL:

no

SZENT-GYÖRGYI MENTOR:

Dr. István Krizbai

SPECIALIZATION:

medicine

SECONDARY SCHOOL:

Budapest-Fasori Lutheran Secondary School

NAME OF TEACHER:

Rita Csernus

LANGUAGES:

English/advanced
Dutch/advanced
German/basic

IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

The aim of our research team is to understand the physiological and pathological conditions of the blood-brain barrier. Most neurological diseases can directly or indirectly be linked to the opening and other abnormalities of the blood-brain barrier, as such understanding this system is of utmost importance to the health care of our time. We investigate how malignant tumors interact with the blood-brain barrier, how they form metastases in the brain, what signaling molecules play a role in this process. In addition, we seek to find out how the cells forming the blood-brain barrier communicate with each other during inflammatory nerve damage. For our research, we use *in vitro* cell models and *in vivo* animal models to simulate the blood-brain barrier, so it is possible to learn many new techniques in the laboratory.

AMBITIONS AND CAREER GOALS

Besides working in a clinic, I would like to do research on a subject related to my future specialization. I think it is extremely important that a physician knows where the knowledge that he applies every day comes from. It's a great opportunity to start gaining experience this early, so that I can become a better physician and researcher in the future.

HONORS AND PRIZES

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PUBLICATIONS

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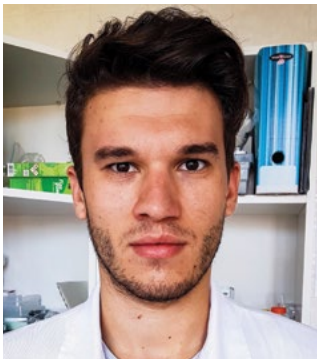
DÁNIEL LÁSZLÓ VIDÁCS



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YEAR OF BIRTH:

1997

FORMER SZENT-GYÖRGYI PUPIL:

no

SZENT-GYÖRGYI MENTOR:

Dr. Zsuzsanna Bata-Csörgő

SPECIALIZATION:

dermatology

SECONDARY SCHOOL:

Radnóti Miklós Experimental Grammar School, Szeged

NAME OF TEACHER:

Viktória Gál

LANGUAGES:

English/advanced
Spanish/intermediate

IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Psoriasis is a multifactorial skin disease affecting about 2-3% of the population worldwide although it is more prevalent in the Caucasian race. The most common form is the plaque type psoriasis, called Psoriasis vulgaris. Psoriatic lesional tissue is characterized by epidermal hyperplasia, abnormal keratinocyte differentiation, intensified and abnormal angiogenesis and inflammatory cell infiltration. The research focus of my group in our laboratory is the pathomechanism of psoriasis. I am involved in investigating the contribution of the extracellular matrix (ECM) components to the development of psoriatic skin pathology. We aim to examine the regulation of ECM genes by using Real-time RT-PCR technology and the expression of ECM proteins with immunocytochemistry and Flow cytometry in a 3D skin model.

AMBITIONS AND CAREER GOALS

By working in this laboratory, I want to learn basic techniques in biomedical research so that later on I can contribute finding new methods in the therapy of inflammatory skin diseases. There are several medicines that cure psoriasis, but many of them are merely symptomatic therapies. A better understanding of the pathomechanisms may lead to more relevant therapies with longer lasting results.

HONORS AND PRIZES

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PUBLICATIONS

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ANDRÁS ISTVÁN VIGH

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YEAR OF BIRTH:

1996

FORMER SZENT-GYÖRGYI PUPIL:

no

SZENT-GYÖRGYI MENTOR:

Dr. Zsuzsanna Bata-Csörgő

SPECIALIZATION:

psoriasis

SECONDARY SCHOOL:

Premonstratenian
St. Norbert Secondary
School

NAME OF TEACHER:

Zoltán Kerényi

LANGUAGES:

English/advanced

IMPORTANCE, AIMS AND POSSIBLE OUTCOME OF RESEARCH

Psoriasis is a multifactorial skin disease with chronic inflammation, and it frequently affects the nails and the joints. In Hungary as well as worldwide, it is regarded as one of the most common skin diseases. The main goal of our research is to justify two key assumptions, one of them being whether the lower limp is the most commonly infected area, - and if so, why? The other hypothesis is whether the skin symptoms invariably appear in the same area of the body. As part of the study, we also take blood samples from the patients suffering from psoriasis and test them with immunological and biochemical methods with the aim of finding possible biomarkers. The outcome of our research will hopefully contribute to understanding the pathomechanism of this disease, which in turn may help find new therapeutic ways to cure and prevent psoriasis.

AMBITIONS AND CAREER GOALS

During and after my medical studies my aim is to continue working in a laboratory. After finishing university, I would like to work abroad for some years as a member of a bigger research team. It is my intention to continuously develop my personal and technical skills in research and to assist in the prevention and treatment of psoriasis with my present and future knowledge. Eventually, as it is my long-term goal, I would like to live and work in Hungary.

HONORS AND PRIZES

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PUBLICATIONS

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Imprint

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