UNIVERSITY OF

PÉCS

SZENTÁGOTHAI RESEARCH

CENTRE

Living Science – home in

SzRC

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Greetings from the President

The highly distinguished Szentágothai Research Centre (SzRC) of the University of Pécs (UP) is a research institute Established: on the premise of modern international science, organizational and management norms and standards. It covers all aspects of education, research and innovation throughout the fields of biomedical, natural and environmental sciences. The infrastructure, instrumentation and expertise comprised of the almost twenty research groups operating in the building usher in an excellent opportunity to evolve into respected, well-known, leading research facility in Hungary, including Central Europe and with an extensive and fruitful network of professional collaboration.

Today, SzRC hosts nineteen research groups with more than two hundred researchers and five associated research groups. All are dedicated and intently focus on internationally acknowledged publication activity, strengthening relationships with industry, increasing the potential regarding international grants and funding, acknowledging the spirit of competitiveness, assimilating young researchers into our folds and encourage participation in the university and postgraduate education, ultimately raising the next generation of scientists. Notably, the SzRC anointed with its infrastructure, also provides the groundwork for future implementation of major projects aligned under the University and other educational activities.

In consideration of its Core Facility (CF), laboratory services SzRC facilitate and develop its research infrastructure providing comprehensively significant scientific and innovation potential in support of future potential regarding global collaboration. Additionally, the CF portfolio handsomely contributes to our engagement among research networks and enhances successful grant funding.

Admirably, SzRC bears an active role in the education among our younger generations of researchers and scientists. Since in 2015, in association with the vision of the UP Senior Management, we launched the "Szentágothai Talent Support Program," supporting the up and coming generation and is open for young researchers demonstrating outstanding performance and notable achievement. The program operates in three year cycles providing three talented young researchers an opportunity to continue their scientific career within SzRC.

In addition to fostering basic and applied research, the strategic goal of SzRC is to accommodate innovation processes. At the inception of the SzRC, one of the primary objectives was the development of a research facility in which science and social benefits are professionally intertwined. Innovation is considered one of the most determining factors of this endeavor, including the process in transferring the novelties based on latest research findings in science to global markets. Our innovative activities are superbly aligned with the strategy regarding the UP, national innovation programs and international best practices. Based on the traditions of the UP, SzRC research are initiated mostly in the field of Life Sciences including medical science, microbiology, virology and drug development. Our primary goal is to achieve internationally outstanding scientific results, recognition of the research efforts and raising international visibility.

Prof. Dr. Zsuzsanna Helyes – President of the SzRC

SZENTÁGOTHAI RESEARCH CENTRE

The **Szentágothai Research Centre**, founded in 2012, stands as the premier research institute of the University of Pécs (UP) developed in line with the internationally accepted contemporary trans- and multidisciplinary organizational and science management standards. SzRC strives to develop all possible aspects of research, education and innovation in matters regarding education in life sciences, natural sciences and environmental sciences. The research activities are implemented among seven clusters: Data Science, Neuroscience, Molecular Biology, Physics-chemistry, Immunology, Building Energetics and Industrial-scientific clusters. The research and infrastructural potential regarding the South-Transdanubian region is highly concentrated at the SzRC. The Centre maintains professionally cooperative relationships with academic and industrial partnerships. Due to its structure and operational model, the SzRC elicits flexible responses to the latest research trends and the challenges of the knowledge based economy. The **two-hundred researchers, nineteen research groups and eight Core Facilities** equipped with a fully contemporary instrument portfolio and outstanding scientific quality provides a benchmark to evolve into one the leading research centres in Hungary including Central Europe.

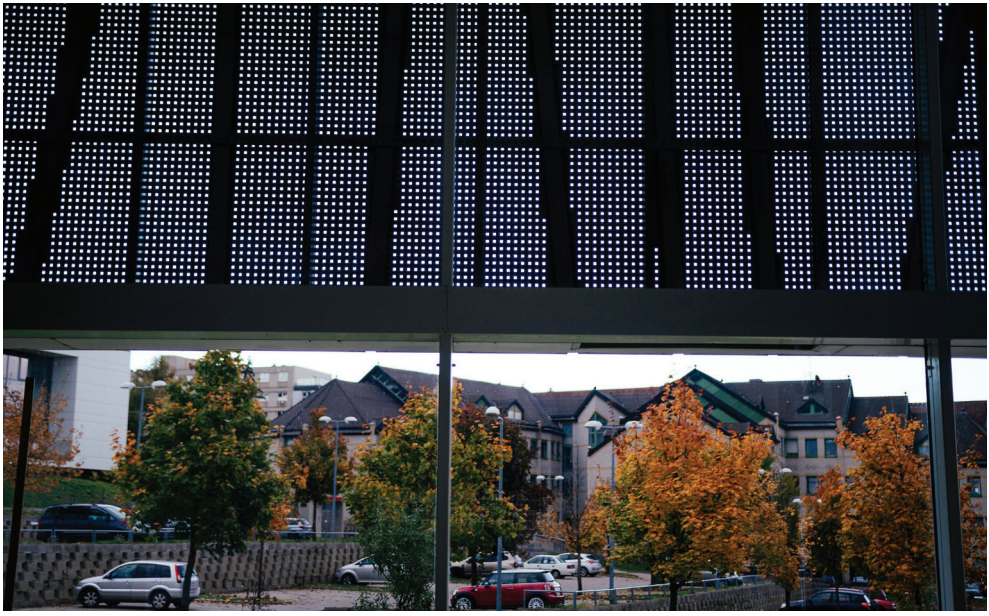
Goals

- to concentrate the research potential of the South-Transdanubian Region on health and environmental industry;
- to support explorative and innovative research potential through establishing a critical researcher mass with well-equipped, state-of-the-art laboratories of the highest standard;
- to enhance successful grant activities cohesively attracting R&D&I sources exploiting synergic possibilities;

- to possess stability, trust and cooperation among academic researchers and industrial partnerships, and to provide an optimal background for knowledge transfer;
- to implement active technology and knowledge transfer activities compliant to the needs of various regional corporate entities regarding basic and applied research;
- to responsively reflect and demonstrate flexibility regarding modern research trends and to the needs of knowledge-based economy;
- to attract and enhance international visibility.

Strategy

Notably, the SzRC is a unique scientific organization and a trans faculty research Centre aligned to a leading university whose focus is directed on life and medical sciences while being multidisciplinary at the same time. The basic goal of research institutions is to increase the effectiveness of research activities and scientific work within the international scene. Additionally, in consideration of the latest trends, to provide social and economical applicability of research synonymous with the strategic goals of the University regarding its commitment to national development. Specifically, the dynamic engagement into national and international scientific realms is inevitable including the exploitation and utilization of national and international grant sources of various origins: central, business non-profit, industrial-academic projects and cooperative partnerships. The efficiency and success of this endeavor immensely benefits from international visibility and networking, of which, requires effective us of communication indigenous to the activities within the research centre. To successfully accomplish these goals, all these preconditions must function simultaneously and coherently: enhancing scientific quality, international visibility, elicit contemporary levels of communication, intensely focused and targeted grant financing regarding different fields of sciences, and effective forms of technology transfer.



Technology Transfer

In addition to increasing internationally recognized productivity and the provision of the social and economic applicability of the activities research centre, the aspect of enhancing technology transfer is yet another primary strategic goal. Joint research projects are implemented on the fundamental basis regarding the active industrial collaborations and SzRC participation within national grants aligned with its varied partnerships. SzRC explores and facilitates the technology transfer potential of each research project and connects researchers with industrial and business partnerships. SzRC maintains active cooperation with the Technology Transfer Centre of the UP and international technology transfer agencies and hubs (i.e., Bio4Dreams - Italy, Cebina - Austria) active in the field of life sciences, drug development and innovation management. The Innovation and Industrial Advisory Board supports the activities and SzRC Established: an intense cooperation with the Chamber of Commerce and Industry of Pécs-Baranya. The Centre entered into strategic partnership collaborations with Bio4Dreams (Italy) and CEBINA (Austria).

SzRC in numbers **(2015-2020)**

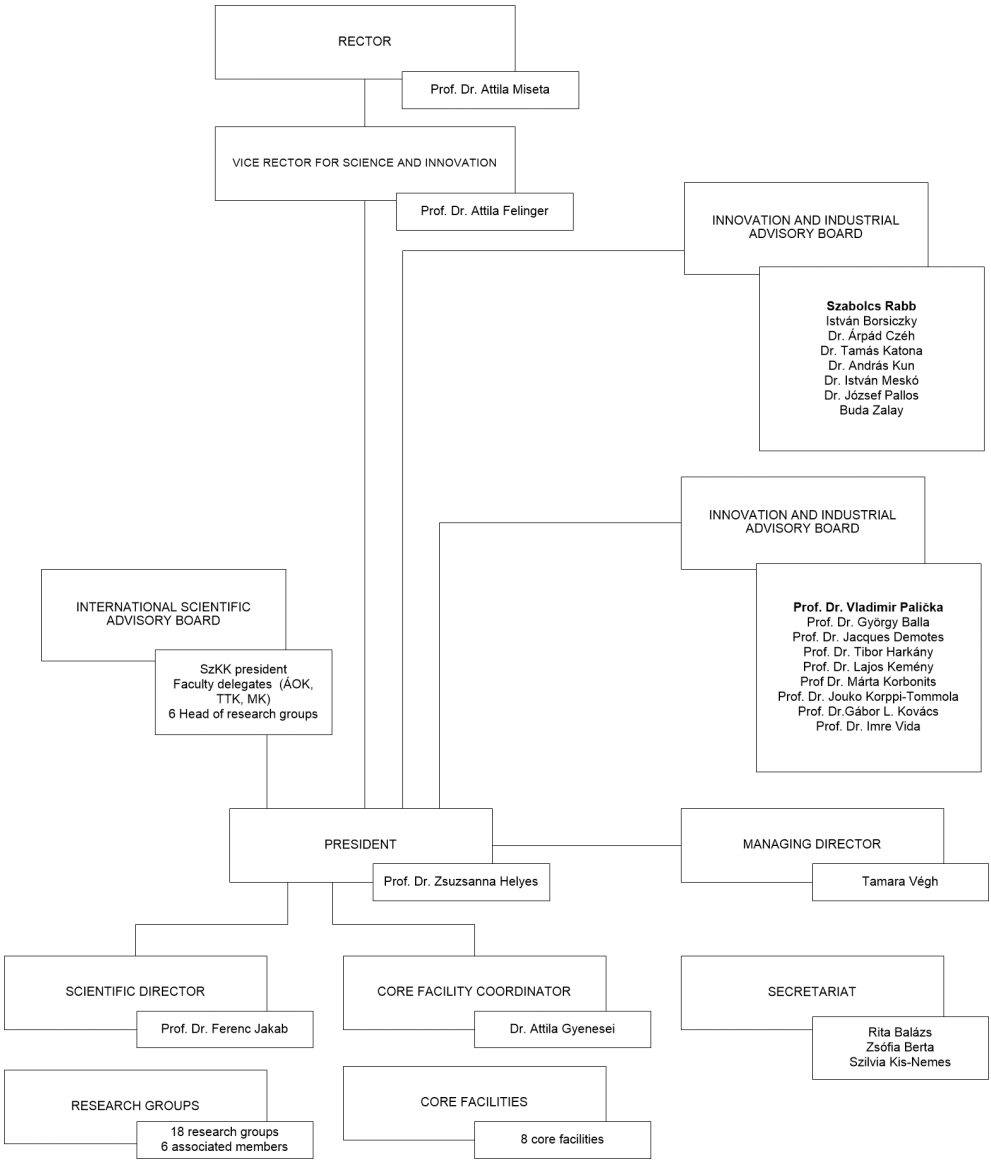
PhD (pcs): 100
Patents (pcs): 50
publications (highlighted): cca. 800
grants (pcs, amount): 100/35 billion HUF
Cooperation agreements (pcs): Hungary: 50 International: 70 Industrial: 50

Education

SzRC contributes premium level university and doctoral forms of education. It has developed and maintains the trans faculty training portfolio regarding the field of researcher education and also provides real estate and professional guidance to the different research teams aligned to the faculties. Additionally, gradual training laboratories and instruments of the Centre are available in support of course education. SzRC coordinates the processes of excellence centres and professional guidance in relationship to the National Program for the Excellence of Higher Education

MANAGEMENT – Organizational Chart

The Centre operates as an institution under the professional guidance of the Vice Rector for Science and Innovation of the UP and overseen by the President of the SzRC.



Management Membership:

Prof. Dr. Zsuzsanna Helyes, President, Tamara Végh, Managing Director, Prof. Dr. Ferenc Jakab, Scientific Director and Dr. Attila Gyenesei, Core Facility Coordinator

Secretariat:

Lívia Rita Balázs, Tamara Végh, Zsófia Berta, Szilvia Kis-Nemes

SCIENTIFIC COMMITTEE

The Scientific Committee represents the decision-making and recommending body of the Centre chaired by the president of SzRC. The Scientific Committee observes the research strategy and implementation, the annual research budget and the report and the research quality assessment system. The tasks of the committee include also the evaluation and supervision of the research activities and results, observation of the CF evaluation system, operation and utilization. An additional competence of the Scientific Committee is to determine the establishment or liquidation of research groups and make recommendations regarding the direction of research, infrastructure development, modification or termination.

Members:

Prof. Dr. Attila Felinger
Vice Rector for Science and Innovation

Prof. Dr. Attila Horváth
Dean, Faculty of Sciences, UP

Prof. Dr. Dóra Reglődi
Scientific Vice Dean,
Faculty of Medical Sciences, UP

Prof. Dr. Gabriella Medvegy
Dean, Faculty of Technical
and Informatics Studies, UP

Prof. Dr. István Kistelegdi
leader of research group

Dr. István Hernádi
leader of research group & CF

Prof. Dr. Ferenc Jakab
Vice Dean, Faculty of Sciences, UP, and leader of research group

Prof. Dr. László Kollár
leader of research group

Prof. Dr. István Ábrahám
leader of research group

Prof. Dr. Judit Pongrácz
leader of research group & CF

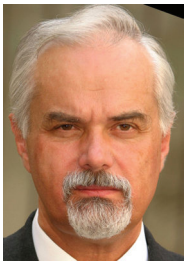
Prof. Dr. Zsuzsanna Helyes
SzRC president

Dr. Attila Gyenesei
Core Facility Coordinator & leader of research group

Tamara Végh, Managing Director
Individual delegated by the Chancellor of UP
Former President of SzRC
Professional leaders of the centres supported under the Institutional Excellence Program

INTERNATIONAL SCIENTIFIC ADVISORY BOARD

The scientific activities of the Centre are supported by the **International Scientific Advisory Board.** Membership representatives of the Board are internationally recognized scientists, researchers, and outstanding professionals of the research areas of the SzRC. Aligned to international research trends, special emphasis and relevant duties of the International Scientific Advisory Board include support, recommendation and management of research direction and networking in support of the Centre. Additionally, the following auxiliary responsibilities include, monitoring and routine evaluation regarding the effort of the research teams, recommendations for development and changes, support of the accreditation program and enhance the international scientific integration of the Centre.



Prof. Dr. Vladimír Palička
Charles University, Faculty of Medicine in Hradec Králové, Czech Republic

Prof. Dr. Gábor L. Kovács
Szentágothai Research Centre

Prof. Dr. György Balla
University of Debrecen, Medical Faculty, Institute of Pediatrics

Prof. Dr. Jacques Demotes-Mainard
European Clinical Research Infrastructure Network (ECRIN), France

Prof. Dr. Tibor Harkány
Medical University of Vienna, Department of Molecular Neurosciences, Austria

Prof. Dr. Lajos Kemény
University of Szeged, Clinics of Dermatology and Allergology

Prof. Dr. Márta Korbonits
The William Harvey Research Institute Barts and The London School of Medicine & Dentistry, Queen Mary University of London, UK

Prof. Dr. Jouko Korppi-Tommola
University of Jyväskylä, Finland

Prof. Dr. Imre Vida
NeuroCure Cluster of Excellence, Charité - Universitätsmedizin Berlin Institut für Integrative Neuroanatomie, Germany

INNOVATION AND INDUSTRIAL ADVISORY BOARD

The **Innovation and Industrial Advisory Board** (IIAB) of the SzRC supports uniting scientific performance within the industry. Membership comprising of the IIAB, mostly practitioners from the field of business, include representatives of different industrial areas, national and local enterprises relating to the main scientific fields of the University. They support the scientific effort with their network, advice and knowledge of the market, all without decision-making authority, and are regularly invited to participate by the management of the Centre. The Chancellor of the UP, or its delegates, are also regular members of the IIAB.

Mr. Szabolcs Rabb
General Secretary of the Chamber of Commerce and Industry, Pécs-Baranya, Chairman of the IIAB

Mr. István Borsiczky
Tomelilla Kft.

Dr. Árpád Czéh
FOSS - Soft Flow Hungary Kft.

Dr. János Tamás Katona
Faculty of Technical and Informatics Studies, UP, MVM Paksi Atomerőmű Zrt.

Dr. András Kun
Auro-Science Consulting Kft.

Mr. István Herbály
RG Net Kft.

Dr. József Pallos
Pannonpharma Kft.

Mr. Buda Zalay
Hauni Hungaria Kft.

Mr. Károly Fehér
iBioScience Kft.

International network memberships

The Centre maintains its membership comprised of many different international scientific organizations and research infrastructures (ECRIN, ELIXIR, Euro-Bioimaging). SzRC participates as a founding consortium member in the international initiative assembled to admit and register FNH-RI, an organization engaged with food and biotechnology research, as a European research Infrastructure (ERIC) member. SzRC is a member of the Hungarian node of BBMRI ERIC. In consideration of its strategic goals, the SzRC aspires to achieve memberships in different, primarily ERIC or other significant organizations ideally suitable to the research profiles regarding SzRC. Engagement regarding the effort of international organizations and networks can usher incomparable potential in support of successful grant applications, i.e., H2020, as a member of a consortia. Lastly, international networking activities are coordinated and supported by the international coordination unit of the Centre.

HECRIN

HECRIN (Hungarian European Clinical Research Infrastructure Network) is a national research network focusing on academically based clinical investigation and the member of ECRIN (European Clinical Research Infrastructure Network) the international, Pan-European non-profit organization. Distinctly, the SzRC is the exclusive leader of HECRIN, functioning as a hub throughout Hungary.
ECRIN is a public, non-profit organization linking scientific partnerships and networks throughout Europe to facilitate multinational clinical research. ECRIN provides sponsorships and investigators with advice, management services and tools to overcome hurdles in multinational trials and enhance professional collaboration. With the aid of national research networks, ECRIN supports high quality academic-based research which is not financially supported by the drug industry, and international clinical investigations. Currently, ECRIN coordinates research networks consisting of nine European countries enabling each member country to initiate multinational clinical investigation projects and participate in all areas of medical sciences. Astonishingly, ECRIN facilitates beneficial results emanating from the dimensions of the vast population of the EU. ECRIN assists those participating countries in the investigations with services required for the fulfilment of the clinical investigations (methodological support, pharmacovigilance, statistics, data management, full-scale project management, monitoring and administration).

ELIXIR

ELIXIR Hungary is the Hungarian node of ELIXIR (European Life Science Infrastructure for Biological Information). ELIXIR as a European research infrastructure and is a member of the umbrella organization of European research infrastructures within the Biological and Medical Sciences Research Infrastructures, BMS RI working group. It provides access to life sciences data and relating services for research and industry and also coordinates, unifies and maintains related bioinformatics resources. SzRC is a member of the coordinating body of the Hungarian ELIXIR consortium.

EURO-BIOIMAGING

Euro-Bioimaging is also a member of ERIC (European Research Infrastructure). It provides for open, physical access to comprehensive world-class imaging technologies in the field of biology and medical biology for life science researchers. Their goal is to organize a network of microscopy and medical imaging laboratories and provide access to methods requiring significant cost and expertise throughout Europe.

FNH-RI

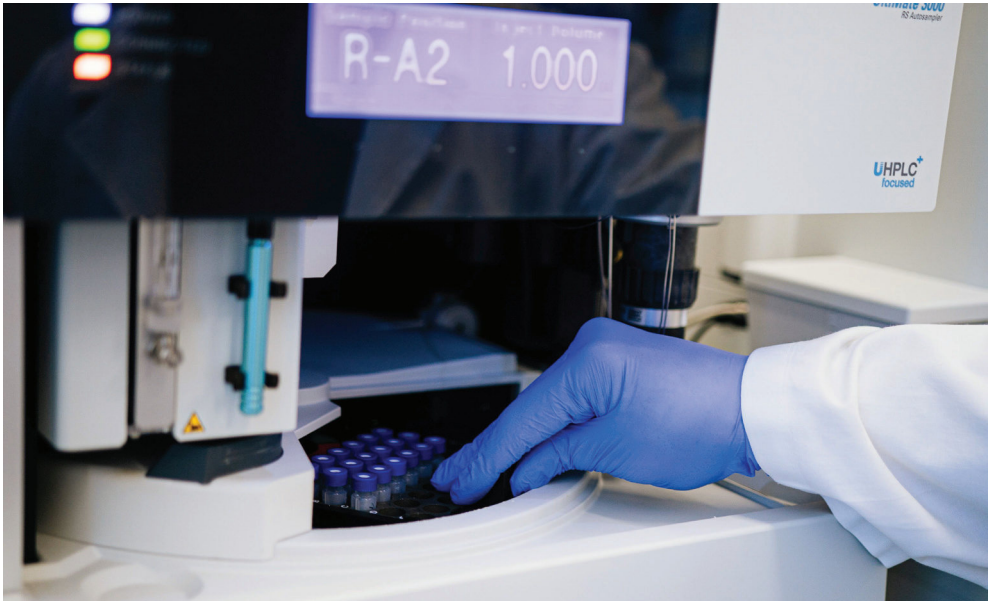
In response to the call of the European Strategy Forum of Research and Infrastructure (ESFRI), the "Food, Nutrition and Health Research Infrastructure" was launched in 2020, through the support and initiative of the Wageningen University. An international consortium was Established: , highlighted by the participation of one hundred and twenty institutions originating in nineteen countries, including the SzRC. The consortium applied for EU support for the period 2022 - 2024. The aim of the organization is dynamic monitoring and understanding of consumer food choices regarding the citizens of the EU and non-EU countries, and their impact on sustainable food production and health conditions of consumers. The findings will soon be based on data and models collected in developed and newly formulated research infrastructures analyzed with network research methods. This will be achieved via the interconnection of currently fragmented Pan-European infrastructure, providing access to all participating consortium members. In consideration of the multidisciplinary approach regarding the data collected in the food production and consumption chain, the public health care system will undergo a transformation to develop new production systems and eating habits, including the education of environment and health conscious citizens. The central hub for FNH-RI is the Wageningen University. The leader of the Hungarian consortium is the University of Debrecen and Food and the SzRC contributes to the scientific activities via the Biotechnology Research Group of the Centre.

BBMRI

BBMRI-ERIC field – researchers, biobankers, industry, and patients – to boost biomedical research. BBMRI is a European research infrastructure for biobanking bringing together all the main players from the biobanking offers quality management services, support with ethical, legal and societal issues, and a number of online tools and software solutions for biobankers and researchers. BBMRI-ERIC currently includes 20 countries and one international organisation, making it one of the largest European research infrastructures. The Hungarian consortium of BBMRI is coordinated by Semmelweis University. Members are: University of Pécs, University of Szeged, University of Debrecen, South-Pest Central Hospital.

NATIONAL LABORATORIES

National Laboratories, founded in accordance with the initiative of the Ministry of Innovation and Technology, will encompass various knowledge centres of the scientific areas and is especially promising for the national economy, in hopes of becoming internationally recognized hubs and articulating meaningful responses to world-wide challenges. The National Research and Development Office implements and coordinates the multiannual priority program. The UP and the SzRC obtained possibilities in this program to develop two National Laboratories:



Human Reproduction National Laboratory (Professional Leader: Prof. Dr. Gábor L. Kovács).

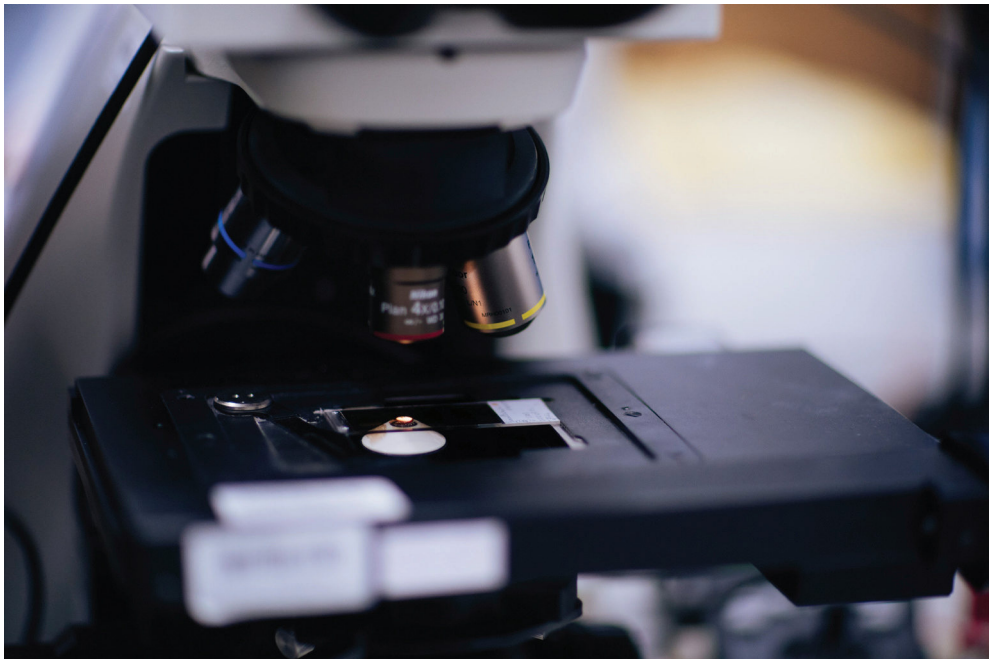
In Hungary, the number of couples struggling today with infertility problems reaches 15% (150,000 couples). The government acknowledged the dimension of this problem and immediately ushered in responsive legislation resulting in free-of-charge infertility examinations for women and men and cancelled waiting lists associated with infertility treatment nation-wide. In consideration of the objectives in successful treatment regarding infertility, the increase of the efficiency of assisted reproduction treatments and the realization of a demographic stability comprehensive, innovation driven, frontline clinical R&D activities are mandatory. The Human Reproduction National Laboratory will carry out the professional coordination of theoretical and clinical research, grants, programs, the utilization of EU and USA patents, doctoral programs and investments in core facility related instruments (i.e, new generation sequencing, mass spectrometry, etc.). This new lab will integrate the research groups, enterprises and professional organizations active within and outside the University. Its activities include the elaboration of research programs, establishing research teams and the effective dissemination of scientific knowledge.

Virology National Laboratory (Professional Leader: Prof. Dr. Ferenc Jakab)

The world-wide threat and spread of infectious disease demonstrates significant health care risk and social peril on a global scale. In addition to the elimination of local problems, joint national and international cooperation is adamant. In Hungary, and in consideration of the past several years, the number and significance of new infectious diseases experienced a spike, which elevates social risk factors. Today, the mission objectives of the Virology National Laboratory is to increase research performance associated with the complex virology lab unit operating within the sphere of the SzRC, UP, and simultaneously participate in the efforts of national and international research infrastructure and networks.

Distinctly, Hungary's only such complex virology research laboratory exclusively belongs to SzRC, UP, and was erected solely for research purposes and not for an epidemiologic role. Therefore, young colleagues of the unit are aligned to its mission and compliant to the priorities of the University, which is to achieve internationally recognition and outstanding scientific accomplishments. The Virology National Laboratory, including the aforementioned complex research facility, forms the basis of the national research network.

RESEARCH GROUPS



BIOINFORMATICS RESEARCH GROUP

Established: 2018
Research Group Leader: Dr. Attila Gyenesei, PhD

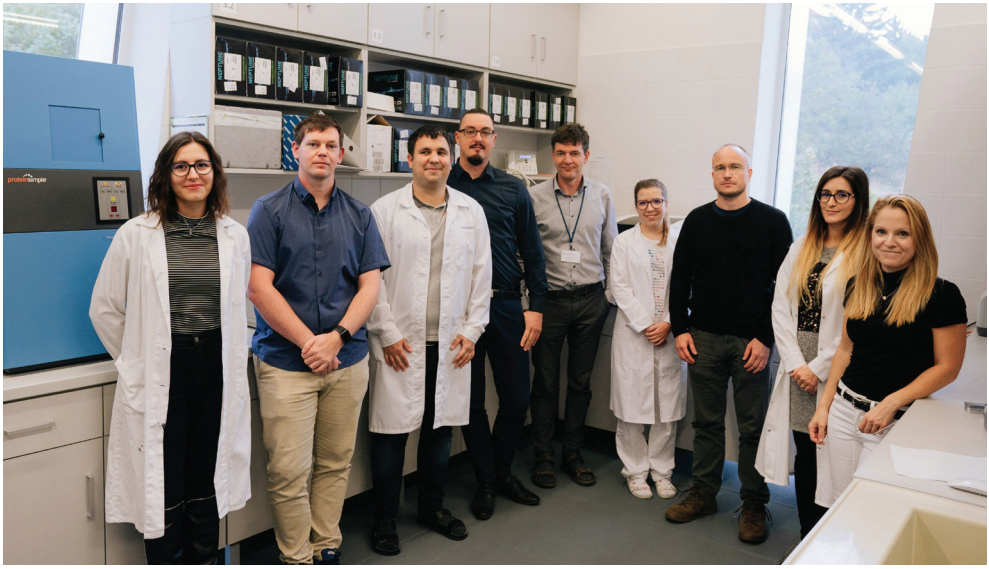
Research Profile

The main goal of the Bioinformatics Research Group is not only to concentrate and conduct research on a specific scientific issue, but rather to develop and implement comprehensive bioinformatics pipelines, tools and strategies in support of the research groups aligned at the Szentágothai Research Centre and the University of Pécs. The strategy is comprised of four pillars:

- bioinformatics research driving the development of new analysis methodologies,
- bioinformatics core facility providing data analysis services for biomedical researcers,
- bioinformatics education and training provided to students and researchers, and
- bioinformatics infrastructure enabling the collection, storage and analysis of data.

The group established numerous research collaborations among local and international research groups, and developed and implemented various data analysis algorithms and methods. Several of these groups have already been published or are currently under submission or review.

Additionally, the research group set up the Genomics and Bioinformatics Core Facility and initiated sequencing and data analysis collaboration-based services for its academic and industrial partnerships. Today, the group participates in a number of European networking activities such as ELIXIR.



Selected publications 2015-2020

1. Gombos K et al.: *Translating Scientific Knowledge to Government Decision Makers Has Crucial Importance in the Management of the COVID-19 Pandemic.* Popul Health Manag. 2020 Sep 2. doi: 10.1089/pop.2020.0159
2. Kraboth Z et al.: DNA *CpG methylation in sequential glioblastoma specimens.* J Cancer Res Clin Oncol. 2020 Aug 10. doi: 10.1007/s00432-020-03349-w.
3. Aczél T. et al.: *Hemokinin-1 Gene Expression Is Upregulated in Trigeminal Ganglia in an Inflammatory Orofacial Pain Model: Potential Role in Peripheral Sensitization.* International Journal of Molecular Sciences 21:8, 2020
4. Gángó A. et al.: *Dissection of subclonal evolution by temporal mutation profiling in chronic lymphocytic leukemia patients treated with ibrutinib.* International Journal of Cancer. 146:1, 2020.
5. Bauer W. et al.: *Age at Seroconversion, HLA Genotype, and Specificity of Autoantibodies in Progression of Islet Autoimmunity in Childhood.* Journal of Clinical Endocrinology & Metabolism 104:10, 2019.

Primary academic collaborations

Hungary: Semmelweis University, University of Szeged, Dél-Pesti Central Clinic

International: Imperial College London, UK, University of Turku, Finland, and the Medical University of Bialystok, Poland.

Memberships

ELIXIR Hungary: Hungarian node of ELIXIR.
KETLAK: Translational Research and Action Group supporting the population against Covid19.

Industrial cooperation

4iG Nyrt; iBioScience Kft. and Xenovea Kft.

Core Facility: Genomics and Bioinformatics, CF

BIOTECHNOLOGY AND WNT SIGNALLING RESEARCH GROUP

Established: 2012
Research Group Leader: Prof. Dr. Judit Pongrácz

Research Profile

diseases. To effectively investigate such vast diversity, reliable tissue models were developed and used throughout various experiments. Its goal is to produce reliable data in vitro and the results are compared with primary human clinical data. The efforts regarding 3D tissue cultures continue to generate information deemed relevant and used in the development of bioprinting facilities also located within the Centre. Recently, the research has led to a more comprehensive understanding of lung cancer responses to therapy. Novel and sophisticated diagnostic methods were also identified using extracellular vesicles and their role regarding the aging process.

The research effort in thymic tissues revealed the molecular background of adipoid involution including the role of steroids associated with the process of aging. Additionally, the research group is responsible for the development of protocols and human tissue printing for clinical application.

Selected publications 2015-2020

1. Abdelwahab, EMM. et al.: *Wnt signaling regulates trans-differentiation of stem cell like type 2 alveolar epithelial cells to type 1 epithelial cells* Respiratory Research 21:1, 2019.
2. Banfai, K. et al.: *'Beige' Cross Talk Between The Immune System and Metabolism* Frontiers in Endocrinology 2019.
3. Banfai, K. et al.: *Transgenic exosomes for thymus regeneration.* Frontiers in Immunology 10:862, 2019.
4. Abdelwahab, EMM. et al.: *Mitochondrial dysfunction is a key determinant of the rare lung disease lymphangioleiomyomatosis and provides a novel therapeutic target* Oncogene 38(16):3093, 2019.
5. Feller, D. et al.: *Cigarette smoke induced lung inflammation is made systemic via Wnt5a and inflammatory cytokines delivered to tissues in extracellular vesicles.* Frontiers in Immunology 9:1724, 2018.

Main academic collaborations

Hungary: Semmelweis University and the University of Debrecen

International: University of Pennsylvania, Philadelphia, USA; University of Aberdeen, Aberdeen, UK and the University of Birmingham, Birmingham, UK

Memberships

Hungary: Hungarian Biotechnology Association and the Hungarian and European Immunology Association

International: ISEV (International Society for Extracellular Vesicles); Hungarian and European Respiratory Society and the European Biotechnology Network

Industrial cooperation

Richter Gedeon Nyrt. and Foss-Soft Flow Kft.

Patents: Pongracz JE: Lung tissue model, HU1200206, SG201108022-3, China, Taiwan, US20120045770, PAU2010244121

Core Facility: Cell and Tissue Engineering

CELLULAR BIOIMPEDANCE RESEARCH GROUP

Established: 2020
Research Group Leader: Dr. Attila Tóth

Research Profile

The research group started its operation, by the guidance of Academy member Prof. Dr. László Lénárd and Prof. Dr. Zoltán Karádi, as the cooperation of a few colleagues from the Medical School and the Faculty of Engineering and Informatics since the late summer of 2018. Our main goal was to create a multidisciplinary scientific research network whose integrated innovative research activity from the basic science to production development would guarantee outstanding inventions, substantial new research findings. Our highly variable functioning is based and determined by self-invented, multiple and integrated utilization opportunities, worldwide considered as brand new measuring techniques which are free of tissue deficiency or extensive damages, and which are, at the same time, associated with a particular data analysis method, and the specific know-how. Accordingly, we are to successfully accomplish basic and applied research tasks, solve related problems (inventing measuring devices, equipments, specific examination procedures, etc.), which, on the one hand, may result in remarkable progress in various biological, in primary focus, medical (gastroenterological, endocrinological, as well as circulatory, pulmonological, and virological) fields, and which, on the other hand, would, at the same time, claim worldwide priority.

With respect to our major research lines, the projects aiming to unravel details of development of the „fatty liver syndrome", those to improve rehabilitation of COPD patients, and also those that analyze whole body composition changes, at the same time validating the bioimpedance measuring technique are of distinguished significance. Similar attention is paid at the studies related to the electric current induced selective enhancement of therapeutic sensitivity of the tumor cells, or at those aiming to better understand fine details of the virus penetration.

Our technical-methodological platform is primarily characterized by the investigations associated to bioimpedance spectrum analysis and along them the well controlled practicing

of this specific technical system. In addition to the above, our microelectrophysiological, histological and cell biological examinations to identify impedance phenomena associated to cell compaction, or oxygenation dependent structural alterations of the cell membrane, and the extra- and intracellular compartments are also important elements of this platform.

Selected publications

1. Vizvari Z. et al.: Measurement system with real time data converter for conversion of I2S data stream to UDP protocol data. Heliyon, 2020. Q1
2. Odry Ákos et al.: A Novel Fuzzy-Adaptive Extended Kalman Filter for Real-Time Attitude Estimation of Mobile Robots. MDPI Sensors, 2020. Q1
3. Odry Ákos et al.: Fuzzy control of self-balancing robots: A control laboratory project. COMPUTER APPLICATIONS IN ENGINEERING EDUCATION, 2020. Q1
4. Z. Vizvári. et al.: Exact schemes for second order linear differential equations in self-adjoint case. Advances in Difference Equations. Applied Mathematics, 2020. D1
5. Z. Vizvari. et al.: Physical Validation of a Residual Impedance Rejection Method during Ultra-Low Frequency Bio-Impedance Spectral Measurements. MDPI Sensors, 2020. Q1

Primary collaborations

Academic: PU, PF, Pharmaceutical Biotechnology; PU, CC, Surgery Clinic, PU, CC, Internal Medicine Clinic I., PU, CC, Radiology Clinic, PU, MS and CC, Pathology Inst., PU, SzRC, Virology RG, PU, SzRC, Molecular Pharmacology RG, PU, SzRC Cellular Neurobiology RG

Hungary: Óbuda University (ÓU) Physiological Regulations RG, ÓE Neumann János Applied Informatics and Applied Mathematics Doctoral School, University of Dunaújváros, Kaposvár University

International: „Josip Juraj Strossmayer" University, Osijek, Croatia, Subotica Technical College, Subotica, Serbia

Membership

Hungarian Physiological Society, Hungarian Obesitology Society, Hungarian Engineers' Academy, Neumann János Computer Science Society, International Biometric Society, IEEE Societies

Industrial collaborations

NWM Consult Ltd. Co. (development, purchase)
APPL-DSP Doo. Co. (parts and software developments)

Patents: „Electronic and acoustic multi-frequency material examination procedure" invention; PCT/HU2016/050062 –international submission; EP1689383 – European announcement: June 17, 2020; USA - 16/062,319: National patent: June 30, 2020, ID: 10,699,446.; Japan - 2018-531076 (submission) acceptance: October 29, 2020

ENERGY DESIGN BUILDING TECHNOLOGIES

Established: 2016
Research Group Leader: Prof. Dr. István Kistelegdi

Research Profile

saving methods. To achieve their objectives, this group uses and develops comfort (light, heat and air quality), energy and numerical aerodynamic simulations. Within this realm, a particular aim is to create a guideline deemed beneficial to architects and mechanical engineers regarding the design of natural ventilation in buildings. Additionally, a vastly relevant project of the group's registered trademark, the Energy Design Method for buildings with plus energy balances. In the upcoming stage, a new method will be introduced, the Energy Design Synthesis, with the aid of artificial intelligence based on mathematical solutions and simulation series. As a result, the EDS offers designers and architects immense leverage when creating a guaranteed optimal eco-friendly home given the circumstances. The professional services appreciated by various partnerships include visual, thermal comfort, energy modelling and optimization in all aspects regarding structure, buildings and functions (dynamic simulations); building energy consumption advisory issues; numerical aerodynamic (CFD) simulations for detailed climate, comfort and energy modelling and architectural design.

Selected publications 2015-2020

1. Sara Elhadad et al.: *Model Simplification on Energy and Comfort Simulation Analysis for Residential Building Design in Hot and Arid Climate*. Special Issue of Buildings and Sustainable Construction, 2020.
2. Gantumur Tsovoodavaa et al.: *A review and systemization of the traditional mongolian yurt (Ger),* Pollack Periodica, An International Journal for Engineering and Information Sciences 13(3):19, 2018.
3. Danilo V. Ravina et al.: Bakwitanan: Design of a Blackboard Convertible to an Evacuation Centre Partition by Participative Design Method. Pollack Periodica, An International Journal for Engineering and Information Sciences 13(2):195, 2018.
4. Petrit Ahmeit et al.: *Current energy demand by the residential sector in city of Pristina based on the main resources.* Pollack Periodica, An International Journal for Engineering and Information Sciences 12(1):147, 2017.
5. Bálint Baranyai et al.: *„Simulation-Supported Design of a Hungarian National Sports Centre".* Pollack Periodica: An International Journal for Engineering and Information Sciences 11(1):113, 2016.

Primary academic collaborations

Jiao Tong Shanghai University Shanghai PRC

Memberships

Hungary: MABIM Hungarian BIM Association

International: Active House Alliance

Industrial cooperation

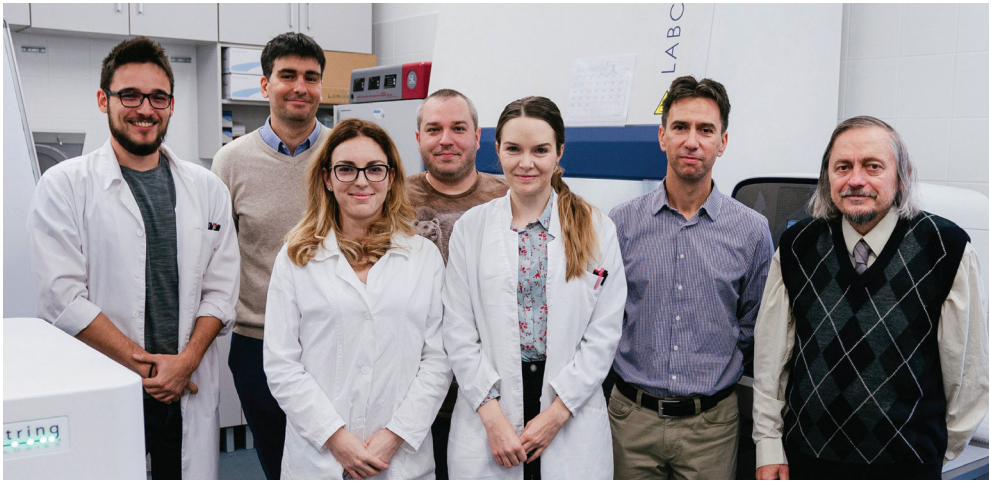
REHAU Kft.,; Grundfos Magyarország Gyártó Kft., Prefa Hungária Kft., Alumínium Panel Coverage, Siemens Zrt. and Smarthaus DRGB Engineering Kft.

FOOD- AND BIOTECHNOLOGY RESEARCH GROUP

Established: 2020
Research Group Leaders:
Dr. Krisztián Kvell (UP-SzRC) and
Dr. Árpád Czéh (Soft Flow)

Research Profile

the spectrum of universities and research centres intensified resulting in the formation of industrial collaborations. In response, the University of Pécs and Soft-Flow, Ltd. signed a strategic framework agreement. The established Food Biotechnology Research Group ensures fruitful cooperation over the span of time. The Food Biotechnology Research Group initiated a common applied research activity integrating university-based know-how with industrial expertise to tackle dedicated issues (e.g., toxicity caused by mycotoxin co-exposition and extracellular vesicles in alimental fluids). Within the framework of the research group, the aim is to create an opportunity for researchers and students to join the group and identify specific projects worth investigating, thus accelerating the efforts within the group. According to a survey by the Food and Agriculture Organization of the United Nations (FAO), the world food production will double by 2050. Such a dramatic increase of food production will require innovative solutions over the next 30 years. The virtual research team enables the competitive collaboration of food biotechnology complementary (basic research and industrial) competencies focusing on regional agricultural and biotechnological intersections (grain, milk and meat analytics).



Selected publications

1. Zelma Faisal et al.: *Interaction of the mycotoxin metabolite dihydrocitrinone with serum albumin.* Mycotoxin Research 35:129, 2019.
2. Zelma Faisal et al.: *Interaction of dihydrocitrinone with native and chemically modified cyclodextrins.* Molecules 24:1328, 2019.
3. Eszter Fliszár-Nyúl et al.: *Interaction of mycotoxin alternariol with serum albumin.* International Journal of Molecular Sciences 20:2352, 2019.
4. Zelma Faisal et al.: *Cyclodextrins can entrap zearalenone-14-glucoside: Interaction of the masked mycotoxin with cyclodextrins and cyclodextrin bead polymer.* Biomolecules 9:354, 2019.
5. Eszter Fliszár-Nyúl et al.: *Interactions of mycotoxin alternariol with cyclodextrins and its removal from aqueous solution by beta-cyclodextrin bead polymer.* Biomolecules 9:428, 2019.

Memberships

Founding member in association with SzRC of the Hungarian node of a FNH-RI ERIC consortium.

Industrial Cooperation

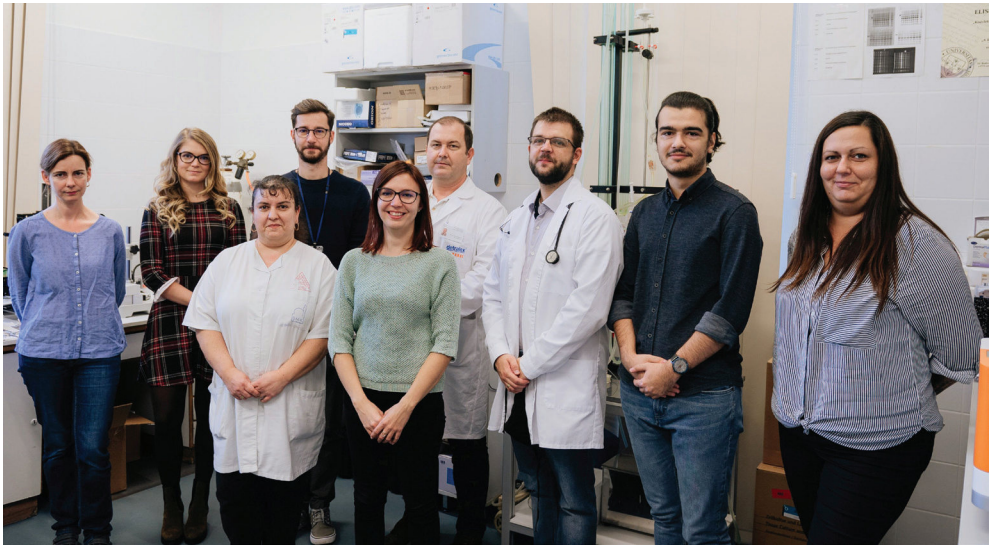
Soft-Flow Kft.: the Pécs-based Soft Flow Kft. as a part of the FOSS group (FOSS Analytical SA) is the research and development subsidiary of the entity. Over the past 20 years, Soft Flow evolved from a small enterprise into an internationally acknowledged research and development entity, with activities encompassing biotechnology, conjugation chemistry, molecular biology, assay development, laboratory services, and small scale reagent production.

"BALAZS SUMEGI" FUNCTIONAL GENOMICS AND EXPERIMENTAL CARDIOLOGY RESEARCH GROUP

Established: 2014
Research Group Leader:
Prof. Dr. Róbert Halmosi and
Prof. Dr. Kálmán Tóth

Research Profile

associated to this research group is heart failure, which remains a disease with a poor prognosis despite the broadening of therapeutic possibilities in the last decades. The therapeutic approaches of other pathologies leading to heart failure, such as myocardial infarction, hypertension, and atrial fibrillation are also undergoing investigation. The studies aim to reveal the role regarding certain signalling factors and mitochondrial quality control processes in the development and progression of these diseases. Moreover, new possibilities for therapeutic intervention are examined. The methodological profile of these studies spans from cell culture studies to isolated cardiac perfusion (ischemia-reperfusion, cold ischemia) and to chronic animal models. Additionally, human clinical trials were also performed in patients with stable coronary heart disease and systolic heart failure. The small animal echocardiography equipment is also a part of the Animal Imaging Core Facility.



Selected publications 2015-2020

1. Kemény Á. et al.: *Integrative characterization of chronic cigarette smoke-induced cardiopulmonary comorbidities in a mouse model.* Environ Pollut. ePub 2017.
2. Riba A. et al.: *Doxycycline protects against ROS-induced mitochondrial fragmentation and ISO-induced heart failure.* PLoS One 12(4):e0175195, 2017.
3. Eros, K. et al.: *Chronic PARP-1 inhibition reduces carotid vessel remodeling and oxidative damage of the dorsal hippocampus in spontaneously hypertensive rats.* PLoS One 12(3):e017440, 2017.
4. Riba A. et al.: *Cardioprotective effect of resveratrol in a postinfarction heart failure model.* Oxid Med Cell Longev Article ID 6819281, 2017.
5. Deres L. et al.: *The Effects of Bradykinin B1 Receptor Antagonism on the Myocardial and Vascular Consequences of Hypertension in SHR Rats.* Front Physiol. 10:624, 2019.

Main academic collaborations

Medical Faculty, UP, Hungary

Core Facility: Animal Imaging

CLINICAL GENETICS AND GENOMICS RESEARCH GROUP

Established: 2012
Research Group Leader: Prof. Dr. Béla Melegh

Research Profile

array CGH). The department plays a critical role in the research of Rare Diseases within our country. While performing research mutations, genotype-phenotype variants are examined, which are the cause certain diseases and can aid with a definite diagnosis; hopefully, within the scope of the SB project, and an increased emphasis will be placed on the gene mutation-phenotype axis. Additionally, a portion of responsibility is the research of mitochondrial DNA related diseases. These diseases are most commonly inherited metabolic diseases, which most often affect the muscular, cardiac and central nervous system. Examining the differences within the mitochondrial DNA aid significantly in determining the cause of the disease. In its role as the coordinating department of the National Biobank Network, the group has an immense Biobank collection of diseases affecting large populations. In this context, diseases which seemingly appear rare, yet are actually common diseases (stroke, heart attack, metabolic syndrome, etc.) and depict a Mendelian inheritance pattern, nonetheless exhibit strong research potential: armed with the help of this research, it is possible to search for new genes, which will greatly contribute to the comprehensive understanding of the

disease.

Selected publications 2015-2020

1. Bánfai Z. et al.: *Revealing the Genetic Impact of the Ottoman Occupation on Ethnic Groups of East-Central Europe and on the Roma Population of the Area.* Front Genet. 10:558, 2019.
2. Schrauwen I. et al.: *Hearing impairment locus heterogeneity and identification of PLS1 as a new autosomal dominant gene in Hungarian Roma.* Eur J Hum Genet. 27(6):869, 2019.
3. Bánfai Z. et al.: *Revealing the impact of the Caucasus region on the genetic legacy of Romani people from genome-wide data.* PLoS One. 13(9):e0202890, 2018.
4. Lipson M. et al.: *Parallel palaeogenomic transects reveal complex genetic history of early European farmers.* Nature 551(7680):368, 2017.
5. Weber A. et al.: *Increased prevalence of functional minor allele variants of drug metabolizing CYP2B6 and CYP2D6 genes in Roma population samples.* Pharmacol Rep. 67(3):460, 2015.

Main academic collaborations

European Reference Networks (ERN) CRANIO, GENTURIS, ITHAKA; EURO-NMD, RND, Joint Action on Rare Cancer (JARC); Undiagnosed Diseases Network International (UDNI)

Core Facility: Genomics and Bioinformatics CF

ENVIRONMENTAL ANALYTICAL AND GEOANALYTICAL RESEARCH GROUP

Established: 2012
Research Group Leader:
Prof. Dr. Attila Felinger and
Prof. Dr. Ferenc Kilár

Research Profile

Research aspects and objectives regarding this group include liquid chromatography, gas chromatography, capillary and microchip electrophoresis, mass spectrometry and sample preparation. Additional areas of study include the interaction of pollutants and microorganisms, biosorption, biodegradation, bioanalysis, geomicrobiology and biogeochemistry, environmental geology, sedimentary geology, sedimentary petrology and Pliocene-Quaternary stratigraphy. Research topics highlighting interactions between rocks (minerals) and water (including thermal water) in which the primary focus is to study dissolution and precipitation processes.
The research group provides the following professional services to its various partnerships, whether originating from Hungary, the international academic realm or industry. Valued and professional services rendered by this group include high performance liquid chromatography, gas chromatography,

capillary and microchip electrophoresis and LC-MS, GC-MS, CE-MS methods, determination of urinary steroid profiles for medical diagnostic purposes from 24-hour urine samples, both outpatient or inpatient; development of novel, environmental-friendly biosorbents and biocomposites for environmental technology. Additional areas of responsibility include the development of a novel environmental technology based on biosorption and biodegradation, the analysis and assorting of organic content of wastewater and contaminated surface water, and biodegradation and photocatalytic degradation of organic contaminants in water and soil. Lastly, the completion of expert opinion, an expert's report and experimental analysis are all routinely performed and professionally driven.

Selected publications 2015-2020

1. Lambert, N. et al.: *Comparison of the kinetic performance of different columns for fast liquid chromatography, emphasizing the contributions of column end structure,* Journal of Chromatography A 1473:99, 2016.
2. Újvári, G. et al.: *Coupled European and Greenland last glacial dust activity driven by North Atlantic climate.* Proceedings of National Academy of Sciences 114: 10632, 2017.
3. Körösi, L. et al.: *Hydrothermal evolution of PF-co-doped TiO2 nanoparticles and their antibacterial activity against carbapenem-resistant Klebsiella pneumoniae.* Applied Catalysis B: Environmental 231:115, 2018.
4. Pernyeszi, T. et al.: *Use of non-living lyophilized Phanerochaete chrysosporium cultivated in various media for phenol removal,* Environmental Science and Pollution Research 25:8550, 2018.
5. Sándor, Viktor et al.: NACE-ESI-MS/MS method for separation and characterization of phosphorylation and acylation isomers of lipid A, Electrophoresis 41:1, 2020.

Primary academic collaborations

The Helmholtz Centre Potsdam - GFZ German Research Centre for Geosciences

Memberships

CEEPUS, CIII-RO-0010-14-1920 Network on research and education of Bioanalysis.

Industrial cooperation

Mecsekérc Zrt., Rotaqua Kft., Geochem Kft. (Hungary) and GFZ Potsdam (Germany)

Core Facility: Mass Spectrometry CF

LAB-ON-A-CHIP RESEARCH GROUP

Established: 2012
Research Group Leader: Prof. Dr. Gábor L. Kovács

Research Profile

fertilized embryos. Their goal is to develop non-invasive laboratory assays and not to injure nor harm the embryo. In the use of new generation sequencing, this group now detects free embryonic DNA in the culture medium samples of in vitro fertilized embryos and examines the chromosomal constitution regarding the embryo. Identifying chromosomal abnormalities enables the possibility to assess the potential viability of the corresponding embryo and to estimate the possible risk of spontaneous abortion, prior to the transferring process of the the embryo. In consideration of the structural and quantitative analysis of miRNA molecules excreted by the developing embryo into the surrounding culture medium environment, the process of early embryo adaptation to the endometrium can be fully studied. Similar to using non-invasive liquid chromatography coupled mass spectrometry, a subunit of the human haptoglobin protein is detected, of which, as a quantitative biomarker, indicates the possible success of embryo implantation. These results are further enhance within industrial and academic collaboration to create a lab-on-a-chip point-of-care assay. In the described fields, patent protection in both the EU and the USA were submitted and approved. In addition to the main profiles, the research group examines circulating biomarkers describing the state and prognosis of critically ill patients, such as stress hormones (free and protein bound cortisol) and gelsolin and orosomucoid present in sera and urine.
In regards to its research platform, the group provides the following services: non-invasive liquid chromatography of in vitro fertilized embryos and prenatal genetic examination upon nucleic acid markers. Additionally, the group services include:

performing ELISA assays, viability-toxicity tests on cell cultures using plate readers, antioxidant capacity measurements in biological samples on plate readers, detection of circulating tumor cells from peripheral blood using microfluidic chip technology, western-blot analysis using a quantitative chemiluminescence method, quantitative HPLC measurements, HPLC coupled mass spectrometric analysis, fluorescence spectroscopy and polarization measurements in support of its varied partnerships.

Selected publications 2015-2020

1. Farkas B. et al.: Comparative analysis of abdominal fluid cytokine levels in ovarian hyperstimulation syndrome (OHSS). Ovarian Res. 13(1):25, 2020.
2. Montskó G. et al.: Alpha-1 chain of human haptoglobin as viability marker of in vitro fertilized human embryos: information beyond morphology. Syst Biol Reprod Med. 65(2):174, 2019.
3. Montskó G. et al.: Noninvasive embryo viability assessment by quantitation of human haptoglobin alpha-1 fragment in the in vitro fertilization culture medium: an additional tool to increase success rate, Fertil Steril. 103(3):687, 2015.
4. Bódis J. et al.: Serum and follicular fluid levels of sirtuin 1, sirtuin 6, and resveratrol in women undergoing in vitro fertilization: an observational, clinical study. Int Med Res. 47(2):772, 2019.
5. Magnin A. et al.: European survey on national training activities in clinical research. C. Trials. 20(1):616, 2019.

Main academic collaborations

Hungary: University of Szeged, Semmelweis University, Budapest University of Technology and Economics, Energy Science Research Centre and the Natural Sciences Research Institute.

International: University of Twente, MESA+, Netherland; Università degli Studi di Napoli Federico II, Naples, Italy and the Istituto Ramazzini, Bologna, Italy.

Memberships

ECRIN (European Clinical Research Infrastructure Network), HECRIN (Hungarian European Clinical Research Infrastructure Network) and the CRIGH (Clinical Research Initiative for Global Health).

Industrial cooperation

77 Elektronika Kft. and Bay Zoltán Nonprofit Kft.

Patents: Viability assessment of in vitro cultured human embryos using protein markers of the culture medium EP2975402A1

National Laboratory: Human Reproduction National Laboratory

MOLECULAR PHARMACOLOGY RESEARCH GROUP

Established: 2012
Research Group Leader: Prof. Dr. Zsuzsanna Helyes

Research Profile

The complex analysis regarding the role of capsaicin-sensitive afferents, the released neuropeptides and their receptors, including the pathophysiological importance of neuro-immune interactions in complex animal models of pain, inflammation, and tumor development represents the focus of the neuropharmacological activities of the group. Additionally, other areas of responsibility include the identification of new pharmacological targets and preclinical investigation of analgesic and anti-inflammatory drug candidates in these systems. The research goal highlights mapping and discovery of pathophysiological processes of different origin and mechanism (inflammatory, neuropathic, tumor and migraine related) in chronic pain, of which no therapeutic possibility currently available. Due to the results, the engineering in drug candidates regarding new mechanisms of action are also tested and developed in this lab.
Complex pharmacological investigations are carried out in support of partnerships regarding acute or chronic mouse models of painful/inflammatory conditions using functional, morphological, immunological, and imaging techniques. Additionally, the examination of complex pathophysiological processes and integrative analysis of the effects of drug candidates in vivo and in vitro are also priorities aligned to this lab.

Selected publications 2015-2020

1. Borbely E. et al.: *Capsaicin-sensitive sensory nerves exert complex regulatory functions in the serum-transfer mouse model of autoimmune arthritis.* Brain Behav Immun 45:50, 2015
2. Horváth Á. et al.: *Transient receptor potential ankyrin 1 (TRPA1) receptor is involved in chronic arthritis: in vivo study using TRPA1-deficient mice.* Arthritis Res Ther. 18:6, 2016.
3. Horváth Á. et al.: *Analgesic effects of the novel semicarbazide-sensitive amine oxidase inhibitor SZV 1287 in mouse pain models with neuropathic mechanisms: Involvement of transient receptor potential vanilloid 1 and ankyrin 1 receptors.* Pharmacol Res. 131:231, 2018.
4. Szentes N. et al.: *Exploratory and locomotor activity, learning and memory functions in somatostatin receptor subtype 4 gene-deficient mice in relation to aging and sex.* Geroscience. 41(5):631, 2019.
5. Helyes Zs. et al.: *Capsaicin-sensitive sensory nerves exert complex regulatory functions in the serum-transfer mouse model of autoimmune arthritis.* Proc Natl Acad Sci U S A. 116(26):130, 2019.

Main academic collaborations

Hungary: Semmelweis University, University of Szeged, ELKH

International: University of Liverpool, UK; Pavlov Institute of Physiology, St.Petersburg, RF; Dalhousie University, Halifax, Nova Scotia, Canada; Maastricht University, The Netherlands; University of Zagreb, Croatia and the University of Bialystok, Poland

Industrial cooperation

Hungary: PharmInVivo Kft.; Hévíz Spa; Richter Gedeon Nyrt.; Varga Herbál Manufactura; E-Group Kft. and Toxicoop Kft.;

International: Cebina Gmbh., Algonist Gmbh., Calyxha Gmbh., Austria; Bio4Dreams, Italy; and Pharmnovo Ltd., Sweden

Patents: USA PCT P1400432 (University of Pécs and Vichem Kft.), HU and USA PCT P1400205 (University of Pécs), U1200173 (University of Pécs); (five patents under development)

Core Facility: Animal Imaging CF, utilizing Genomics and Bioinformatics CF, Microscopy CF and Molecular Biology CF

MOLECULAR NEUROENDOCRINOLOGY RESEARCH GROUP

Established: 2014
Research Group Leader: Prof. Dr. István Ábrahám

Research Profile

Our research group investigates the effect of estrogen on neurons in the brain. Estrogen secreted from the ovary, as a classical feedback molecule, alters the function of several neuronal phenotypes. Although estrogen is primarily thought to alter the neuronal activity via modulating gene expression directly, it also exerts "non-classical" effects on neurons by altering signal transduction pathways. In our laboratory, we systematically characterize the mechanism and role of estrogen-induced "non-classical" effect on signalling molecules in neurons using immunohistochemistry, calcium imaging, single cell electrophysiology, single molecule detection and transgenic technology.
In Cortical Microcircuits Research Group (PI: Csaba Varga PhD) our mission is to find basic circuit mechanisms in the temporal cortex underlining the coding of memory traces and spatial information. We also investigate how pathological brain activities may evolve from "normal" activities. We are particularly interested in how specific interneuronal populations -or even individual neurons- take part in commanding the neuronal networks. We use versatile tools in order to dissect and understand the physiological and pathophysiological roles of circuitry elements. Our laboratory successfully combines in vitro and in vivo electrophysiology, correlated light- and electron microscopy, optogenetics on transgenic animals, and behavioral experiments.

Selected publications 2015-2020

1. Barabás K et al.: Effect of Inflammation on Female Gonadotropin-Releasing Hormone (GnRH) Neurons: Mechanisms and Consequences. Int J Mol Sci. 2020 Jan 14;21(2):529. doi: 10.3390/ijms21020529.
2. Barabás K et al.: The Role of Interleukin-10 in Mediating the Effect of Immune Challenge on Mouse Gonadotropin-Releasing Hormone Neurons In Vivo), ENEURO, 2018 Oct 15;5(5)
3. Barabás K et al.: Rapid non-classical effects of steroids on the membrane receptor dynamics and downstream signaling in neurons. Horm Behav. 2018 Aug;104:183-191. doi: 10.1016/j.yhbeh.2018.05.008. Epub 2018 May 19.
4. Barabás K et al.: Dynamic changes in binding interaction networks of sex steroids establish their non-classical effects. Sci Rep. 2017 Nov 1;7(1):14847. doi: 10.1038/s41598-017-14840-9.
5. Barabás K et al.: Treatment of beta amyloid 1-42 (Aβ(1-42))-induced basal forebrain cholinergic damage by a non-classical estrogen signaling activator in vivo. Sci Rep. 2016 Feb 16;6:21101. doi: 10.1038/srep21101.

Main academic collaborations

Hungary: Biological Research Centre Szeged, University of Debrecen, Institute of Experimental Medicine,University of Pécs.

International: Okinawa Institute of Science and Technology Graduate University, (Okinawa, Japan); The Babraham Institute, (Cambridge, UK); University of Otago School of Medical Sciences, Dunedin, (New Zealand); National Institute of Environmental Health Sciences, North Carolina, (USA); School of Dentistry and BK21 Program, Chonbuk National University, (Jeonju, Korea); University of Otago, Dunedin (New Zealand); University Medical Centre Hamburg, (Hamburg, Germany); University of Massachusetts, (Amherst, USA); University of Minnesota Department of Neuroscience (Minnesota, USA); Victorian College of Pharmacy, Monash University, (Australia).

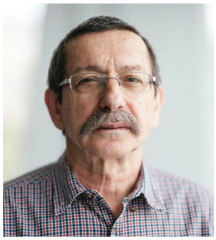
Industrial cooperation

- Femtonics Company: construction of the 3D single molecule detection (3D-SMD) microscope system, the production of a prototype of the microscope and the development of data analysis software.
- Biotalentum: Development of 2D and 3D human neuron culture from Alzheimer's disease patients we use inducible pluripotent stem cells from Alzheimer's patients.

Core Facility: Nano-Bio Imaging CF

HIGH-FIELD TERAHERTZ RESEARCH GROUP

Established: 2012
Research Group Leader: Prof. Dr. János Hebling



Research Profile

medical sciences. Additionally, this group facilitates the conceptual development of devices and methods which ensures performing these nonlinear optical investigations in world-class results.

This research group has achieved outstanding results in the generation and application of ultrashort (single-cycle), high-energy terahertz electromagnetic pulses (having 0.1 – 10 THz frequency, 0.1 -10 ps oscillation period). In the period beginning in 2004, up through 2014, the members of the group increased the energy regarding available THz pulses by more than one-million times. In consideration of this monumental achievement, the research group generated the highest energy THz pulses witnessed in years, and today, this group generates incredibly high energy pulses in the 2 THz frequency range. Notably, the group members have performed the first THz pump, THz probe measurements worldwide, and proposed the first application of high energy THz pulses for acceleration and manipulation of electron and proton/ion bunches.

In consideration of the implementation of THz sources with high field strengths, respected collaborations are nurtured with industrial and academic partnerships to establish ultra-precise machining throughout Hungary, poised to usher in

professional services in the field of implementation of THz sources customized to user-demands, linear and nonlinear terahertz spectroscopic measurements, consulting services and developmental efforts regarding laser- and spectroscopic systems.

Selected publications 2015-2020

1. P. Pongrácz et al.: *A step towards hydroformylation under green conditions: platinum-catalysed enantioselective hydroformylation of styrene in gamma-valerolactone.* Green Chem. 18:842, 2016.
2. Tóth Gy. et al.: *Single-cycle scalable terahertz pulse source in reflection geometry.* Optics Express 27: 30681, 2019
3. Salén P. et al.: *Matter manipulation with extreme terahertz light: Progress in the enabling THz technology.* Physics Reports 836-837: 1, 2019
4. Tibai Z. et al.: *Relativistic electron acceleration by focused THz pulses.* J. Phys. B: At. Mol. Opt. Phys. 51: 134004, 2018
5. Pálfalvi L. et al.: *Numerical investigation of a scalable setup for efficient terahertz generation using a segmented tilted-pulse-front excitation.* Optics Express 25: 29560, 2017

Primary academic collaborations

Longitudinal Beam Diagnostics, EUPRAXIA, ELI-ALPS

Memberships

EUPRAXIA Hungary Consortium Founder

Industrial Cooperative Partnerships

Kugler Precision, GmbH.

Patents: HU 229943, HU 230293, HU 230314, HU 230587, US 9128349, US 9497848, US 9548584, US 9837786, US 10359687, US 10481468, EP 2848099, EP 2965391, EP 2556407, EP 19626

Published: EP 3396447, EP 3353600, EP 2745649 EP3493657; and, an additional four under current review, soon to be published, upon approval.

NEUROTRAUMA RESEARCH GROUP

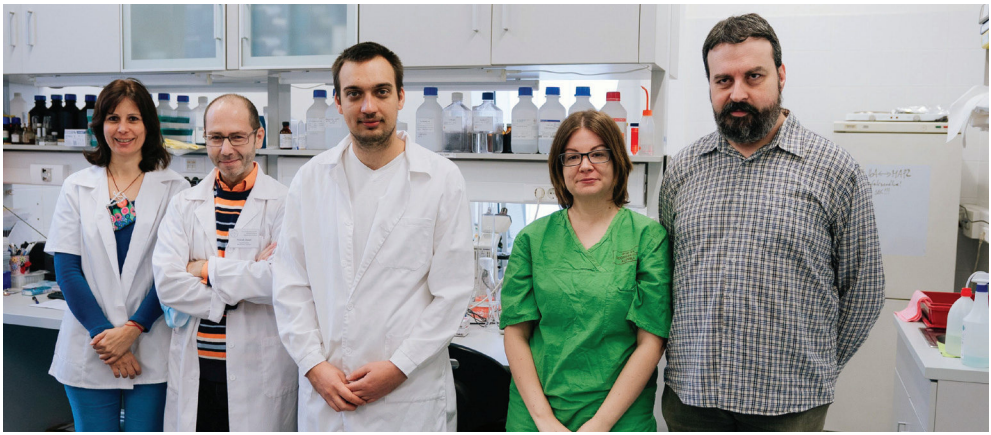
Established: 2014
Research Group Leader: Prof. Dr. András Büki

Research Profile

Our research group investigates different potential diagnostic, therapeutic possibilities and the clinical/functional outcome in the case of traumatic brain injury (TBI) applying translational research strategies.

Experimental neurotraumatology: the investigation of traumatic brain injury (TBI) with the utilization of our two licensed neurotrauma animal models: a) the impact acceleration head injury model, described by Marmarou, et al. 1994, and b) the fluid percussion head injury model, described first (for rats) by Dixon, et al., 1987. Quantification of the impact of the injury, in strong collaboration with various other research groups aligned with the Centre, involve histological methods (immunohistochemistry and silver staining methods), functional tests, the measurement of protein biomarker levels including neuro-imaging (MRI and microCT) techniques. Additionally, other areas of responsibility include the investigation of histological, blood based biomarkers and functional alterations, as a consequence of mild/repetitive mild TBI, of which, represent the primary focus of our current experiments.

Clinical studies in TBI: the maintenance of the serum biobank with the serum samples from more than 3500 TBI subjects originating from sixty sites throughout Europe as part of the CENTRE-TBI ('Collaborative European NeuroTrauma Effectiveness Research in TBI') consortium. Other duties include protein biomarker assays, analyses including the publication regarding the results are in progress in reference to this project. Additionally, the construction and targeted statistical analyses of the 'Pécs severe head injury database' with the clinical and outcome data of all sTBI subjects treated by the Department of Neurosurgery dating back to 1 July 2002, of which, is comprised of more than 700 consecutive cases, thus far. The group provides the following services



for partnerships: physiologically monitorized experimental traumatic brain injury of rats and/or mice by impact acceleration or fluid percussion head injury models, protein biomarker measurements originating from animal/human biofluids and tissue preparation for silver staining and/or immunohistochemistry investigations.

Selected publications 2015-2020

1. Czeiter E. et al.: *Blood biomarkers on admission in acute brain injury: Relations to severity, CT findings and care path in the CENTRE-TBI study*. EBioMedicine. 56:102785., 2020.
2. Mondello, S. et al.: *Circulating Brain Injury Exosomal Proteins following Moderate-To-Severe Traumatic Brain Injury: Temporal Profile, Outcome Prediction and Therapy Implications.* Cells, 9(4):977, 2020.
3. Tadepalli, S. A. et al.: *Long-term cognitive impairment without diffuse axonal injury following repetitive mild traumatic brain injury in rats*. Behavioural brain research, 378:112268, 2019.
4. Steyerberg, E. W. et al.: *Case-mix, care pathways, and outcomes in patients with traumatic brain injury in CENTRE-TBI: a European prospective, multicentre, longitudinal, cohort study.* The Lancet. Neurology, 18(10):923, 2019.
5. Mondello, S. et al.: *Blood-Based Protein Biomarkers for the Management of Traumatic Brain Injuries in Adults Presenting to Emergency Departments with Mild Brain Injury: A Living Systematic Review and Meta-Analysis.* J Neurotrauma, in press.

Main academic collaborations

Hungary: UP Faculty of Sciences and the Institute of Biology, SzRC Translational Neuroscience Research Group

International: University of Messina, Messina, Italy; Antwerp University Hospital and University of Antwerp, Antwerp, Belgium; Erasmus University Medical Centre, Rotterdam, Netherlands; University of Cambridge, Cambridge, UK; University of Florida, US; McKnight Brain Institute, Gainesville, Florida, US; University Witten/Herdecke, Cologne, Germany and the University Witten/Herdecke, Cologne, Germany

Memberships

Hungary: Hungarian Neuroscience Association (MIT): Prof. Dr. Büki András, President

International: International Neurotrauma Society (INTS); National Neurotrauma Society (NNS) USA; European Brain Injury Consortium (EBIC) and the European Association of Neurosurgical Societies (EANS).

Industrial cooperation

GE Healthcare Magyarország Kft.

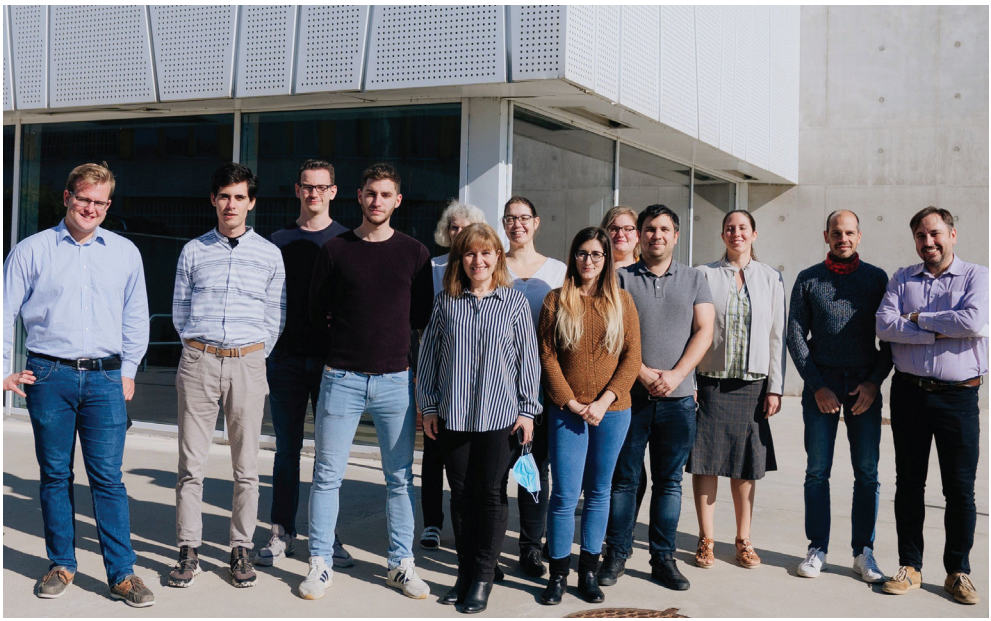
Core Facility (utilized): Animal Facility CF

REGENERATIVE SCIENCE, SPORTS AND MEDICINE RESEARCH GROUP

Established: 2020
Research Group Leader: Dr. Ildikó Bock-Marquette

Research Profile

regeneration and repair in humans. Their pursuit embraces a wide spectrum of research areas such as regenerative science, sports and medicine in which the fields are intertwined in a three dimensional approach, ultimately resulting in health. The umbrella expression, "regenerative medicine" covers the rejuvenation of the heart, traumatized outer/inner ear, skeletal muscle and tendons. Sports and athletics reflects the complex spectrum of biochemical processes during physical exertion and mental stress supporting a search for novel drug candidates associated with regenerative medicine. Thus, a translational approach of enhancing quality of life by understanding the very concept of regeneration is at the epicentre of this vastly interesting program.



Selected publications 2015-2020

1. Hinkel R. et al.: *C-terminal Ages domain of Thymosin β4 promotes post-ischemic cardiac function and repair* JMCC 87:113, 2015.
2. Kovacs Krisztina et al.: *PARP Inhibitor Protects Against Chronic Hypoxia/Reoxygenation-Induced Retinal Injury by Regulation of MAPKs, HIF1α, Nrf2, and NFκB.* Investigative Ophthalmology And Visual Science 60:5, 2019.
3. Tapodi Antal et al.: *PARP inhibition induces Akt-mediated cytoprotective effects through the formation of a mitochondria-targeted phospho-ATM-NEMO-Akt-mTOR signalosome.* Biochemical Pharmacology 162:98, 2019.
4. Szabo, A. et al.: *Activation of mitochondrial fusion provides a new treatment for mitochondria-related diseases* Biochemical Pharmacology 150:86, 2018.
5. Földes F. et al.: *Serologic survey of the Crimean-Congo haemorrhagic fever virus infection among wild rodents in Hungary.* Ticks Tick Borne Dis. 10(6):101258 2019.

Main academic collaborations

Hungary: Medical Faculty UP, Faculty of Sciences, Hungarian Academy of Sciences, International Training Centre, University of Szeged

International: UT Southwestern Medical Centre, Dallas, USA; UCSF Gladstone Institute, San Francisco, USA and LMU Munich, Munich, Germany.

Memberships

International: European Society of Cardiology, Heart Failure Association; International Society of Heart Research - European Section (ISHR-ES); Society of Hungarian Cardiologist; New York Academy of Sciences and the American Heart Association

Patents: Use of small peptides to promote tissue regeneration;
Method of treating, preventing, inhibiting or reducing damage to cardiac tissue

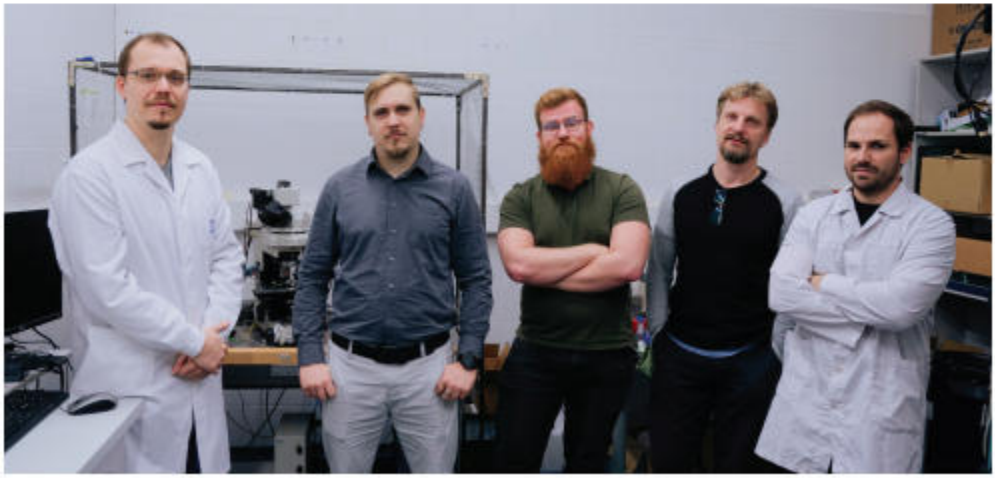
Core Facility (utilized): Genomics and Bioinformatics CF, Mass Spectrometry CF

RETINAL NEUROBIOLOGY RESEARCH GROUP

Established: 2012
Research Group Leader: Dr. Béla Völgyi

Research Profile

The group is primarily interested in the structure and function regarding the neuronal networks of the mammalian retina, the flow of information through parallel channels in the visual system, and the image encoding mechanisms which occur in the retina. In the realm of its research, this group's special emphasis is the electrical synapses maintained by the output ganglion cell of the retina. Previously it was described in which these relationships play a pivotal role in the synchronization of ganglion cell activity and thus, in the formation of the commonly referred to population code. The current experiments focus on the role of population activity in the coding of various image features. Additionally, the possible interaction of electrical and chemical synaptic signal transmission are examined. Recently, experimental measurements with visual encoding via neuromorphic retinal models were combined. This approach not only provides additional knowledge regarding the functional architecture of the mammalian retina but also serves as effective guidance to refine and/or develop algorithms deemed potentially beneficial for next generation retinal implants and bionic eyes used in robotics. In addition to the aforementioned information regarding parallel retinal information flow, it serves as the basis of devices using extended reality and augmented reality systems. Based on the research platform, the group provides the examination of transmitters and receptors using histologic, molecular biology and electrophysiology approaches, histologic, molecular biology examination of apoptosis mechanisms and imaging (Ca++ -).



Selected publications 2015-2020

1. Kovács-Öller T. et al.: *Spatial Expression Pattern of the Major Ca2+-Buffer Proteins in Mouse Retinal Ganglion Cells.* Cells 9(4):E792, 2020.
2. Tengölics Á. et al.: *Response Latency Tuning by Retinal Circuits Modulates Signal Efficiency. under revision in Scientific Reports*. under revision (2019).
3. Kovács-Öller T. et al.: *Expression of Ca2+-Binding Buffer Proteins in the Human and Mouse Retinal Neurons.* International Journal of Molecular Sciences 20(9), 2019.
4. Kovács-Öller T. et al.: *Connexin36 Expression in the Mammalian Retina: A Multiple-Species Comparison.* Frontiers in Cellular Neuroscience 11:65, 2017.
5. Kántor O. et al.: *Bipolar cell gap junctions serve major signaling pathways in the human retina.* Brain Structure and Function 222(6):2603, 2017.

Main academic collaborations

Hungary: Institute of Biophysics and the Szeged Biology Research Institute,.

International: Burke Rehabilitation Centre, White Plains, NY, USA; Newcastle University, Newcastle, UK; Los Alamos National Laboratory; Los Alamos, NM, USA and the University of Glasgow, UK.

Memberships

Hungary: Hungarian Neuroscience Association (MITT)

International: European Neuroscience Association (ENA); Association for Research in Vision and Ophthalmology (ARVO); FASEB Retinal Neurobiology and Visual Processing.

Core Facility (utilized): Animal Facility CF, Histology and Light Microscopy CF and Nano-bio-imaging CF

STRUCTURAL NEUROBIOLOGY RESEARCH GROUP

Established: 2014
Research Group Leader: Prof. Dr. Boldizsár Czéh

Research Profile

The physiological stress response is essential for daily survival and aids humans to adapt to the ever-changing environment. However, sustained uncontrollable levels of stress can induce various forms of dysfunctions and pathological alterations within our bodies. The primary interest regarding this group is the structural plasticity of the brain in relation to stress.

The group is intently focused on stress-induced changes in neuronal plasticity affecting neuronal networks, adult neurogenesis including glial changes in the hippocampus and neocortex. Accordingly, in respect to their hypothesis, such stress-induced structural changes contribute to the pathophysiology of psychiatric disorders including depression or schizophrenia, however, medications such as antidepressants and/or antipsychotic treatment also prove influential.

The approach uses translational research in reference to multidisciplinary

methods ranging from molecular biology to in vitro and in vivo imaging.

Selected publications 2015-2020

1. Nagy SA. et al.: *Stress-induced microstructural alterations correlate with the cognitive performance of rats: A longitudinal in vivo diffusion tensor imaging study.* Frontiers in Neuroscience Brain Imaging Methods 2020 (under review).
2. Simon M. et al.: Childhood Adversity Impairs Theory of Mind Abilities in Adult Patients With Major Depressive Disorder. Frontiers in Psychiatry 10:867, 2019.
3. Rusznák K. et al.: *Long-Term Stress and Concomitant Marijuana Smoke Exposure Affect Physiology, Behaviour and Adult Hippocampal Neurogenesis.* Frontiers in pharmacology, 9:786, 2018.
4. Czéh B. et al.: *Long-Term Stress Disrupts the Structural and Functional Integrity of GABAergic Neuronal Networks in the Medial Prefrontal Cortex of Rats.* Frontiers in Cellular Neuroscience 12:148, 2018.
5. Csabai D. et al.: *Reduced Synapse and Axon Numbers in the Prefrontal Cortex of Rats Subjected to a Chronic Stress Model for Depression.* Frontiers in Cellular Neuroscience 12:24, 2018.

Main academic collaborations

International: Aalborg University, Aalborg, Denmark and the University of Mississippi Medical Centre, Jackson, MS, USA

Memberships

Hungary: Hungarian Neuroscience Association, Hungarian Laboratory Diagnostic Associationand the Hungarian Experimental and Clinical Pharmacology Association

International: Federation of European Neuroscience Societies

Core Facility: Histology and Light Microscopy CF

TRANSLATIONAL NEUROSCIENCE RESEARCH GROUP (TNRG)

Established: 2012
Research Group Leader: Dr. István Hernádi

Research Profile

This research group is dedicated to basic and applied research regarding systems neuroscience. The aim of this group is to adopt and further develop in vivo animal and human models of higher order mammalian brain function with special emphasis on searching for functional biomarkers regarding pathological mechanisms related to neurodegenerative brain disorders, in particular, Alzheimer's disease, schizophrenia and developmental spectrum disorders. The four laboratories provide a unique repertoire of technical tools in support of targeting multidisciplinary research within the same research group. The main objective is to support the needs regarding parallel comprehensive testing of novel drug-candidates against cognitive impairment among in vivo preclinical animal experiments and human studies. In regards to the research platform, the following R&D possibilities are as follows: applied systems neuroscience, drug development and validation; development of novel testing techniques and methodology; development of novel equipment for testing; neurophysiological testing of bioactive environmental (chemical and electromagnetic) agents and research and development and formal education within the scope of the laboratory.

Selected publications 2015-2020

1. Tadepalli SA. et al.: *Long-term cognitive impairment without diffuse axonal injury following repetitive mild traumatic brain injury in rats.* Behav Brain Res 378:112268 2020.
2. Bali ZK. et al.: *Cognitive enhancer effects of low memantine doses are facilitated by an alpha7 nicotinic acetylcholine receptor agonist in scopolamine-induced amnesia in rats.* Frontiers in Pharmacology 10:73, 2019.
3. Grabenhorst F. et al.: *Primate amygdala neurons evaluate the progress of self-defined economic choice sequences*. Elife 12:5, 2016.
4. Trunk A. et al.: *Effects of concurrent caffeine and mobile phone exposure on local target probability processing in the human brain.* Scientific Reports 5:14434, 2015.
5. Hernádi I. et al.: *Planning activity for internally generated reward goals in monkey amygdala neurons.* Nature Neuroscience 18:461, 2015.

Main academic collaborations

Hungary: University of Pécs
International: University of Zurich, CH; Tohoku University, Sendai, Japan and the University of Cambridge, UK.

Memberships

Hungary: MITT (Hungarian Neuroscience Association); MÉT (Hunagarian Physiology Association) and the MLTT (Hungarian Laboratory Animal Association)

International: FENS (Federation of European Neuroscience Societies); IBRO (International Brain Research Organization) and the SFN (Society for Neuroscience)

Core Facility: Animal Facility CF

VIROLOGICAL RESEARCH GROUP

Established: 2012
Research Group Leader: Prof. Dr. Ferenc Jakab

Research Profile

The main profile of this research group is the pursuit of viral zoonoses (diseases spread from animals to humans caused by viruses). Due to increased levels of global warming and the expansion of human living-space, animal viruses pose a growing threat to human and veterinary health. Pathogens causing severe epidemics are emerging more frequently largely due to global activities. One of the research aims is to identify well-known and new pathogens in samples originating from Hungary and from foreign countries, due to the extensive international collaboration network of the group. Notably, this group's intent is to monitor the prevalence, characterize the genetic background and describe the mechanism regarding viral infection. This group predominantly examines rodent and bat populations, and the study regarding mosquitoes, ticks and other arthropod vectors. On the basis of a well-established and superbly functioning collaboration with a varied stakeholders in public health, animal health and industry, this group handsomely contributes to the development of diverse diagnostic methods regarding the pathogens characterized in the lab. The Virological Research Group is a member of the National Laboratories network, as of 2020, and provides professional services for academic and non-academic partnerships supporting the development of diagnostic methods and processes and molecular biology techniques and testing.

Selected publications 2015-2020

1. Zana B. et al.: Multi-Approach Investigation Regarding the West Nile Virus Situation in Hungary, Viruses 20;12 (1), 2020.
2. Zana B. et al.: *Molecular Identification of a Novel Hantavirus in Malaysian Bronze Tube-Nosed Bats (Murina aenea)*. Viruses 21;11(10) 2019.
3. Földes F. et al.: *Serologic survey of the Crimean-Congo haemorrhagic fever virus infection among wild rodents in Hungary.* Ticks and Tick Borne Diseases 10(6):101258, 2019.
4. Kemenesi G. et al.: *Re-emergence of Lloviu virus in Miniopterus schreibersii bats, Hungary.* Emerging Microbes and Infection 7(1):19, 2018.
5. Bányai K. et al.: *Candidate new rotavirus species in Schreiber's bats, Serbia.* Infection Genetics and Evolution 48:19, 2017.

Main academic collaborations

Hungary: University of Debrecen, Szeged Science University, Biology Centre, Szeged University Veterinary Medicine and the Eötvös Loránd Research Network

International: recently, the group established several collaborations primarily throughout Europe (i.e., Serbia, UK and Germany) and also with the US and the Far-East.

Industrial cooperation

Hungary: DIAGON Kft. and HM-EI Zrt.

International: Ciklonizacija, Ltd., (Novi Sad, Serbia)

National Laboratory: Virological National Laboratory

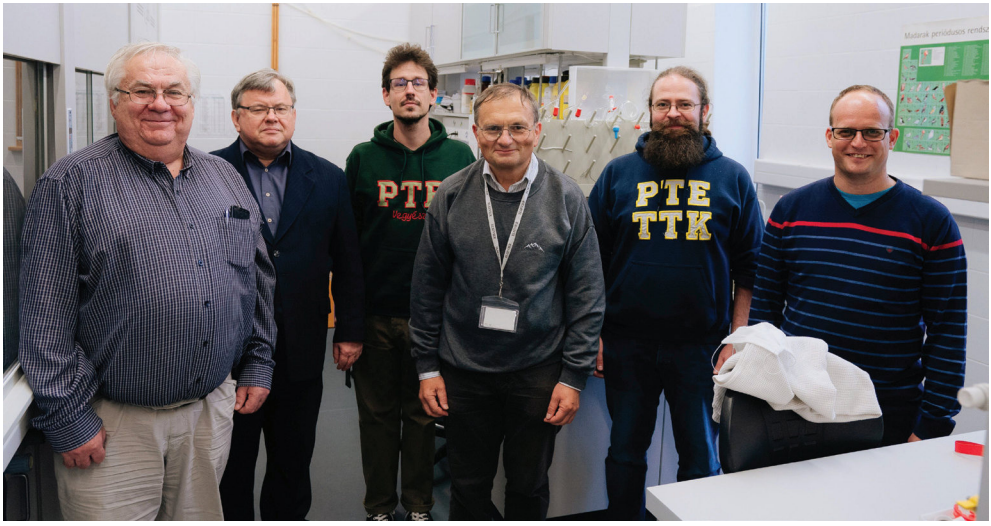
Core Facility (utilized): Genomics and Bioinformatics CF

GREEN CHEMISTRY RESEARCH GROUP

Established: 2013
Research Group Leader: Prof. Dr. László Kollár

Research Profile

The primary aim of the research group is to develop highly efficient synthetic methods which can be used for the synthesis of compounds of practical (e.g., pharmaceutical) importance. The research involves environmentally benign synthetic procedures, including related analytical investigations. Important research areas and topics include the activation regarding built-in small molecules, such as carbon monoxide and other related aspects, into skeletons and building blocks via homogeneous catalytic reactions. Additional investigation highlight the reaction mechanism by analytical and theoretical methods; synthesis and application of paramagnetic building blocks (nitroxides) in research projects of pharmaceutical interest; the investigation of weak chemical intractions, development in the field of sensor chemistry; synthesis of 'host' compounds and their use in supramolecular chemistry and investigation of alternative (e.g., biomass-based) solvents in syntheses.
Services in support of academic and/or industrial partnerships include NMR measurements; inert, microwave irradiation and high-pressure experiments at laboratory levels; investigations based on fluorescence or vagy Rayleigh-scattering measurements. Other professional services include polarization, anizotropy and solvent relaxation measurements (Fluorolog tau3 fluorimeter), and investigations based on Raman-scattering (Scanning Raman photometer, atomic force microscopy). Lastly, services are rendered with the following, highly intricate instruments including, GC-MS measurements and microcalorimetry measurements and conformation analysis of



proteins (SETARAM nano-II DSC).

Selected publications 2015-2020

1. B. Lemli et al.: *Noncovalent Interaction of Tilmicosin with Bovine Serum Albumin.* Molecules 23:1915, 2018.
2. N. Pálinkás et al.: *Palladium-Catalysed Synthesis of Amidines via Isonitrile Insertion.* ACS Omega 3:16118, 2018.
3. P. Pongrácz et al.: *A step towards hydroformylation under green conditions: platinum-catalysed enantioselective hydroformylation of styrene in gamma-valerolactone.* Green Chem. 18:842, 2016.
4. K. Erős et al.: *Chronic PARP-1 inhibition reduces carotid vessel remodeling and oxidative damage of the dorsalhippocampus in spontaneous lyhypertensiverats.* PLoSOne 12, 2017.
5. Z. Nagymihály et al.: *Palladium-Mediated Catalysis Leads to Intramolecular Narcissistic Self-Sorting on a Cavitand Platform.* J. Org. Chem. 82:390, 2017.

Main academic collaborations

Hungary: Pannon University, BME, MTA Central Research Institute

International: IREE, Prague, Czech Republic; University of Bucharest, Romania; University of Osijek, Croatia; Institut National de la Santé et de la Recherche Médicale (INSERM); University la Laguna, Spain; INESC Porto, Portugal; Beijing Normal University, Beijing, China; University of Bordeaux, Bordeaux, France; Devi Ahilya University, Indore, India; State Research Inst. for Viticulture and Pomiculture, Weinsberg, Germany; Department of Physics, Xiamen University, Xiamen, China; University of Graz, Graz, Austria; Gakushuin University, Tokyo, Japan; Technical University Graz, Austria; University of Coimbra, Portugal; Semenov Institute, Moscow, Russia; Dartmouth College, Lebanon, USA

Industrial cooperation

Toxicoop Ltd. (Hungary); E-group

ASSOCIATED MEMBERS

SIGNAL TRANSDUCTION RESEARCH GROUP

Established: 2012
Research Group Leader: Dr. Marianna Pap

Research Profile

The research group studies various signal transduction processes. The majority of glioblastoma multiforme (GBM) brain tumors are resistant to temozolomide (TMZ) treatment. The aim of the research is to study the exact mechanism of TMZ resistance. GBM cell lines utilized, inducing apoptosis by activating alternative signaling pathways. Protein kinase R (PKR) is involved in the regulation of cell division and differentiation as well as apoptotic processes. The signaling effects of PKR are examined using clones expressing PKR siRNA. Signaling of mitogen-Activated Protein Kinases (MAPKs) was studied in cultures of PC12 cells using various agents, e.g. proteasome inhibitors (e.g. MG-132 and epoxomycin) or a peptide called urocortin 2. Nitric oxide is known to have many intra- and intercellular signaling effects. research also focuses on the investigation of the role of the Ras protein family as well as the p53 protein in NO-induced signaling processes. Studies include the role of Ras and RhoA proteins and PI 3-K and NFκB transcription factor in the signal transduction processes of the inhibitory effect of nerve growth factor (NGF) on cell proliferation and apoptosis. Periodontal ligament plays a role in the formation of periodontal supporting and supporting tissue changes due to forces. The aim of the experiments is to investigate the cellular responses of root-derived fibroblast cells to continuous, physiological compressive mechanical force and the underlying signaling events.

Selected publications 2015-2020

1. Szabo A. et al.: *Activation of mitochondrial fusion provides a new treatment for mitochondria-related diseases.* Biochem Pharmacol. 2018 Apr;150:86-96.
2. Andrea Krisztina Sükösd et al.: *Cell death and survival following manual and femtosecond laser-assisted capsulotomy in age-related cataract.* Int J Ophthalmol. 2018 Sep 18;11(9):1440-1446.
3. Éva Sághy et al.: *Carboxamido steroids inhibit the opening properties of transient receptor potential ion channels by lipid raft modulation* J Lipid Res. 2018 Oct;59(10):1851-1863.
4. Kovács-Valasek A. et al.: *Accelerated retinal aging in PACAP knock-out mice.* Neuroscience. 2017 Apr 21;348:1-10.

5. Schipp, R. et al.: *Partial p53-dependence of anisomycin-induced apoptosis in PC12 cells.*MOLECULAR AND CELLULAR BIOCHEMISTRY 2017 434 : 1-2 pp. 41-50. , 10 p.

Main academic collaborations

Hungary: Neurology Clinics, Neurosurgery Clinics, Pediatrics Clinics, No. 2. Internal Medicine Clinics and Nephrology, Centre for Diabetology, Institute of Pathology, Immunology and Biotechnology Institute, Institute of Physiology, Institute of Pharmacology and Pharmacotherapy, Clinics of Dental and Oral Surgery and the Institute of Physiology of Faculty of Sciences.

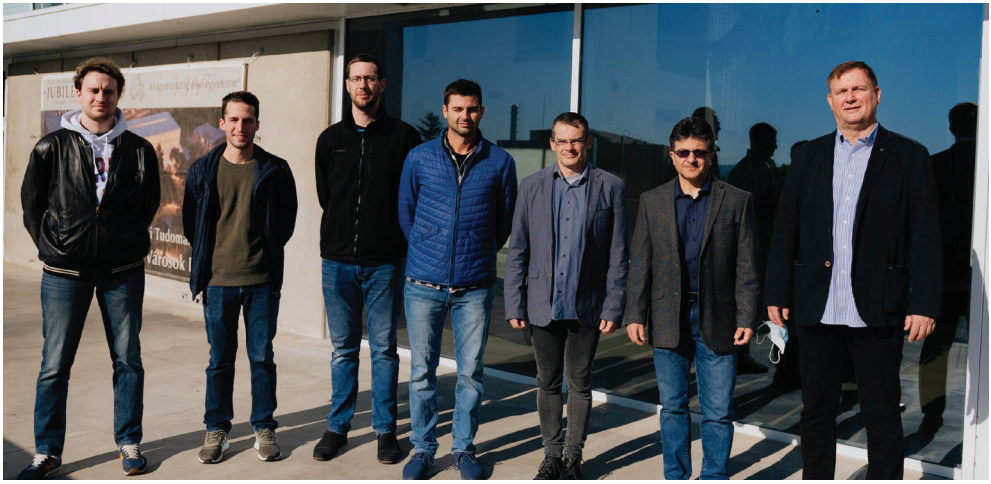
International: Josip Juraj Strossmayer University of Osijek Medical Faculty, Institute of Biology, Croatia

MOLECULAR CARDIOLOGY RESEARCH GROUP

Established: 2016
Research Group Leader: Prof. Dr. István Szokodi

Research Profile

findings obtained in preclinical studies toward clinical application, or vice versa, is envisaged, from clinical observations back to mechanistic insights. The main objectives of the preclinical studies are the following: [i] identification of novel cardiokine systems (adrenomedullin, apelin, apela, endothelin-1, etc) regulating cardiac contractility, coronary circulation, metabolism, ventricular remodelling, and cardiac regeneration; [ii] identification of novel cardiokine regulators of cardiac fibrosis; [iii] elucidation of cross-talk between cardiac fibroblasts and cardiomyocytes regulating pathological processes of the heart; [iv] identification of interaction between microRNAs, long non-coding RNAs, and mRNAs modulating ventricular remodeling; and [v] development of novel small-animal models of myocardial infarction and heart failure.
The major objectives of the clinical studies include the following: [i] identification of novel biomarkers (cardiokines, microRNAs, and long non-coding RNAs) with tissue specificity in acute myocardial infarction and heart failure; and [ii] development of novel reperfusion therapies to improve myocardial salvage in patients afflicted with myocardial infarction. In regards to research basis, the group provides the following professional services extended to its participating partnerships: Development of novel small- and large-animal models of heart failure; cardiac PET-MRI studies in large-animal models of heart failure and testing novel lead compounds in small- and large-animal models regarding heart failure.



Selected publications 2015-2020

1. Kiss R. et al.: *Determination of frail state and association of frailty with inflammatory markers among cardiac surgery patients in a Central European patient population.* Clin Hemorheol Microcirc. 2019 (online, in publishing).
2. Szentes V. et al.: *The role of CXCR3 and associated chemokines in the development of atherosclerosis and during myocardial infarction.* Front Immunol. 9:1932,2018.
3. Bartunek J. et al.: CHART Program. *Cardiopoietic cell therapy for advanced ischaemic heart failure: results at 39 weeks of the prospective, randomized, double blind, sham-controlled CHART-1 clinical trial* Eur Heart J. 38(9):648, 2017.
4. Perjés Á. et al.: *Characterization of apela, a novel endogenous ligand of apelin receptor, in the adult heart.* Basic Res Cardiol. 111:(1): 2, 2016.
5. Perjés Á. et al.: *Apelin increases cardiac contractility via protein kinase Cε- and extracellular signal-regulated kinase-dependent mechanisms.* PLoS One. 9(4):e93473, 2014.

LYMPHOID ORGAN RESEARCH GROUP

Established: 2012
Research Group Leader: Prof. Dr. Péter Balogh

Research Profile

The research field regarding this team is the developmental biology of murine lymphoid tissues involved in immune defence and addressing the roles of hematopoietic and stromal constituents. The team produced several rat monoclonal antibodies against the cellular and matrix components of mesenchymal scaffolding, deemed beneficial in evaluating the roles of various morphogenetic factors (DNA-binding proteins and cytokines), while guiding the development of spleen and intestinal lymphoid tissues in animal experimentations by using transgenic models and in vivo immunomodulatory approaches. In regards to this scientific effort, the group effectively identified hitherto unknown lymphoid tissue components and novel forms of lymphoid tissues, which may play important roles in the regulation of peritoneal lymphocyte distribution and progression of lymphoid malignancies.
The R&D activities include the analysis of immunomodulatory agents affecting the structure, composition and immunological functions regarding lymphoid organs, and the development of tumor models. Notably, we recently initiated recombinant antibody development. The service portfolio includes the development of monoclonal antibodies (rat and mouse), immunochemical procedures (antibody purification and downstream processing, labelling [fluorochromes, biotin, HRPO], QC), fluorescence, immunohistochemical and serological kit development and lymphoid tissue analysis, cell sorting (fluorescent and magnetic), establishment of hematopoietic chimeras using MHC and Thy-1 allotype including fluoroprotein tracing, and in vivo motility analysis using Kikume photoconversion.

Selected publications 2015-2020

1. Jia X. et al.: *Foliate Lymphoid Aggregates as Novel Forms of Serous Lymphocyte Entry Sites of Peritoneal B Cells and High-Grade B Cell Lymphomas.* J Immunol. 204(1):23, 2020.,
2. Vojkovics D. et al.: *Differential Effects of the Absence of Nkx2-3 and MAdCAM-1 on the Distribution of Intestinal Type 3 Innate Lymphoid Cells and Postnatal SILT Formation in Mice.* Front Immunol. 10:366, 2019.
3. Kellermayer Z. et al.: *IL-22-Independent Protection from Colitis in the Absence of Nkx2.3 Transcription Factor in Mice.* J Immunol. 202(6):1833, 2019.
4. Robles EF. et al.: *Homeobox NKX2-3 promotes marginal-zone lymphomagenesis by activating B-cell receptor signalling and shaping lymphocyte dynamics.* Nat Commun. 7:11889, 2016.

5. Kellermayer Z. et al.: *Divergence of Vascular Specification in Visceral Lymphoid Organs-Genetic Determinants and Differentiation Checkpoints.* Int Rev Immunol. 35(6):489, 2016.

Primary academic collaborations

Semmelweis University, Institute of Pharmacology and Pharmacotherapy

Memberships

Hungary: Hungarian Society for Immunology

International: American Association of Immunologists and EuroMAbNET

Industrial cooperation

Histopathológia Kft.

Patents: Mouse lymphoma cell line and animal model of human high-grade B-cell lymphoma WO2017072544A1

REPRODUCTIVE AND TUMOUR IMMUNOLOGY RESEARCH GROUP

Established: 2012
Research Group Leader: Dr. Júlia Szekeres

Research Profile

The primary focus of this group centres on the communication among the embryo/foetus and the maternal immune system. Paternal antigens expressed by the foetus, are recognized as foreign, thus should be "rejected" by maternal immune cells.

However, during normal gestation, the conceptus is not attacked, since maternal immune functions are re-adjusted and tolerate these antigens and to create a favourable environment supportive of the developing foetus. Progesterone and its downstream mediator; the progesterone induced blocking factor (PIBF) are important players in this process. The role of PIBF in decidualization, and implantation, including ongoing pregnancy has been investigated, using PIBF-deficient mice. We have aptly demonstrated how embryo-derived extracellular vesicles are involved in feto-maternal communication. The competent embryo is another prerequisite for successful implantation. The goal of assisted reproduction is to achieve a single pregnancy in the effective transfer of a single embryo. This requires improved methods to identify the competent embryo. We have developed a simple, non-invasive test for identifying the competent embryo, by means in using a flow cytometric determination regarding the number of DNA containing extracellular vesicles in embryo culture media.

The group develops innovative bioinformatics algorithms and data analysing processes in cooperation with industrial partnerships for the purposes of resolving problems associated with medical biology and provides professional biostatistical and bioniformatical data analysing services for research groups throughout Hungary and abroad.

Selected publications 2015-2020

1. Csabai T. et al.: *Altered Immune Response and Implantation Failure in Progesterone-Induced Blocking Factor-Deficient Mice.* Front Immunol. 2020 Mar 11;11:349.
2. Bognar Z. et al.: *The effect of light exposure on the cleavage rate and implantation capacity of preimplantation murine embryos.* J Reprod Immunol. 2019 Apr;132:21-28.

3. Szekeres-Bartho J. et al.: *The Role of Extracellular Vesicles and PIBF in Embryo-Maternal Immune-Interactions.* Front Immunol. 2018 Dec 13;9:2890. 2018.
4. Pallinger E. et al.: *PIBF+ extracellular vesicles from mouse embryos affect IL-10 production by CD8+ cells.* Sci Rep. 2018 Mar 16;8(1):4662.
5. Pallinger E. et al.: *A simple and rapid flow cytometry-based assay to identify a competent embryo prior to embryo transfer.* Sci Rep. 2017 Jan 6;7:39927.

TRANSLATIONAL MEDICINE RESEARCH GROUP

Established: 2016
Research Group Leader: Prof. Dr. Péter Hegyi

Research Profile

Translational Medicine is the breakthrough of the 21st century, which improves healthcare prevention, accelerates disease diagnosis, improves the quality of patient care and, last yet not least, ensures health care will be cost-effective, while providing an appropriate environment regarding high-level clinical and basic research activities.
The Centre for Translational Medicine, founded in January 2016, at the University of Pécs, was the first in Hungary and throughout Central-Eastern-Europe to promote translational medicine. The aim of the Centre is to support translational processes regarding patient care, science, in the area of structuring and summarizing knowledge and communication.
Distinctly, the questions and current challenges first manifest at the patient's bedside. Answers are found with the aid of one of the scientific disciplines or the combination of several of theses respected premises. Thereafter, all these answers and results are organized into practical evidence-based (EBM) guidelines, which handsomely serve as the basis for evidence-based medicine. The knowledge gathered in the EBM, with educational and illustrative materials, are returned to patients, healthcare participants, insurance companies, industry partnerships and policy-makers.
The Centre promotes 1) the organization of quality patient care, 2) the education of clinical research methodologies, 3) the operation of clinical research, and 4) the organization of conferences and involvement of young researchers, 5) the development of translational centres in academy and healthcare 6) and, the extension of translational medicine in patient care, scientific research and education.

The Interdisciplinary Unit of the Centre for Translational Medicine (IT, biostatistics, data and patient coordination, medical project coordination, communication) has long since supported the conduct of more than 150 meta-analyses (55 published), the development of 41 patient registries and 21 academic clinical trials.
In September 2019, twenty research fellows jump-started their scientific career aligned with the Centre for Translational Medicine, University of Pécs, in clinical and basic research PhD programs (with 17 and 3 research fellows, respectively). Additionally, in September of 2020, a new group of 15 research fellows joined either the 12- or the 24-months program.
In regards to the successful operation of clinical research, multicentre cooperative initiatives are paramount and essential. The Szent György Teaching Hospital of County Fejér, located in Székesfehérvár, and the Heim Pál National Pediatric Institute in Budapest have recently aligned themselves to these efforts and today, are participating in several clinical research projects.

Selected publications 2015-2020

1. Hegyi P. et al.: *Bile Acids in Regulation of Intestinal Epithelial Function in Health and Disease.*, PHYSIOLOGICAL REVIEWS 98: (4) pp. 1983-2023., 2018;
2. Nemeth BC. et al.: *Misfolding cationic trypsinogen variant p.L104P causes hereditary pancreatitis,* GUT 66: (9) pp. 1727-1728., 2017;
3. Hegyi P. et al.: *A New Horizon in the Pathomechanism and Treatment of Pancreatitis,* Reviews of Physiology Biochemistry and Pharmacology 170: pp. 37-66., 2016;
4. Parniczky A. et al.: *Prospective, Multicentre, Nationwide Clinical Data from 600 Cases of Acute Pancreatitis*, Plos One 11: (10) e0165309, 2016;
5. Maléth József et al.: *Alcohol Disrupts Levels and Function of the Cystic Fibrosis Transmembrane Conductance Regulator to Promote Development of Pancreatitis,* Gastroenterology 148: (2) pp. 427-439., 2015;

Laboratory Infrastructure and primary instruments

- Laboratory of Molecular Genetics: DNA/RNA isolation, PCR, RT-PCR, Sanger sequencing, mutagenesis, Western blot, biochemistry (affinity chromatography, enzyme activity measurements), cell culture and mouse model experiments.
- Equipment Inventory includes the following: StepOne™ Real-Time PCR System (Applied Biosystems), ChemiDoc Imaging System (BioRad), Agarose and Protein Gel Electrophoresis System (BioRad), C1000 Touch Thermal Cycler (BioRad)and SpectraMax Absorbance Reader (Molecular Devices) and the ÄKTA pure protein purification system GE Healthcare Life Sciences.
- Laboratory of Thermophysiology: Various surgeries in rodents, thermocouple thermometry, respirometry measurements biotelemetry, thermal imaging, food intake, body composition, and nocifensive reactionary measurements. Additionally, various techniques of blood collection and tissue harvesting, including effective sample storing in support of molecular biology experiments.

CORE FACILITIES

CORE FACILITIES

Scientific evolution is typically escorted by the development of technologies and interdisciplinary research. Significant breakthroughs in life science, such as the sequencing of the entire genome or precision medicine occurs as a result of joint efforts including members comprised of various scientific fields (i.e., biologists, physician, mathematicians and informaticians). These results are only possible within the realm of research supporting facilities, core facilities (CF), providing specialized technologies and expertise. Such unique research infrastructures, frequently mentioned as research facilitating central laboratories, enhance the sculpting of the research environment based on cooperative perspectives of efficient interdisciplinary science. Assurance and maintenance in respect to contemporary technology is of the utmost regarding the deploying revolution in medical biology and the researchers of different university institutions and research groups, deemed necessary for interdisciplinary approach, and can be resolved via central research support laboratories more efficiently. SzRC is dedicated to invest, maintain and manage such technologies.

The following Core Facilities operate in SzRC: Animal Facility, Flow Cytometry, Genomics and Bioinformatics, Animal Imaging, Nano-bio-imaging, Cell and Tissue Culture, Histology and Light Microscopy, Mass Spectometry.

Enterprises also partnership in the development of new applications providing benefits for all participating parties. Enterprises manage their own infrastructure in a given CF minimizing the investments costs compared to a full time employed basis. CF also contributes to joint method development, relying on its existing professional expertise, acquiring patent rights for the jointly developed technologies and providing access for the academic users to the newly developed application. Characteristically, additional interactions among CF and business entities include obtaining financing via joint technology and innovation grants or the cooperation of CF in a consortium partnerhip within different EU framework programs in which the engagement of multiple industrial partnerships is both diversified and required.

ANIMAL CORE FACILITY

CF Leader: Dr. István Hernádi

Service Profile

The primary objective of this group is the organization and operation of state-of-the-art maintenance of small laboratory animals at the Szentágothai Research Centre (SzRC). The SzRC Animal Facility operates on a minimal disease (MD) hygiene level with one rat and two mice holding rooms including a total of eleven individually ventilated cage racks. Currently, lab animals are housed in support of nine research groups who are employeds at the SzRC. This includes the daily maintenance of the animals (feeding, watering and bedding) and their daily health monitoring. Additionally, the highly trained staff of the Animal Facility is fully compliant to individual maintenance protocols and monitoring, in accordance to research requirements.

Laboratory infrastructure and primary instruments

- Ten non-sterile filtered IVC racks, five dedicated to housing rats and five assigned to housing mice
- One HEPA-filtered IVC rack for mice
- A normal light-dark cycle (light on from 0700 - 2100 hours), and a shifted light-dark cycle room (light on from: 0100 - 1300 hours) for mice
- A normal light-dark cycle (light on from 0700 – 2100 hours) room for rats
- Individual maintenance protocols and monitoring
- Individual health monitoring
- Endoparasite and ectoparasite treatment and monitoring
- Routine check-in of the animals upon arrival
- Animal transportation within the borders of Hungary using a specialized vehicle and trained personnel on call duty

Highlighted Grants 2015-2020

The Animal Facility participates in the facility users' grants.

Memberships

- Hungarian Laboratory Animal Science Association (MLTE)
- European Animal Research Association (EARA)

FLOW CYTOMETRY CORE FACILITY

CF Leader: Dr. Mátyás Meggyes

Service Profile

analyses using ten different parameters and eight-color detection up to 4-5000 events per second. Multiparameter detection, combined with a highly sensitive optical system, allows advanced cell subset analysis, including soluble and cell-surface protein quantification. Additionally the BD FACSCanto II flow cytometer is capable to perform functional studies such as cytotoxicity, cytokine measuring, viability (early or late apoptosis), and cell cycle analyses.

Laboratory infrastructure, main instruments

- BD FACS Canto II

Selected publications 2015-2020

1. Meggyes M. et al.: *Different Expression Pattern of TIM-3 and Galectin-9 Molecules by Peripheral and Peritoneal Lymphocytes in Women with and without Endometriosis,* International Journal of Molecular Sciences, 21(7), 2324 (2020)
2. Csepregi R. et al.: *Cytotoxic, Antimicrobial, Antioxidant Properties and Effects on Cell Migration of Phenolic Compounds of Selected Transylvanian Medicinal Plants.* Antioxidants, 2076-3921 9(2) Paper: 166, 29p (2020)
3. Das S. et al.: *Antioxidant and antimicrobial properties of randomly methylated β cyclodextrin - captured essential oils,* Food Chemistry 278, 305-313 (2019)
4. Miko E. et al.: *Immune Checkpoint Molecules in Reproductive Immunology,* Frontiers in immunology, 10 (APR): 846 (2019)

GENOMICS AND BIOINFORMATICS CORE FACILITY

CF Leader: Dr. Attila Gyenesei

Service Profile

long-read sequencing (MinION), and full-service protocols for genome, transcriptome, epigenome and metagenome sequencing. Additionally, the facility offers advice regarding the study design and provides bioinformatics and biostatistical data analysis services on NGS including other biomedical data. The Genomics and Bioinformatics Core Facility offers a broad range of library preparatory methods ranging from DNA and RNA samples depending on the sequencing technology, sample source, and biological question of interest. The available instruments cover short (Illumina technology) and long sequencing (Oxford Nanopore technology) including a broad range of output, from a few million to hundreds of millions reads.

The facility provides bioinformatics services covering all the major steps associated with NGS data analysis, including data preprocessing (demultiplexing and the transfer of unaligned BAM file), standard bioinformatic analysis (alignment and genome browser visualization of BAM file), downstream bioinformatic analysis (e.g., differential expression or genotype calling) including assistance with publication-related data sharing requirements (e.g., GEO submission).

Laboratory infrastructure and primary instruments

- Fluorescence Quibit 4.0
- Bioanalyzer 2100
- TapeStation 4200
- Nextseq 550
- MiSeq
- MiniSeq
- iSeq
- Nanopore (MinION)

Highlighted grants awarded 2015-2020

- **GINOP-2.3.1-20-2020-00001**
- **H2020-CONVERGE-RIA-871075: "ELIXIR-CONVERGE -** Connect and align ELIXIR Nodes to deliver sustainable FAIR life-science data management services"
- **NKFIH 2020-2.1.1-ED-2020-00009:**
- **GINOP-2.3.4-15-2020-00010: 2019-1-HU01-KA203-061251 (ERASMUS+):**
- Educating Experts of the Future: Developing Bioinformatics and Biostatistics Competencies of European Biomedical Students (BECOMING)

Selected publications 2015-2020

1. Gombos K. et al.: *Translating Scientific Knowledge to Government Decision Makers Has Crucial Importance in the Management of the COVID-19 Pandemic.* Population Health Management (2020)
2. Krabóth Z. et al.: *DNA CpG methylation in sequential glioblastoma specimens.* Journal of Cancer Research and Clinical Oncology (2020)
3. Gángó A. et al.: *Dissection of subclonal evolution by temporal mutation profiling in chronic lymphocytic leukemia patients treated with ibrutinib.* International Journal of Cancer. 146(1):85-93. (2020)
4. Montgomery SA. et al.: *Chromatin Organization in Early Land Plants Reveals an Ancestral Association between H3K27me3, Transposons, and Constitutive Heterochromatin.* Current Biology 30(4):573-588.e7 (2020)
5. Bödör C. et al.: *Molecular Subtypes and Genomic Profile of Primary Central Nervous System Lymphoma.* Journal of Neuropathology & Experimental Neurology 79(2):176-183. (2020)

Main academic & industrial collaborations

- UP Szentágothai Research Centre: Prof. Dr. Zsuzsanna Helyes, Prof. Dr. Judit Pongrácz , Prof. Dr. Gábor L. Kovács and Prof. Dr. Ferenc Jakab
- Dr. Csaba Bödör (Semmelweis University)
- Foreign collaboration: Dr. István Nagy (Imperial College London, UK), Prof. Dr. Jorma Ilonen and DIPP Study Finland (University of Turku, Finland) and Prof. Dr. Adam Krętowski (Medical University of Bialystok, Poland)
- Industrial collaboration: 4ig Nyrt, iBioScience Kft. and Xenovea Kft.

Networking, membership

ELIXIR Hungary and KETLAK

ANIMAL IMAGING CORE FACILITY

CF Leader: Prof. Dr. Zsuzsanna Helyes

Service Profile

of CT imagery, it is possible to determine the internal structure of the examined objects, calculate their parameters and digitally map them in three dimensions. Additionally, in consideration of IVIS Lumina III. and FMT 2000, it is possible to monitor and quantify biological and biochemical reactions in living tissues.

Laboratory infrastructure, main instruments

- Bruker's PharmaScan 4.7T MRI Scanner: the PharmaScan MR scanner is a modern, high field, easy-to-use system. It is designed for MRI applications on small animals such as rats and mice in the field of whole-body conventional, advanced functional, dynamic heart, and pharmaceutical imaging including biomedical and molecular imaging research.
- B-314: Skyscan micro-CT, IVIS Lumina III. and the FMT 2000
- IVIS Lumina III.
- FMT 2000
- VisualSonics Vevo 770 high resolution small animal imaging system

Highlighted grants obtained 2015-2020

- **KTIA_NAP_13-2-2014-0019:** Hungarian Brain Research Program (123, 567,612 Ft)
- **2017-1.2.1-NKP-2017-00002:** Hungarian Brain Research Program 2.0: (6,500,000,000 Ft)
- **EFOP-3.6.2-16-2017-00008:** "The role of neuro-inflammation in neurodegeneration: from molecules to clinics" (1,259,882,179 Ft)

Selected publications 2015-2020

1. Nagy SA. et al. (2020) *Stress-induced microstructural alterations correlate with the cognitive performance of rats: A longitudinal in vivo diffusion tensor imaging study.* Frontiers in Neuroscience 14:474 (2020)
2. Bolcskei, K. et al. (2018). *Behavioural alterations and morphological changes are attenuated by the lack of TRPA1 receptors in the cuprizone-induced demyelination model in mice.* Journal of Neuroimmunology 320, 1-10.
3. Kriszta, G. et al. (2019). *Investigation of Cuprizone-Induced Demyelination in mGFAP-Driven Conditional Transient Receptor Potential Ankyrin 1 (TRPA1) Receptor Knockout Mice*. Cells 9(1):81 (2019)
4. Toth, A. et al. (2019). *Cerebral Microbleeds Temporarily Become Less Visible or Invisible in Acute Susceptibility Weighted Magnetic Resonance Imaging: A Rat Study.* Journal of Neurotrauma 36(10), 1670-1677.

NANO-BIO-IMAGING CORE FACILITY

CF Leader: Prof. Dr. István Ábrahám

Service Profile

The Nano-Bio-Imaging Core Facility (NBICF) is a molecular imaging service centre which uses state-of-the-art microscope technologies to study individual molecules, ions and their interactions, even within a living cell. These assays are complemented by single-cell ion imaging including Ca2 + imaging in acute brain sickle and in the brain of vigilant mice. NBICF is committed to providing excellent, professional, affordable and efficient imaging services to scientists. The client, after consultation, participates in a tool use training provided by NBICF staff. Following a routine, standardized successful exam, the client can initiate the implementation of the project.

Laboratory infrastructure and primary instruments

- Total Internal Reflection Fluorescence Microscope (Olympus) (fiber-TIRF)
- "Stimulated Emission Depletion" - FLIM Microscope (STED-FLIM) (Nikon Abberior)
- N-Stochastic Optical Reconstruction Microscope (N-STORM) (Nikon)
- 3D single molecule detection microscope (3D-SMD)
- Structured Illumination Microscope (SIM) Zeiss)
- In vivo 2-photon Microscope for Ca2+ imaging (Femtonics)
- In vitro 2-photon Microscope with Raman spectroscopy (Femtonics)
- In vitro single cell electrophysiology set-up Ca2+ with imaging (Nikon-Axon)
- In vitro single cell electrophysiology set-up (Nikon-Axon)

Highlighted grants obtained 2015-2020

- **GINOP-2.3.3-15-2016-00030:** „Nano-Bio-Imaging"
- **EFOP-3.6.1-16-2016-00004 / EFOP-3.6.1-16-2016-0000** Core facility
- **EFOP-3.6.2-16-2017-00008:** Neuroinflammation investigations
- **20017-1.2.1-NKP-2017-00002:** NAP2.0 National Brain Research Program
- **FIKP II.** "Excellence Program for Higher Education Institutions,"
- **OTKA; 112807**

Selected publications 2015-2020

1. Kovács T. et al.: *Estradiol-Induced Epigenetically Mediated Mechanisms and Regulation of Gene Expression. International Journal of Molecular Sciences.* 21(9), 3177 (2020)

2. Barabás K. et al.: *Effect of Inflammation on Female Gonadotropin-Releasing Hormone (GnRH) Neurons: Mechanisms and Consequences.* International Journal of Molecular Sciences. 21(2):529. (2020)
3. Kwakowsky A. et al.: *Treatment of Beta Amyloid 1-42 (Aβ(1-42))-induced Basal Forebrain Cholinergic Damage by a Non-Classical Estrogen Signaling Activator in Vivo.* Scientific Reports (Nature publishing Group) F1000 selected, 6:21101. (2016)
4. Barabás K. et al.: *The Role of Interleukin-10 in Mediating the Effect of Immune Challenge on Mouse Gonadotropin-Releasing Hormone Neurons In Vivo.* ENEURO,5(5) (2018)
5. Barabás K. et al.: *Rapid non-classical effects of steroids on the membrane receptor dynamics and downstream signaling in neurons.* Hormones and Behavior. 104:183-191. (2018)

Academic and industrial collaborations

- Prof Akihiro Kusumi, (Kyoto University, Okinawa Institute of Science and Technology Graduate University, Japan)
- Prof Allan Herbison, Characterization of estrogen effect on neuronal signaling system in GnRH neuron. (Department of Physiology, Development and Neuroscience, Cambridge, UK; Department of Physiology, University of Otago School of Medical Sciences and Dunedin, New Zealand)
- Dr. Gábor Csúcs (ETH, Zürich), Dr. István Katona (MTA KOKI), Dr. László Barna (MTA KOKI), CellSyStemics, CF spin off (3D-SMD development),
- Biotalentum Kft., Femtonics Kft. , Richter Gedeon Nyrt.

Memberships

Euro-Bio-Imaging and Hungarian Microscopy Society

CELL AND TISSUE CULTURE CORE FACILITY

Leader: Prof. Dr. Judit Erzsébet Pongrácz

Service Profile

rates, nutritional requirements and the length of time they are able to survive within the state of culture. Tumor cells and tumor-derived cell lines can be cultured as adherent cells or in suspension cultures. Tumor-derived cell lines which can be ordered are characterized (their mutation profile is known). Some of the cell lines are genetically modified, suitable for use in specially designed experiments. The cell lines are of either human or animal origin, and presently, we do not work with plant cells. The plans of the group involve the culture of complex cells and tissues, the directed culture of bio-printed cells and tissues, induction of mutations, all of which aid while performing experiments, culture and use of cells/cell-lines overexpressing certain molecules.

Laboratory infrastructure and the most important instruments

- Standard Tissue Culture BioLevel 2 Hood, Safemate ECO1 & 2, Euroclone and the LDE2200
- Standard Tissue Culture Incubator, SafeGrow 188, Euroclone and the CO20010
- Standard Pipettes Eppendorf 3120000.329
- Pipettor, Thermo Fisher Scientific S1 Thermo 9501
- Centrifuge Eppendorf 5804
- Micromax RF230 Mikrocentrifuge Eppendorf
- Standard PCR Hood Faster F00012100000
- GentleMACS-Dissociator Miltenyi
- 3D Perfusion Bioreactor System 3D Biotek

Highlighted grants obtained 2015-2020

- **TUDFO/51757-1/2019-ITM:** Scientific Area Excellence Program
- **GINOP 2.3.2-15-2016-00022:** Establishment of Interdisciplinary Centre for Research: Education and development at the University of Pecs through the application of 3D printing and visualization technologies
- **EFOP-3.6.1-16-2016-00004:** Complete development fostering intelligent specialization at the University of Pecs

- **EFOP-3.4.3-16-2016-00005:** Modernized university in a modern city: 21st century educational approach with focus on values, receptiveness and tolerance
- **FIKP 20765-3/2018/FEKUSTRAT topic 3/2:** "Excellence Program for Higher Education Institutions," 2nd Scientific Area: Identification and follow-up of hormonal and immune biomarkers. Development of diagnostic procedures using biotechnology methods.
- **17886-4/2018 FEKUTSTRAT:** Institutional Excellence Support and Excellence Talent Centre in Pharmaceutical Sciences

Selected publications 2015-2020

1. Papp, E et al.: Feasibility study of in vitro drug sensitivity assay of advanced non-small cell lung adenocarcinomas. *BMJ Open Respiratory Research* (2020)
2. Abdelwahab, EMM et al..: Wnt signaling regulates trans-differentiation of stem cell like type 2 alveolar epithelial cells to type 1 epithelial cells. *Respiratory Research* 20:1, 9 p. (2019)
3. Garai, K; et al.: Artificial Neural Network Correlation and Biostatistics Evaluation of Physiological and Molecular Parameters in Healthy Young Individuals Performing Regular Exercise. *Frontiers in Physiology* 10 Paper: 1242, 11 p (2019)
4. Banfai K et al..: Transgenic Exosomes for Thymus Regeneration. *Frontiers in Immunology* 10:862 (2019)
5. Abdelwahab EMM, et al.: Mitochondrial dysfunction is a key determinant of the rare disease lymphangioleiomyomatosis and provides a novel therapeutic target. *Oncogene.* 38(16):3093-3101. (2019)
6. Feller D et al..: Cigarette Smoke-Induced Pulmonary Inflammation Becomes Systemic by Circulating Extracellular Vesicles Containing Wnt5a and Inflammatory Cytokines. *Frontiers Immunology* 9:1724. (2018)

Academic and industrial collaborations

- Dr. Donald McPhail, Antoxis, Ltd, Aberdeen, UK
- Professor Dr. Vera Krymskaya, University of Pennsylvania, Philadelphia, PA, USA

Memberships of networks and organizations (national and international)

- ECRIN

HISTOLOGY AND LIGHT MICROSCOPY CORE FACILITY

CF Leader: Prof. Dr. Boldizsár Czéh

Service Profile

The Histology and Light Microscopy Core Facility offers competences and equipment in histology and performs routine duties such as the sectioning of tissues or classical stains for researchers. Additionally, this group assists in the setting up and optimizing regarding histological approaches specific for each scientific project. Furthermore, the MicroBrightfield-Nikon systems, which includes the Neurolucida and Stereo Investigator software packages, enables the complex morphometrical quantification of microscopic structures. The Core Facility includes a fluorescence spectroscopy laboratory, supervised by Dr. János Erostyák (Associate Professor) which allows the spectrofluorometric characterization of inorganic and biological samples.

Laboratory infrastructure, main instruments

- Nikon Eclipse Ti-U fluorescence microscope
- MicroBrightField system with StereoInvestigator and Neurolucida programs
- Mantra™ pathological workstation
- HORIBA Jobin-Yvon Nanolog spectrofluorometer for measurements in the 200-1600 nm (UV-VIS-NIR) spectral range and in the 50 ps to 100 ns time range
- Leica CM1860 cryostat
- Leica VT1200 S and Leica VT1000 S vibratomes

Highlighted grants obtained 2015-2020

- **KTIA_NAP_13-2-2014-0019** National Brain Research Program 1 (12 billion HUF)
- **2017-1.2.1-NKP-2017-00002** National Brain Research Program 2 - National Excellence Program
- **EFOP-3.6.2-16-2017-00008** "The role of neuro-inflammation in neurodegeneration: from molecules to clinics"
- **20765-3/2018/FEKUTSTRAT** Higher Education Institutional Excellence Program of the Ministry for Innovation and Technology in Hungary, within the framework of the 5. thematic program of the University of Pécs
- **GINOP 2.3.3-15-2016-00026** New generation electron microscope: 3D ultrastructure

- **GINOP-2.3.3-15-2016-00012** HECRIN
- **GINOP-2.3.3-15-2016-00030** "Nano-bioimaging"

Selected publications 2015-2020

1. Rusznák K. et al.: *Long-Term Stress and Concomitant Marijuana Smoke Exposure Affect Physiology, Behavior and Adult Hippocampal Neurogenesis.* Frontiers in Pharmacology 9:786. (2018)
2. Czéh B. et al.: *Long-Term Stress Disrupts the Structural and Functional Integrity of GABAergic Neuronal Networks in the Medial Prefrontal Cortex of Rats.* Frontiers in Cellular Neuroscience 12:148. (2018)
3. Csabai D. et al.: *Reduced Synapse and Axon Numbers in the Prefrontal Cortex of Rats Subjected to a Chronic Stress Model for Depression.* Frontiers in Cellular Neuroscience 12:24. (2018)
4. Csabai D. et al.: *Electron Microscopic Analysis of Hippocampal Axo-Somatic Synapses in a Chronic Stress Model for Depression.* Hippocampus. 27(1):17-27. (2017)
5. Czéh B. et al.: *Chronic stress reduces the number of GABAergic interneurons in the adult rat hippocampus, dorsal-ventral and region-specific differences.* Hippocampus. 25(3):393-405. (2015)

Academic and industrial collaborations

- Prof. Dr. Zsuzsanna Helyes, PTE SzKK and the Molecular Pharmacology Research Group
- Prof. Dr. Ove Wiborg, Laboratory of Neurobiology, Department of Health, Science and Technology and the Aalborg University, Aalborg, Denmark
- Prof. Dr. Craig A. Stockmeier, Department of Psychiatry and Human Behavior, University of Mississippi Medical Centre, Jackson, MS, USA

Memberships

- Hungarian Neuroscience Society (MITT), Federation of European Neuroscience Societies (FENS)

MASS SPECTROMETRY CORE FACILITY

CF Leader: Dr. Anikó Takátsy

Service Profile

This newly developed facility includes a number of devices capable of quantitative and qualitative identification. The accuracy of identifications can be increased by using coupled techniques, even for complex samples. High-sensitivity tandem mass spectrometers connected to liquid chromatography or gas chromatography are suitable for structural identification of polar, moderately polar and apolar compounds, determination of sum formulas, quantitative studies, qualitative and quantitative determination of drug molecules and their metabolites, and contamination profile analysis. The span of equipment is beneficial regarding proteomic research, mass determination, identification and structural characterization of intact protein, protein sequencing, study of post-translational modifications, and biomarker research. Additionally, analysis of inorganic/organic molecules, synthetic polymers, dendrimers, peptide mixtures, oligonucleotides, carbohydrates are all possible. Both the performation of non-targeted screening of samples or targeted measurements are entirely feasible. The instrumentation includes an imaging device suitable for mass spectrometric measurements. This unit scans specially prepared sections and captures a mass spectrum from each point, creating an image of the section based on mass/charge. This can be used to study the local enrichment of specific molecules and can play an important role in biomarker research. High resolution and accuracy allow for a wide range of qualitative and quantitative applications in drug discovery, metabolomics, environmental and food safety, clinical research, diagnostics (e.g., determination of serum total and free cortisol), and forensic toxicology.

Laboratory infrastructure, main instruments

- Agilent 1290 UHPLC – Agilent 6530 Accurate Mass Q-TOF MS
- Agilent 6300 LC/MSD Trap XCT Plus
- Agilent 6890N GC – Agilent 5975 inert MSD
- Bruker Daltonics Autoflex speed
- maXis 4G by Bruker Daltonics
- Bruker MicrOTOF II
- Thermo Scientific ™ Q Exactive ™ hybrid kvadrupol-Orbitrap

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