PROGRAMME

Korean Scientists and Engineers Association in Austria

Winter Scientific Meeting 2026

DATE	VENUE	TIME
Saturday, 7 November 2026	Klubsaal, VHS Wiener Urania Uraniastrasse 1, 1010 Wien	13:00 – 18:00

13:00 **Opening** — 10′
Yoo Jin Oh · KOSEAA President

PLENARY **20th Anniversary of European KSEA Collaboration**

13:10 **20th Anniversary of European KSEA Collaboration** — 20′
Man Wook Han · Former KOSEAA President

13:30 **AI in Energy Systems: Applications and Responsible Use** — 30′
Martin S. D. Yoo · Former VeKNI President

14:00 **Geodynamics, Earthquakes and Cascading Natural Hazards** — 30′
Yujin Choi · Former ASCoF President

14:30 **From High-Dimensional Chaos to Shape: Visualization Tool of High-Dimensional Data** — 20′
Jooyoung Hahn · Czech Technical University in Prague

14:50 COFFEE BREAK

SESSION I **Mathematics · Physics · Chemistry**

15:10 **Rydberg Atom-Based Digital Quantum Computing** — 20′
Andrew (Woojeong) Byun · Institute for Theoretical Physics, University of Innsbruck

15:30 **Programmable Photonic Integrated Circuits: From Hardware to Quantum Information Processing** — 20′
Yong Kwon · Fondazione Bruno Kessler & University of Trento

15:50 **Mathematical and Computational Methods for Image and Data Analysis, with Applications to Biomedical Data** — 20′
Seol Ah Park · Czech Technical University in Prague

16:10 BREAK

SESSION II **Biology · Medical**

16:30	**Understanding Emerging Viral Threats: Pathogenesis, Transmission, and Protection** Jiho Lee · Medical University of Vienna	20′
16:50	**Brain-to-Speech BCI — From Thought to Voice: Restoring Speech with Brain–Computer Interfaces** Da In Kim · Albert Szent-Györgyi Medical School, University of Szeged	15′
17:05	**When Cancer Therapy Disrupts Metabolism: Hyperglycemia with PI3K/AKT/mTOR Inhibitors** Sehyun Park · Albert Szent-Györgyi Medical School, University of Szeged	15′
17:20	**Beyond AI Adoption: From Learner Needs Assessment to Curriculum Development and Explainable AI** Yeongchan Nam · University of Szeged	15′
17:35	**Behind the Science: Why Researchers Struggle and How We Can Protect Their Mental Health** MinGyu Lee · Albert Szent-Györgyi Medical School, University of Szeged	15′
17:50	**Closing Remark & KOSEAA General Assembly**	
18:30	**Dinner**	

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Abstracts

A01 14:30 PLENARY · 20TH ANNIVERSARY OF EUROPEAN KSEA COLLABORATION

From High-Dimensional Chaos to Shape: Visualization Tool of High-Dimensional Data

Jooyoung Hahn

Czech Technical University in Prague

Topological Data Analysis (TDA) has emerged as a powerful framework for uncovering meaningful structure in high-dimensional, complex datasets. In this talk, we present an application of TDA in analyzing patterns; high-resolution chemical profiling. We utilize the Ball Mapper algorithm to simplify and visualize high-dimensional data obtained from 2D Chromatography with high-resolution mass spectrometry. This enables interpretable chemical profiling of complex mixtures and supports tasks such as sample authentication and environmental analysis. Together, these studies demonstrate the versatility and interpretability of TDA for extracting chemically meaningful information.

A02 15:10 SESSION I · MATHEMATICS · PHYSICS · CHEMISTRY

Rydberg Atom-Based Digital Quantum Computing

Andrew (Woojeong) Byun
Institute for Theoretical Physics, University of Innsbruck

The quantum counterpart of conventional classical computing is digital, circuit-based quantum computing. To build quantum circuits, suitable hardware architecture is required. Just as classical computing relies on semiconductor devices, quantum computing requires tailored hardware. Rydberg atom arrays are one of the promising platforms for quantum computing due to their robustness against atomic position fluctuations and scalability. In this talk, I briefly review the achievements of digital quantum computing with Rydberg atom arrays over the past two decades, from basic single- and two-qubit gates to quantum circuits, and discuss future prospects for quantum error correction.

KEYWORDS
Quantum computing, Rydberg atom, AMO physics

A03 15:30 SESSION I · MATHEMATICS · PHYSICS · CHEMISTRY

Programmable Photonic Integrated Circuits: From Hardware to Quantum Information Processing

Yong Kwon, Leonardo Limongi, Gioele Piccoli, Georg Pucker, Mher Ghulinyan

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Photonic integrated circuits (PICs) offer a compact and reconfigurable platform for manipulating light on a chip. In contrast to bulk-optical setups, they integrate waveguides, beam splitters, and phase shifters into a single device, allowing optical signals to be guided and transformed through interferometric networks. This integration can reduce the footprint of optical systems and enable functionalities relevant to both classical and quantum information processing. At the same time, circuit performance depends on design choices and fabrication quality, including material properties, waveguide geometry, and manufacturing tolerances.

This talk provides a hardware-oriented introduction to programmable PICs, highlighting their potential applications in quantum computing and the practical considerations involved in their fabrication and operation. We first introduce the main building blocks of integrated photonic devices, along with a brief overview of their fabrication processes. We then outline how waveguides, beam splitters, and phase shifters can be combined into interferometric networks, such as meshes of Mach–Zehnder interferometers (MZIs). By tuning relative optical phases, these meshes can implement configurable linear optical transformations, providing essential building blocks for photonic quantum information processing.

Real devices, however, do not always behave exactly as predicted by ideal circuit models. Fabrication variations, optical loss, thermal cross-talk, and phase drift can cause the implemented transformations to deviate from their intended behavior and limit reproducibility. To address these issues, we introduce the basic concepts of device characterisation, calibration, and phase control, using thermo-optic phase shifters as an illustrative example.

KEYWORDS

Quantum Computing, Photonic Quantum Computing, Integrated Photonics

REFERENCES

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3. L. Limongi, R. Favaretto, L. Baldessarini, M. Bernard, Y. Kwon, G. Piccoli, A. Samusenko, G. Pucker, and M. Ghulinyan, A single-step lithography process for reconfigurable SiN photonics with TiN heaters and Al interconnects, J. Micromech. Microeng. 36, 085005 (2026).

A04 15:50 SESSION I · MATHEMATICS · PHYSICS · CHEMISTRY

Mathematical and Computational Methods for Image and Data Analysis, with Applications to Biomedical Data

Seol Ah Park

Czech Technical University in Prague

Advances in imaging and measurement technologies have made it possible to collect data in unprecedented detail, from time-lapse microscopy and medical images to large, high-dimensional datasets. However, turning this wealth of data into meaningful and reliable insight remains a major challenge. Real-world data are often noisy, heterogeneous, and incomplete, and manual analysis quickly becomes impractical as the amount of data grows. This talk gives a brief personal introduction followed by an overview of research on mathematical and computational methods for image and data analysis, applied mainly to biomedical data.

The research covers image processing, image analysis, and data analysis. On the imaging side, the focus is on methods for enhancing images, identifying and separating objects of interest, and following how they change over time. A key goal is to move from raw images to quantitative descriptors, such as shape, size, and motion, that can be measured consistently and compared across experiments. On the data analysis side, the work addresses methods for uncovering patterns and structure in complex, high-dimensional data, including approaches that capture the geometric and spatial organization of the data rather than only individual measurements.

These methods draw on a range of tools, including mathematical modeling, numerical methods, machine learning, and topological data analysis. The overall aim is to combine the interpretability and robustness of mathematical approaches with the flexibility of data-driven techniques. Close collaboration with the researchers who generate the data plays an important role, as it helps ensure that the developed methods address practical needs and produce results that are meaningful in their application context.

Although the main focus lies in biomedical applications, many of these tools are general and can be applied to a broad range of scientific problems. Examples will illustrate how similar analytical ideas can be transferred across different types of data and fields.

The talk concludes with current research directions and a discussion of open challenges and future perspectives in image and data analysis.

A05 16:30 SESSION II · BIOLOGY · MEDICAL

Understanding Emerging Viral Threats: Pathogenesis, Transmission, and Protection

Jiho Lee, Florian Krammer
Medical University of Vienna

Infectious diseases continue to pose a major threat to global health, causing millions of deaths each year and placing a substantial burden on societies worldwide. Beyond long standing challenges, new threats are emerging at an accelerating pace. Climate change, increasing contact between humans and animals, habitat destruction, and the high degree of global interconnectedness are expected to drive more frequent outbreaks and pandemics caused by novel pathogens. Addressing these issues requires coordinated, forward looking research efforts that span basic virology, immunology, epidemiology, and translational science.

The Ignaz Semmelweis Institute is dedicated to meeting these challenges through comprehensive infectious disease research viewed through a planetary health lens. Its mission is to deepen our understanding of pathogens and disease processes and to translate this knowledge into effective countermeasures such as therapeutics and vaccines. The Institute is an inter university center for infection research supported by the Medical Universities of Vienna, Graz and Innsbruck, the Johannes Kepler University Linz, and the University of Veterinary Medicine Vienna.

Within this collaborative framework, the Krammer laboratory at the Medical University of Vienna focuses on RNA viruses, particularly influenza viruses, coronaviruses, hantaviruses, and other emerging viral pathogens. The lab aims to understand viral pathogenicity, evaluate the potential for human to human transmission, and characterize immune responses that protect against infection. A major emphasis is placed on humoral immunity to viral surface glycoproteins, including defining antibody antiviral potential and mechanisms of action. The lab also investigates mucosal immunity and its role in blocking transmission of respiratory viruses.

Building on these insights, the Krammer laboratory develops vaccine candidates and therapeutics designed to prevent or treat viral infections. Current projects include characterizing and assessing the human transmission potential of H3N8 viruses, developing a viral vector vaccine platform using Newcastle disease virus, and developing vaccines and therapeutics targeting Rustrela virus. Through this integrated approach, the laboratory contributes to the broader mission of the Ignaz Semmelweis Institute: advancing preparedness for emerging infectious threats and strengthening global health resilience.

KEYWORDS
Virus, Viral diseases, One health, Vaccine, Vectored vaccines

A06 16:50 SESSION II · BIOLOGY · MEDICAL

Brain-to-Speech BCI — From Thought to Voice: Restoring Speech with Brain–Computer Interfaces

Da In Kim

Albert Szent-Györgyi Medical School, University of Szeged

INTRODUCTION

Amyotrophic lateral sclerosis (ALS) and other severe neurological disorders can progressively impair the motor control required for speech, while language and the intention to communicate may remain preserved. Brain-–computer interfaces (BCIs) offer a new approach by bypassing the damaged neuromuscular pathway and directly decoding cortical activity associated with attempted speech. Recent advances in neural recording and artificial intelligence have enabled these signals to be converted into synthesized speech with increasingly natural timing and expression.

DISCUSSION

This presentation reviews recent developments in implantable brain-to-speech neuroprostheses, focusing on human studies that have demonstrated near-real-time speech synthesis from cortical activity in individuals with severe speech impairment. It will examine how neural signals are recorded, decoded using machine-learning algorithms, and reconstructed into personalized speech, including features such as intonation and pitch. Emerging clinical translation, including ongoing BCI trials in patients with ALS, will also be discussed.

CONCLUSION

Recent studies demonstrate that direct brain-to-speech communication is technically feasible in humans and may restore meaningful communication for patients who have lost the ability to speak. Although challenges involving long-term reliability, invasiveness, and accessibility remain, brain-to-speech BCI represents a rapidly advancing strategy for restoring communication and autonomy in severe motor disability

KEYWORDS

amyotrophic lateral sclerosis, brain–computer interface, speech neuroprosthesis, neural decoding, speech restoration

A07 17:05 SESSION II · BIOLOGY · MEDICAL

When Cancer Therapy Disrupts Metabolism: Hyperglycemia with PI3K/AKT/mTOR Inhibitors

Sehyun Park

Albert Szent-Györgyi Medical School, University of Szeged, Szeged, Hungary

Background. The PI3K/AKT/mTOR (PAM) signaling pathway regulates both cancer cell growth and glucose homeostasis. While targeting this pathway is an important therapeutic strategy in breast cancer, its inhibition can also disrupt normal glucose metabolism. This study aimed to evaluate the risk of hyperglycemia associated with PAM pathway inhibitors.

Methods. We conducted a systematic review and meta-analysis of placebo-controlled randomized trials evaluating PAM pathway inhibitors added to endocrine therapy in hormone receptor-positive, HER2-negative advanced breast cancer.

Results. Seven trials involving 2,748 patients were included. PAM pathway inhibitors increased the risk of all-grade hyperglycemia (RR 5.12, 95% CI 4.17–6.29) and severe hyperglycemia (RR 13.16, 95% CI 5.45–31.73). The absolute increase in severe hyperglycemia varied widely across trials. Glycemic management outcomes were inconsistently reported.

Conclusions. PAM pathway inhibition substantially increases the risk of hyperglycemia, with considerable variation in the absolute burden of severe events. These findings highlight the metabolic consequences of targeted cancer therapy and the need for more consistent reporting of glycemic safety outcomes.

KEYWORDS

breast neoplasms; hyperglycemia; phosphatidylinositol 3-kinase inhibitors; AKT inhibitors; mTOR inhibitors; alpelisib; capivasertib; inavolisib; everolimus; meta-analysis

A08 17:20 SESSION II · BIOLOGY · MEDICAL

Beyond AI Adoption: From Learner Needs Assessment to Curriculum Development and Explainable AI

Yeongchan Nam

University of Szeged

Background. The integration of artificial intelligence (AI) into medical education presents opportunities to enhance learning while raising questions about learners' perceptions, the quality of assessment instruments, and the reliability of AI-generated outputs. An evidence-based approach is needed to translate learner needs into effective educational interventions while critically evaluating the capabilities and limitations of AI systems. This presentation outlines an ongoing research program addressing these challenges through complementary studies in medical education and explainable AI (XAI).

Current Research. The first study, "Artificial Intelligence Use and Perceptions Among Three Medical Student Cohorts: Cross-Sectional Comparative Survey Study," examined AI-related use and perceptions across three medical student cohorts, providing an empirical foundation for identifying learner needs and informing future curriculum development. Building on these findings, an ongoing COSMIN-based research project evaluates the measurement properties and methodological quality of instruments assessing AI-related affective and evaluative constructs among medical students. This work aims to identify the strengths and limitations of available instruments and inform the selection and development of appropriate assessment tools for future educational research.

Future Directions. The next phase will involve an institutional Delphi study to develop an evidence-informed AI curriculum tailored to medical students' educational needs. Subsequent research will evaluate its implementation and potential effects on learning outcomes. In parallel, a complementary XAI-related research project, "Evaluating Robustness and Trustworthiness in Commercial Large Language Models: A Controlled Perturbation Study Using Medical Optics Problems," will investigate whether the performance of commercially available large language models remains stable when superficial cues are systematically manipulated in medical optics problems. This study will explore potential shortcut reliance and the implications of model robustness for the educational use and evaluation of AI systems.

KEYWORDS

Artificial intelligence, medical education, curriculum development, explainable AI

A09 17:35 SESSION II · BIOLOGY · MEDICAL

Behind the Science: Why Researchers Struggle and How We Can Protect Their Mental Health

MinGyu Lee

Faculty of Medicine, Albert Szent-Györgyi Medical School, University of Szeged, Szeged, Hungary

INTRODUCTION

Many researchers experience considerable stress and psychological distress, yet it is often hard to pin down what exactly causes it and how to deal with it. Early-career researchers report depressive symptoms two to three times more often than their same-age peers [1], psychiatric medication use among Swedish PhD students rises by about 40% by the fifth year of study [2], and more than 60% of academic researchers in a recent survey screened positive for insomnia symptoms [3]

DISCUSSION

From a psychiatric perspective, this presentation explains such distress as a predictable response to the structure of research itself. It identifies four drivers of distress built into research, each paired with an evidence-based strategy drawn from clinical practice: uncertainty (reducing safety behaviors), uncontrollability (behavioral activation), disrupted sleep and daily structure (cognitive behavioral therapy for insomnia), and isolation (safety planning for suicide prevention). For each driver, the underlying neurobiological or clinical mechanism will be discussed.

CONCLUSION

This presentation aims to help researchers better understand their stress and mental health while providing a practical, psychiatrically informed framework for making research life more sustainable. Therefore, the strategies presented in this presentation can help researchers manage stress, protect their mental well-being, and build a more sustainable research life.

KEYWORDS

researcher mental health, early-career researchers, academic stress, insomnia, cognitive behavioral therapy

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