23-25 November, 2025

Szeged

XXV. MEETING OF NOBEL LAUREATES AND TALENTED STUDENTS

An event jointly organized by the National Biomedical Foundation, Academia Europaea Budapest Hub and the Hungarian Academy of Sciences

NEMZETI TUDÓSKÉPZŐ AKADÉMIA
NATIONAL ACADEMY OF SCIENTIST EDUCATION

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MTA MAGYAR TUDOMÁNYOS AKADÉMIA

PETER RATCLIFFE

British scientist and recipient of the 2019 Nobel Prize in Physiology or Medicine for the discoveries of how cells sense and adapt to oxygen availability. He is currently a Distinguished Scholar at the Ludwig Institute for Cancer Research at the University of Oxford and Fellow of the Royal Society.

SHAHROKH SHARIAT

Iranian-born Austrian physician-scientist and internationally renowned urologist, currently serving as the Head of the University Clinic for Urology at the Vienna General Hospital. He is recognized for his contributions to urologic oncology and personalized cancer care and is a fellow of several prestigious scientific societies.

VENUES

ACCOMMODATION

1 **Hunguest Hotel Szeged** (16-24 Szent-Györgyi Albert utca, 6726 Szeged)

2 **Novotel Szeged** (1 Maros utca, 6721 Szeged)

3 **Art Hotel Szeged** (16 Somogyi utca, 6720 Szeged)

4 **Dóm Hotel Szeged** (6 Bajza utca, 6720 Szeged)

KEYNOTE LECTURES BY DISTINGUISHED GUESTS, PLENARY SESSION, GALA EVENT, GALA DINNER

5 **Pick Arena**
(35 Felső Tisza-Part, 6723 Szeged)

ROUND-TABLE DISCUSSIONS, PEDAGOGY SESSION, LECTURES BY SZENT-GYÖRGY STUDENTS

6 **József Attila Study and Information Centre, University of Szeged**
(10 Ady tér, 6722 Szeged)

LABORATORY PRACTICES

7 **TERMOSZ laboratory, Radnóti Miklós Experimental Grammar School in Szeged** (Laboratories 1 and 2, 3 Kazinczy utca, 6720 Szeged)

8 **SzeReTeD laboratory, University of Szeged Báthory István Teacher Training Secondary and Primary School** (2 Szentháromság utca, 6722 Szeged)

2 **Vedres room, Novotel Szeged** (1 Maros utca, 6721 Szeged)

3 **Art Hotel Szeged** (16 Somogyi utca, 6720 Szeged)

Németh László Secondary and Primary School in Hódmezővásárhely (16 Németh László utca, 6800 Hódmezővásárhely)

VISITS TO THE LABORATORIES OF MENTORS

9 **HUN-REN Biological Research Centre, Szeged** (62 Temesvári körút, 6726 Szeged)

Albert Szent-Györgyi Medical School, University of Szeged (at more locations)

CONFERENCE PROGRAM

NOVEMBER 23, 2025 *Sunday*

10.00-12.00 — **Arrival and registration of Szent-Györgyi Pupils**
Novotel Szeged, Art Hotel Szeged, Dóm Hotel Szeged

11.30-12.30 — **Lunch**
for Szent-Györgyi Pupils at Novotel Szeged and Art Hotel Szeged

13.00-19.00 — **Laboratory practices**
for Szent-Györgyi Pupils in the National Education Centres of the Secondary School Education Program of the National Academy of Scientist Education in Szeged and Hódmezővásárhely according to pre-assigned schedule

13.00-14.30 — **Modern educational technology tools in student laboratories**
for Szent-Györgyi Pupils in Körtvélyessy room at Art Hotel Szeged according to pre-assined schedule

17.00-18.00 — **Honorary guests visit Radnóti Miklós Experimental Grammar School**
TERMOSZ laboratory, Radnóti Miklós Experimental Grammar School in Szeged

17.00-19.00 — **Arrival and registration of Szent-Györgyi Students**
Hunguest Hotel Szeged

19.00-20.30 — **Dinner**
for hotel guests only at Novotel Szeged, Art Hotel Szeged, Dóm Hotel Szeged and Hunguest Hotel Szeged

20.00-22.00 — **Closed meeting of Szent-Györgyi Students**
Ernő Duda: *The Promise of the Longevity Industry*
Szent-Györgyi Albert room, Hunguest Hotel Szeged

20.30-22.00 — **Closed meeting of Szent-Györgyi Pupils**
Tisza room, Novotel Hotel; Körtvélyessy room, Art Hotel Szeged

NOVEMBER 24, 2025 *Monday*

07.00-08.00 — **Breakfast**

for hotel guests only at Novotel Szeged, Art Hotel Szeged, Dóm Hotel Szeged and Hunguest Hotel Szeged

08.30-10.00 — **Closed discussion between the distinguished guests and Szent-Györgyi Students**

Szent-Györgyi Albert room, Hunguest Hotel Szeged

Parallel programs:

08.30-10.00 — **Visits to the laboratories of Mentors**

for Szent-Györgyi Pupils at the institutions of the University of Szeged and the HUN-REN Biological Research Centre

08.30-10.00 — **Practice sessions at the Skill laboratory**

for Szent-Györgyi Pupils at the institutions of the University of Szeged and the HUN-REN Biological Research Centre according to pre-assigned schedule

CONFERENCE PROGRAM

10.00-11.00 — **Registration**
Pick Arena

11.00-18.00 — **Plenary session**
Chairmen: **András Varró, Péter Hegyi**
Pick Arena

11.00-11.30 — **Conference opening**
Welcome speeches by:
Balázs Hankó, *Minister for Culture and Innovation*
Balázs Gulyás, *President of the Hungarian Research Network (HUN-REN)*

11.30-11.50 — **Presentation by Péter Hegyi,** program director of the National Academy of Scientist Education: *Introduction of the National Academy of Scientist Education Program*

11.50-12.50 — **Keynote lecture by Peter Ratcliffe,** distinguished British scientist and Nobel Laureate *(Ludwig Institute for Cancer Research at the University of Oxford)*

12.50-13.00 — **„Szent-Györgyi Student of Excellence 2025" award ceremony, presentation by the awardee**
Benedek Szathmári: *Evolution of complexity and fruiting body development*

13.00-14.30 — **Lunch**

14.30-15.30 — **Presentation by Shahrokh Shariat,** head of the University Clinic for Urology *(AKH Vienna)*

15.30-16.30 — **Presentation by Péter Hegyi:** *Why the Pancreas Produces Bicarbonate*

16.30-17.30 — **Coffee break**

18.00-19.00 — **Gala event**

19.00-21.00 — **Gala dinner**

NOVEMBER 25, 2025 *Tuesday*

09.00-10.00 — **Roundtable discussions I**

for Szent-Györgyi Pupils and Szent-Györgyi Students at Basement Auditoriums in József Attila Study and Information Centre, University of Szeged according to pre-assigned schedule

10.30-11.30 — **Roundtable discussions II**

for Szent-Györgyi Pupils and Szent-Györgyi Students at Basement Auditoriums in József Attila Study and Information Centre, University of Szeged according to pre-assigned schedule

Parallel program:

09.00-10.00 — **Presentations by Szent-Györgyi Students I**

Congress Hall

Tamás Zsoldos: *The regulatory cells of our memory*

Kornél Molnár: *Characterization of allergic skin diseases in experimental animals*

Adél Lüvi: *Are our own cells turning against us? – The role of astrocytes in the development of brain metastases*

CONFERENCE PROGRAM

10.30-11.30 — **Presentations by Szent-Györgyi Students II**

Congress Hall

Miklós Lovas: *Sugars against the flu: An introduction to targeted protein degradation*

Bálint Kisjós: *Molecular Fitness: How miRNAs Translate Exercise into Tumor Therapy*

Noémi Vida: *Development of a kidney transplantation large animal model – method and complications*

Parallel program:

09.00-11.30 — **Pedagogy session** for secondary school teachers

Sándor Bán: *Pedagogical Considerations of Planning Spectrophotometry Lab Sessions*

Grand Lecture Hall

11.30-12.30 — **Lunch**

Atrium hall

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BENEDEK SZATHMÁRI

Evolution of complexity and fruiting body development

One of the central questions in evolutionary biology is how solitary, drifting cells gave rise to organisms of increasing structural complexity. However, due to certain lineages being understudied, the general principles of the evolution of complexity remain only partially understood. Fungal complexity follows a unique evolutionary pattern: complex structures (fruiting bodies) evolved multiple times independently. Thus, the fundamentals of the evolution of complexity cannot be fully comprehended without fungi. Understanding the development of mushroom-forming fungi is also of practical importance, as they offer numerous, yet underexploited, applications (e.g., in sustainable food production, biodegradation, and fungal-based leather substitutes).

Our research lies at the intersection of mycology, evolutionary biology, and developmental biology. Using molecular tools (gene knockout and overexpression), we characterised two RNA-binding protein genes in an inky cap fungus, whose expression we found to be informative from the perspective of the evolution of complexity. Based on mutant phenotypes, we named the genes *ort2* and *cer3*, after the multi-headed dogs of classical mythology. These are the first identified RNA-binding proteins that play a role in fungal complex development. We demonstrated that *ort2* is involved in the development of the so-called etiolated fruiting bodies that form in darkness – a finding that may be applicable in mushroom cultivation. Our results concerning cer3 suggest that the cell types of the fruiting body originated from basidia. In my doctoral project, we aim to further elucidate the evolution of fungal complexity using modern single-cell transcriptomic approaches.

TAMÁS ZSOLDOS

The regulatory cells of our memory

The hippocampus is a key structure located in the temporal lobe of the brain that plays a central role in learning, memory processes, and spatial navigation. It has a layered organization and is composed of well-defined cell types, between which precise synaptic connections enable information processing and storage. The main projection cells are pyramidal cells, which dominate the CA1–CA3 regions, while granular cells in the dentate gyrus form the first level of processing for incoming information.

Hippocampal interneurons are inhibitory (GABAergic) cells that fine-tune network activity by regulating the firing patterns of pyramidal cells and synchronizing the firing patterns of cells. Their different subtypes—such as parvalbumin (PV), somatostatin (SOM), and calretinin (CR)-expressing interneurons—play distinct roles in modulating network dynamics and memory processes.

Detailed knowledge of hippocampal cell types and connection patterns is crucial for neurobiological research, as disturbances in these systems are associated with a number of neurological and psychiatric disorders, including Alzheimer's disease, epilepsy, and schizophrenia. Understanding hippocampal circuits is therefore essential not only for elucidating the principles of brain function, but also for developing therapeutic interventions and modeling.

KORNÉL MOLNÁR

Characterization of allergic skin diseases in experimental animals

Allergic contact dermatitis is a common condition that can be triggered by jewellery, cosmetics, or medications. Its development is driven by complex immune processes, the understanding of which is essential for treatment and prevention. Experimental animal models that mimic human dermatitis are invaluable for investigating these processes. Although the role of lymphatics is well known in various immune processes, their role in allergic contact dermatitis is not fully understood. Furthermore, the immune responses induced by chemicals used to elicit dermatitis in experimental animals — such as DNFB and TNCB — requires further studies. Our aim was to investigate the role of lymphatics in the disease, and to characterize the immune response triggered by these model allergens upon single and repeated exposure. Based on our results, lymphatic vessels play distinct roles in the two phases of the disease: during the first exposure, they are required for the immunization, while upon repeated exposure, they contribute to the attenuation of the inflammatory response. When examining the model allergens, our findings showed that both allergens caused significant inflammation after a single treatment; however, DNFB induced more pronounced ear swelling. In contrast, repeated TNCB exposure led to a much stronger allergic response, while DNFB did not enhance inflammation further. These suggest that DNFB primarily triggers irritative responses, whereas TNCB induces allergic mechanisms. Our results may contribute to the better understanding of the pathomechanism and progression of allergic dermatitis and support the development of new therapeutic strategies. In addition, they may aid in refining experimental models for this disease.

ADÉL LÜVI

Are our own cells turning against us? – The role of astrocytes in the development of brain metastases

Brain tumors are often not primary neoplasms but secondary metastatic lesions, among which triple negative breast cancer-derived brain metastases represent one of the most frequent and most aggressive types. The inflammatory processes occurring in the tumor microenvironment of the brain may worsen the progression of the disease, thereby facilitating the growth of metastatic lesions. One of the key mediators of these inflammatory processes is the cytokine IL-1β, which is primarily produced in an inflammasome-dependent manner. Inflammasomes are multiprotein platforms that are part of the innate immune system and induce inflammatory processes.

Here, we aimed to elucidate the role of the NLRP3 inflammasome in the formation of brain metastases and to identify the cell type responsible for its activation.

Using an *in vivo* mouse model of brain metastasis, we observed that NLRP3 inflammasome components were localized in astrocytes surrounding the metastatic lesions. Treatment with MCC950, a specific NLRP3 inflammasome inhibitor, reduced the amount of inflammasome components in astrocytes, decreased the release of pro-inflammatory cytokines, and resulted in significantly fewer and smaller tumors in the brains of tumor cell-injected animals.

Our results demonstrate that activation of the NLRP3 inflammasome in astrocytes promotes the growth of triple negative breast cancer-derived brain metastases. These findings suggest that inflammasomes could represent promising therapeutic targets for the treatment of brain metastases.

MIKLÓS LOVAS

Sugars against the flu: An introduction to targeted protein degradation

Influenza is one of the most common viral diseases affecting hundreds of millions each year. As is the case with most viral infections, the number of antiviral drugs we can use is limited due to the inherent simplicity of viruses, and therapy generally comprises of symptomatic treatment, hydration and rest. In severe cases, however, the use of antivirals can be necessary.

Neuraminidase (NA) inhibitors represent the most prominent class of antiviral drugs for treating influenza. Influenza neuraminidase is an enzyme that is essential in the release of new virus particles from infected cells, and blocking this enzyme with NA inhibitors, such as oseltamivir or zanamivir, can stop the spread of the virus between cells.

NA inhibitors, like the majority of protein inhibitors used as drugs work by binding to an active "pocket" of the target protein and stopping the natural substrate from doing the same and activating the protein. This competitive, occupancy-based inhibition can be limited by the fact that the inhibition is temporary: after the dissociation of the inhibitor, the protein can perform its function again.

An emerging approach in the design of new small-molecule drugs is targeted protein degradation: instead of temporarily blocking the target protein, the drug molecule induces its degradation, blocking its function entirely.

Our goal is the synthesis of zanamivir-based NA-degraders, which, in addition to inhibiting influenza NA, could also induce its degradation. This way, instead of stopping the spread of influenza particles between cells, we can destroy them inside the cell, potentially resulting in better therapeutic outcomes.

BÁLINT KISJÓS

Molecular Fitness: How do miRNAs Translate Exercise into Tumor Therapy?

Regular physical activity is widely recognized for its role in preventing various chronic diseases, including cancer. In addition, recent studies have shown that exercise alters the serum microRNA (miRNA) profile. miRNAs are small, single-stranded RNA molecules that play an important role in the regulation of gene expression and can function as oncogenes or tumor suppressors. While the molecular mechanisms underlying the antitumor effects of physical activity remain unclear, examining alterations in miRNA expression may play a crucial role in their exploration and understanding. Our research group has identified three exercise-responsive miRNAs that are associated with lung cancer. The aim of our research is to verify the anti-lung cancer effect of regular exercise and lung cancer-associated on the A549 lung adenocarcinoma cell line.

Mimic transfection was used to study the effects of exercise-responsive miRNAs on A549 cells in vitro. Mimics are chemically modified double-stranded RNA molecules designed to mimic endogenous miRNAs. The 48-hour treatment was followed by the measurment of metabolic activity, miRNA expression and RNA sequencing. The Ingenuity Pathway Analysis software was used to analyze the effects of the measured transcriptomic alterations in silico. Our results suggest that exercise-responsive miRNAs act together to suppress key oncogenes while causing other transcriptomic alterations that can induce apoptosis and inhibit proliferation and invasion by lung cancer cells. Our research group is currently performing validation experiments to verify these alterations in cell function.

NOÉMI VIDA

Establishing a large animal model. Experiences and lessons: strength in unity

Introduction: Animal experiments are indispensable for understanding the background of many human diseases and for developing therapies. The pig is suitable for this purpose in many respects, but creating a large animal model with high translational value requires overcoming numerous anatomical, physiological, and technical challenges. The aim of our presentation is to emphasize, through the example of a porcine kidney transplantation model, the importance of collaboration between clinicians and researchers in overcoming these obstacles.

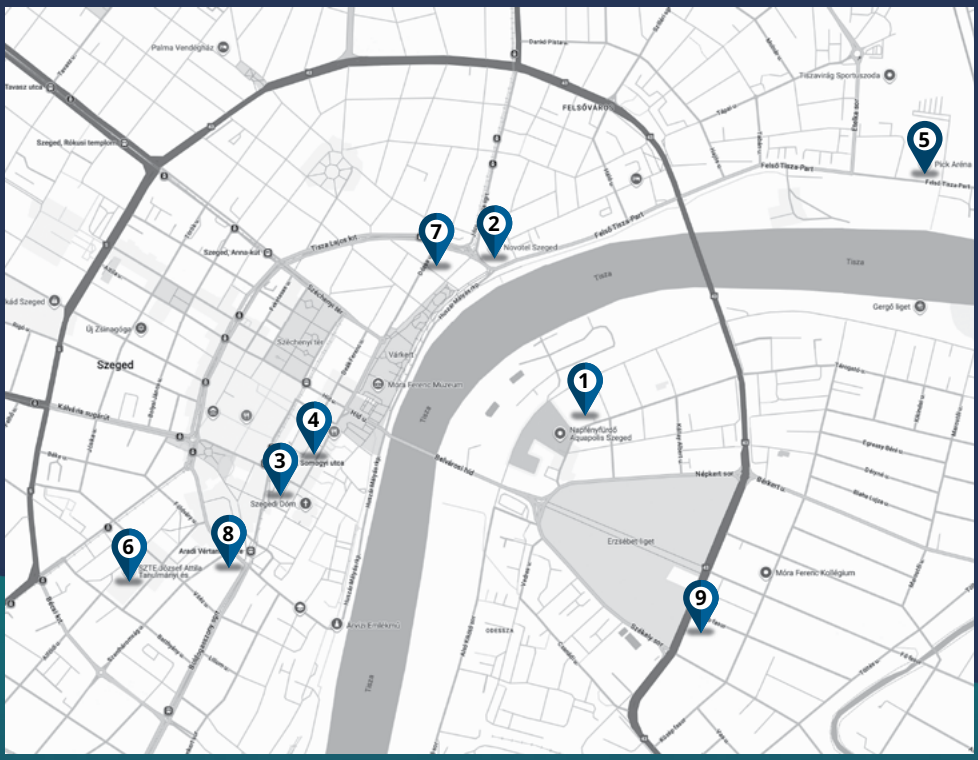
Methods: In anesthetized, ventilated domestic pigs, the left kidney was removed according to human surgical protocols, perfused with preservation solution, and stored at 4°C (n=5, license number V/3262/2022). On the second day, the pigs were re-anesthetized, and the kidneys were autotransplanted; the animals were then monitored for an additional 24 hours. The surgical stages of the transplantation were carried out by clinicians experienced in the technique, while the other phases were directed by the research-experimental team.

Results: No complications occurred during the preparation-anesthesia or postoperative periods. The total operative time for organ retrieval (2.2 ± 0.3 hours) was comparable to the average human surgical time (2–3 hours), and the reimplantation time shortened by 30% (38 vs. 25 minutes) as the number of operations increased. In one case, anatomical variation of the renal hilum vessels prolonged the warm ischemia time by 34.5 minutes. In another case, due to differing intra-abdominal conditions, colonic ischemia and subsequent bowel necrosis developed during nephrectomy. In one transplanted kidney, circulation was partially restored, with 75% of the renal parenchyma reperfused.

Discussion: Due to the technical challenges and the risk of intraoperative complications, clinical experience is indispensable for developing a costly, high-complexity model. At the same time, the distinct physiological and monitoring requirements compared to humans necessitate the involvement of researchers with experimental experience. Furthermore, the purposeful operation of a clinically relevant model allows mentors leading clinical and experimental teams to develop both the clinical and theoretical-scientific skills of young (surgeon) physicians, students, and researchers.

Supervisors: Dr. Gabriella Varga, Assistant Professor, Institute of Surgical Research, University of Szeged, Faculty of Medicine, Dr. Dániel Érces, Assistant Professor, Institute of Surgical Research, University of Szeged, Faculty of Medicine

NOTES



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Summary video of the XXIV. Meeting:

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