

京都大学 KYOTO UNIVERSITY



# Joint Symposium on Global Health

Kyoto University (KU) – University of Vienna (UNIVIE)

at the University of Vienna

June 18 to 20, 2024





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#### Introduction

The Joint Symposium on Global Health taking place from June 18 to 20, 2024 at the University of Vienna is a collaborative effort between the University of Vienna and Kyoto University in the framework of their Strategic Partnership. Established in 2019, this partnership represents a commitment to strengthening the ties between the two institutions, deepening and broadening their inter-institutional collaborations, and fostering a spirit of academic and cultural exchange.

This three-day Symposium on Global Health stands as a testament to the shared dedication of the University of Vienna and Kyoto University to addressing some of the most pressing challenges of our time. The theme of Global Health has been chosen not only for its relevance but also for its critical importance in the contemporary world. By bringing together leading scholars and researchers from both universities, we aim to create a forum for knowledge exchange and meaningful dialogue and discussions.

The Joint Symposium on Global Health intends to enable fruitful discussions that will inspire new insights and collaborative endeavors. It is our hope that this event will not only enhance our understanding of global health issues but also pave the way for impactful future research collaborations.

This booklet provides information about the researchers and participants from Kyoto University and the University of Vienna.





### **General Information**

Universität Wien International Office Universitätsring 1 | 1010 Wien <u>https://international.univie.ac.at/</u>

#### Contact

International Office	Tel.: +43 1 4277 18201
Janna Kazim, Senior Partnership Manager	Tel: +43 664 4757023
Dr. Barbara Good, International Director	Tel.: +43 664 8176326

#### Hotel

Hotel Regina Rooseveltplatz 15 | 1090 Wien Tel.: +43 1 404460 | Email: <u>regina@kremslehnerhotels.at</u> <u>https://www.hotelregina.at/de/hotel-regina-wien</u>

#### Тахі

Taxi 40100 Tel.: +43 1 40100 https://www.taxi40100.at/en/

#### **Public Transport**

Upon check-in at Hotel Regina, you will be provided with a weekly ticket for city-wide travel. The ticket is valid for seven days on all public transport. With the ticket you can take as many journeys as you like on the trains (Schnellbahn or S-Bahn), underground (U-Bahn), tram (Straßenbahn) and bus; special express bus lines (e.g. airport bus) and tourist services like the hop on hop off sightseeing buses are excluded. Wiener Linien Route Planner: <u>https://www.wienerlinien.at/web/wl-en</u>

#### **Emergency Numbers**

Police: 133 Ambulance service: 144 General Practitioners' Out-of-hours service: 141 Expert assistance in cases of poisoning: +43 1 4064343 https://www.wien.gv.at/english/contact/emergency.html





### **Location Map**







### **General Program**

#### Day 1 – Tuesday, June 18, 2024

09:15 - 09:30	Registration	
09:30 - 09:55	<ul> <li>Opening Session – Plenary</li> <li>Moderated by Dr. Barbara GOOD,</li> <li>Director of the International Office, UNIVIE</li> <li>Rector Sebastian SCHUETZE, UNIVIE</li> <li>President Nagahiro MINATO, KU</li> <li>H.E. Ryuta MIZUUCHI, Ambassador of Japan to Austria</li> <li>Prof. Wolfgang MAZAL, Scientific Advisor to the Strategic Partnership, UNIVIE</li> </ul>	
09:55 – 10:00	Photos and Gift Exchange	Small Ceremonial Hall
10:00 - 11:00	<ul> <li>Keynote Lectures - Plenary</li> <li>Yukiko UCHIDA, Professor (Cultural Psychology, Social Psychology), Director of Institute for the Future of Human Society, KU</li> <li>Prof. Dr. Bernadett WEINZIERL, Head of Research Group Aerosol Physics and Environmental Physics, UNIVIE</li> </ul>	(Kleiner Festsaal) UNIVIE Main Building
11:00 - 12:00	PhD Pitch Talk – Plenary Moderated by Prof. Dr. Nikolaus Forgó, Department of Innovation and Digitalisation in Law, UNIVIE Short presentations by ten PhD Students from KU and UNIVIE	
12:00 - 13:00	Lunch	
13:00 - 13:30	Transfer to Group Sessions	





13:30 - 17:00	<ul> <li>Group Sessions</li> <li>Microbiology and Microbe-host Interactions</li> <li>Mathematical Biology and Medicine</li> <li>Social Psychology   Current research on Japan's Society and Cultures</li> </ul>	Please see Group Session Programs
18:30 - 21:00	Welcome Dinner	Plachuttas Gasthaus zur Oper, Walfischgasse 5, 1010 Wien

#### Day 2 – Wednesday, June 19, 2024

09:00 - 11:30	<ul> <li>Group Sessions</li> <li>Microbiology and Microbe-host Interactions</li> <li>Mathematical Biology and Medicine</li> <li>Social Psychology   Current research on Japan's Society and Cultures</li> </ul>	Please see Group Session Programs
11:30 - 12:00	Transfer to Plenary	
12:00 - 13:00	Lunch	
13:00 – 14:00	<ul> <li>Closing Session - Plenary</li> <li>Wrap-up of Group Sessions</li> <li>Closing Remarks by</li> <li>Vice Rector Manuela BACCARINI, Vice Rector for Research and International Affairs, UNIVIE</li> <li>Executive Vice President Tetsuo SAWARAGI, Executive Vice-President for Research Ethics, Integrity, Code of Conduct, and International Affairs, KU</li> </ul>	Small Ceremonial Hall (Kleiner Festsaal), UNIVIE Main Building
14:00 - 18:00	Excursions for KU participants14:00 – 15:00Transfer to the Botanical Garden of the University of Vienna15:00 – 16:00Guided Tour Through the Botanical Garden16:00 – 16:30Walk from the Botanical Garden to the Belvedere Museum16:30 – 17:30Guided Tour "Gustav Klimt and His Time"17:30 – 18:00Transfer to University of Vienna Main Building	

#### Day 3 – Thursday, June 20, 2024

All day	Individual Lab Visits (optional)
All day	Individual Lab Visits (optional)





### Mark ANTHONY | University of Vienna



Mark Anthony is a recently appointed tenure-track assistant professor of fungal ecology at the University of Vienna. He has a Vienna Science and Technology Fund Research Group for Young Investigators Head and a Swiss National Science Foundation Ambizione Fellow. Prior to his post at the University of Vienna, he did his PhD in the U.S.A. at the University of New Hampshire as a U.S. National Science Foundation Graduate Research Fellow. He then moved to Switzerland to do a post-doc at the ETH Zürich and the Swiss Institute for Forest, Snow, and Landscape Research (WSL).

#### Links between soil mycobiomes and forest functioning

Soil fungi are among the most diverse communities on earth. They profoundly influence ecosystem functioning as the main decomposers of plant litter and as ubiquitous plant-associated symbionts. Yet with >5 million fungal species in soils, it is critical to understand how differences in the mycobiome may ripple to influence ecosystem functioning. Here, I will discuss how fungi influence forest carbon cycling through the lens of fungal diversity, with a particular focus on forest productivity and soil carbon storage.

Session: Microbiology and Microbe-host Interactions

#### Robert BÖHM | University of Vienna



Robert Böhm is Professor of Social Psychology in the Context of Work, Economy, and Society at the University of Vienna since 2021. He is also the designated co-director of the "Research Network Health Within Society" as well as of the World Health Organization Collaborating Center "Social and Behavioral Research in Antimicrobial Resistance (SABRA)" at the University of Vienna. In his research, Robert Böhm studies human judgments and decisions in response to societal challenges, including major health threats such as infectious diseases and antimicrobial resistance. He has been and advisor and research collaborator for the World Health Organization (WHO), the United Nations (UN), and governments of several countries.

Session: Social Psychology





### Silvia BULGHERESI | University of Vienna



Silvia Bulgheresi is Associate Professor of Environmental Cell Biology at the University of Vienna since 2020. Prior to that, she was an independent principal investigator at the Marine Biology Department of the University of Vienna. She did her PhD at the Institute of Molecular Pathology (IMP), Vienna.

#### Cell biology of animal symbionts

The phylogenetic and morphological diversity of bacteria is bewildering. However, bacterial cell biology has been focusing on a dozen species that divide by transverse binary fission. This gravely limits our understanding of key life processes such as cell growth and chromosome segregation. Here, I will present what we have learned from studying the reproductive biology of non-model multicellular bacteria that thrive in the human mouth.

Session: Microbiology and Microbe-host Interactions

#### Jingjie CHEN | Kyoto University



Jingjie Chen is a first-year doctoral student at the Division of Biological Sciences, Department of Science, Kyoto University and is supervised by Prof. Hiroyuki Ogata. She completed her master's degree in the same division and is interested in the molecular and cellular mechanism in virus-host and virus-virus interactions. During her postgraduation, she worked on the gene expression changes within the coinfection system constituted by giant viruses, virophages, and the eukaryotic hosts. Currently, she is working on the same topic based on her previous results and is focusing on the detailed gene function verification and protein interaction exploration.

#### Virophage infection affects the transcriptome landscape of giant virus

Virophages are small double-stranded DNA (dsDNA) viruses that parasitize giant dsDNA viruses. Sputnik is a virophage that can only replicate inside the host amoebae when co-infecting with mimiviruses. The co-infection results in reduced production of infective mimivirus particles and abnormal morphology of the virions. Interaction between virophages, giant viruses, and host amoebae remains poorly understood. In this study, we performed a time-course transcriptome analysis of Acanthamoeba castellanii cells infected with Acanthamoeba polyphaga mimivirus (APMV) and Sputnik 3 virophage (hereafter called as Sputnik+) and compared their gene expression pattern to those only infected with APMV (Sputnik-). Between these two conditions, amoeba gene expression





patterns were similar but the APMV gene expressions were drastically different. APMV genes were classified into four groups based on their expression timings in the absence of Sputnik infection: "immediate early," "early," "intermediate," and "late." Sputnik infection differently affected the APMV genes with different expression timings. For immediate early and early genes, the expression period was prolonged, while for intermediate genes, the expression start time was delayed by co-infection with Sputnik.

Keywords: Virophages, Giant viruses, transcriptome, virus-virus coinfection

Session: Microbiology and Microbe-host Interactions

### Igor DE ALMEIDA | Kyoto University



Originally from Brazil, Igor de Almeida received his bachelor's degree in psychology from the University of Sao Paulo (Brazil), and master's and Ph.D. from Kyoto University (Japan). He is currently working as a lecturer at Kyoto University.His research interests include 1) well-being across cultures; 2) cultural diversity in psychological research; 3) culturally specific emotions; 4) conceptualization and differences in emotions across cultures; and 5) natural language processing and other computational methods applied to research in social science.

#### Well-being and the workplace, an analysis in Japan, Taiwan, the US, and the UK

Previous research has highlighted the importance of happiness and wellbeing on people's physical and mental health and productivity, among other benefits. This project aims to identify and understand workplace characteristics that influence well-being in four cultures: Japan, Taiwan, the UK, and the US. We investigated various antecedents of well-being, such as social support, power at the workplace, selfconstrual, age, socio-economic status, and so on, as well as several types of well-being, such as life satisfaction, interdependent well-being, and eudemonic well-being at the workplace. The results revealed that factors such as perceived power at the workplace, self-construal, and social support impact happiness and well-being. Thus, the study discusses the cultural differences in terms of what impacts happiness. For instance, social support, in the form of having colleagues that one can count on and share information about the workplace positively impacts well-being at the workplace; in Japan, this impact is significantly higher than in the other studied cultures.

Keywords: well-being, workplace, cross-cultural

Session: Social Psychology | Current Research on Japan's Society and Cultures





### Antoine DIEZ | Kyoto University



After obtaining Ph.D. from Imperial College London under the supervision of Prof. Pierre Degond and Prof. Sara Merino-Aceituno (Univ. Vienna), Dr. Antoine Diez joined Kyoto University in 2022 as a program specific researcher at the BiMed-Math lab led by Prof. Sungrim Seirin-Lee. He works in the field of applied mathematics and is interested in the emergence of self-organized patterns across scales in biological systems. His research primarily focuses on large interacting particle systems with applications in the modeling of various phenomena in developmental biology. He works with both analytical tools (in particular Partial Differential Equations and Stochastic Analysis) and numerical models.

#### Understanding limb morphogenesis: From 3D organoids to mathematical models

Despite the experimental advances in controlling cell fate to obtain various cell types in culture, it is challenging to produce tissues with a certain shape, especially those made of mesenchymal cells such as limbs. Limb morphogenesis is an emerging phenomenon which can be observed in 3D organoid cultures: starting from a spherical aggregate of cells, one or several limb buds spontaneously develop through various complex chemical and mechanical processes. Experimental imaging data give a good insight into the individual and collective behavior of the cells but the precise interaction mechanisms leading to the emergence of limb buds remain unclear. Using a first principle approach, we propose a mathematical model based on a novel coupling hypothesis between the dynamics of morphogens and the mechanical forces acting between individual cells. Numerical simulations in a simplified setting show the emergence of an arbitrary number of limb buds. The mathematical analysis leads to a Cahn-Hilliard model with extra terms that are believed to play a crucial role in symmetry breaking. Understanding the sharp interface limit associated to this model is a challenging problem which is still under investigation. This work is conducted in collaboration with Rio Tsutsumi, Steffen Plunder, and Hyunjoon Park.

Session: Mathematical Biology and Medicine

#### Gianluca FAVRE | University of Vienna



Graduated in Theoretical Physics at the University of Pavia, completed a PhD under the supervision of Prof. C. Schmeiser at the University of Vienna, focusing on Hypocoercivity for linear and non-linear kinetic models. In 2021, spent one and a half months at the University of Kyoto collaborating on biological models with Prof. K. Svadlenka. Currently, he is working on models for Opinion Formation (OF), with his primary objective being to delve deeper into the mathematical foundations of OF, starting from recent results on Epistemic Bubbles and Echo Chambers in the fields of epistemology and social sciences.

Over the past decade, the proliferation of social networks has radically transformed modes of communication, influencing how individuals develop and solidify their beliefs. A significant outcome of this dynamic is the emergence of "echo chambers," where groups of individuals evolve to hold extreme, immutable opinions. This





work presents a mathematical exploration aimed at understanding the mechanisms behind the formation of these echo chambers. Specifically, we examine how the structure of the network and initial opinion distributions contribute to this phenomenon. The goal is to offer a comprehensive mathematical description that elucidates the conditions under which echo chambers are likely to form, thereby informing strategies for mitigating their effects on public discourse.

Session: Mathematical Biology and Medicine

### Marina GROSS | University of Vienna



After completing her master's degree in psychology at RWTH Aachen University in Germany in 2022, Marina Gross became a Research Assistant at the Social and Economic Psychology group under supervision of Robert Böhm. Her research focuses on health informationseeking behavior, particularly in the context of vaccination decision making and antibiotic use. Her research applies behavioral experiments. For instance, she develops and tests behavioral interventions to increase vaccination readiness and reduce mis- and overuse of antibiotics in primary care.

Session: Social Psychology | PhD Pitch Talk

### Valentina HAMPEJS | University of Vienna



Hello, my name is Valentina Hampejs, and I started my doctoral studies at the University of Vienna in March 2024, associated with the Vienna Cognitive Science Hub. After completing both my Bachelor's and Master's degrees in Psychology at the same university, I was eager to continue my academic journey. I am part of the EU Horizon RESONATE research team, which aims to gather additional evidence on the positive effects of nature on our health and wellbeing. My work focuses on various methodological aspects such as scale development for biopsychosocial resilience, data synthesis, and analysis from three case studies investigating at-risk populations engaging in physical activity in nature. Having lived in Vienna for most of my life, I enjoy visiting different countries and learning about other cultures. In my spare time, I love doing Pilates and going for walks or hikes - there's something truly refreshing about exploring the great outdoors.





The potential of natural environments to enhance well-being and improve mental, physical, and social health has been the subject of past research. While links between nature and health have been shown, the underlying mechanisms are still unclear. RESONATE is a four-year EU-funded project uniting experts in the fields of health, environment, economy, and society to conduct nine distinct case studies investigating the effects of nature and health. The case studies will evaluate the effectiveness of nature-based therapies (NbTs) on three levels of participants: the general public, at-risk groups, and individuals with pre-existing health impairments. We hypothesise that exposure to natural stimuli, such as forests or urban parks, may promote healthy lifestyles, prevent illness, and support rehabilitation, thereby increasing biopsychosocial resilience. Currently, resilience is used as an umbrella term, indicating that there is no existing universal definition. This three-year doctoral project, conducted within RESONATE, will first provide a universal conceptualisation of biopsychosocial resilience, which will form the basis for developing a Self-Report Biopsychosocial Resilience Scale. Furthermore, the project will focus on the synthesis of data from three strongly aligned case studies of at-risk populations. Our objective is to identify causal links that demonstrate the potential for NbTs to complement traditional healthcare.

Session: PhD Pitch Talk

### Ibuki HAYASHI | Kyoto University



Ibuki Hayashi's research interests is in the file of microbial community ecology; particularly, he is interested in various processes in community transitions such as stochastic or deterministic processes. He has been conducting experiments at the Toju Laboratory in Kyoto University as a JSPS Doctoral Course Research Fellow to verify the various ecological concepts. He has been using both the DNA based experimental approach and informatics to deal with big-data and analyze the complex species-rich microbial systems. By unifying these wet and dry methods, he is trying to find some working regularities among the complex microbial systems.

#### Probing Ecological Stochasticity in Experimental Microbial Systems

In natural systems, community transitions are often observed. One of our major goals in community ecology is the prediction and manipulation of communities for applied utilization. Subsequently, it is important to understand various transition processes such as biotic interactions, abiotic interactions, and environmental fluctuations in community transition. However, there are stochastic processes among community transitions, and knowledge on how these processes work and affect the accuracy of the predictability of community transitions is limited. Thus, I conducted the experiment to observe the transition processes of the multi-replicated communities. I aimed to quantify the effect of stochastic processes by evaluating the emerging differences among the replicated communities under the same condition. The results revealed that the stochastic processes cause not only continuous differences among replicates but also discrete differences. Through a series of experiments, we propose the importance of quantifying stochastic processes among the various processes of community transitions. Ibuki Hayashi, Hiroaki Fujita, Hirokazu Toju, *Deterministic and stochastic processes generating alternative states of microbiomes*, ISME Communications, Volume 4, Issue 1, January 2024, ycae007

Session: Microbiology and Microbe-host Interactions | PhD Pitch Talk





### Lukas HELMLINGER | University of Vienna



Lukas Helmlinger is a PhD student at the Centre for Microbiology and Environmental Systems Science at the University of Vienna. In the research group of Matthias Horn, he combines his interest in microscopy and bioinformatics to study symbiosis. Prior to that he finished the master's program of Environmental Microbiology at the University of Vienna.

#### Adaptations of environmental chlamydiae to social amoebae

Chlamydiae are best-known as widely prevalent human pathogens. However, far less is known about their counterparts, the environmental chlamydiae, which are found in animals and single-celled organisms alike. Some of these single-celled organisms, the social amoebae, have developed a unique life cycle. Whenever food is scarce tens of thousands of these cells form multicellular structures to ensure the survival of the population. Understanding how social amoebae and their chlamydial symbionts co-evolved with each other will shed further light on the adaptations of, potentially pathogenic, symbionts to their respective hosts.

### Hiroyuki HIKIDA | Kyoto University



Hiroyuki Hikida is an assistant professor at Kyoto University. He received a PhD in Agricultural Science from the University of Tokyo for his research on an insect virus, baculovirus. He moved to Kyoto University as a postdoctoral researcher to study giant viruses that infect free-living amoebae. He primarily focuses on biology and evolution of giant viruses, especially on the trajectories of viruses that have evolved to become giant and how they hijack host systems. Currently, he is isolating new viruses from the environment and working on their comparative genomics with infection experiments.

#### Diversity of virocells formed by different giant viruses

Giant viruses are diverse viruses with huge particles and genomes. The viruses encode many genes related to cellular processes, such as metabolism or translation, which evoked the concept of virocell. Previously, people considered viral particles as "viruses," but, according to the virocell concept, infected cells whose machineries were hijacked by viruses are also considered as another form of "viruses." Although isolation studies have uncovered vast diversity in particle morphology and genetic contents of giant viruses, diversity of virocells has remained relatively unexplored. Here, we aimed to reveal the diversity of virocells and compared early transcriptome patterns of different giant viruses in infected cells. Some host genes showed similar expression patterns among the cells infected with different viruses, whereas some others showed unique expression pattern specific to certain viruses. These results indicated that each virus has a different strategy to hijack host cellular





machinery. Furthermore, we found that proportion of viral transcripts was extremely low in cells infected with pithovirus throughout the analysis, compared with the other viruses. This suggests that pithovirus has a unique infection strategy without host-transcript takeover. Overall, we found that virocell-forming processes of giant viruses are also diverse, just like their morphology and genetic contents. **Keywords:** Transcriptomics, Diversity, Infection experiment, Giant virus

Session: Microbiology and Microbe-host Interactions

### Matthias HORN | University of Vienna



Matthias Horn is Professor and department head at the Centre for Microbiology and Environmental Systems Science (CeMESS) at the University of Vienna. Matthias held an FWF START Award and an ERC Starting Grant (Consolidator Track) and has worked at the Technische Universität München (Germany), the University of Washington (Seattle, USA), and the Australian Institute for Marine Sciences (Townsville, Australia). He is coordinator of the PhD program "Microbial Symbioses" funded by the Austrian Science Fund and the University of Vienna.

#### Amoebae as intracellular arena for bacterial symbionts and giant viruses

Chlamydiae are well-known as pathogens of humans. Yet, these intracellular bacteria are also widely distributed in various environments and eukaryotic hosts, including protists such as amoebae. Here I will discuss, how studying these microbes has contributed to our understanding of the evolution of the intracellular lifestyle of bacteria and the relationship with their eukaryotic hosts. I will show how bacterial symbionts impact the biology and ecology of amoebae, and how they interact with giant viruses, a highly unusual group of viruses recognized only recently.

Session: Microbiology and Microbe-host Interactions





### Christiane V. R. HÜTTER | University of Vienna



Christiane V. R. Hütter is a trained architect and computational bioengineer. During her PhD in the group of Jörg Menche, she explores how data can be understood and navigated in virtual reality, blending digital arts and biomedical sciences. Her work focuses on creating visually interpretable data representations of high-dimensional digital matter that allow for interactive exploration within a virtual environment to foster insights and generate knowledge. Utilizing analytical tools, interface modalities driven by natural human gestures and language, as well as developing application-tailored visual languages, her work is centered around a synergistic relationship between human and machine intelligence. Simultaneously to her scientific efforts, her experience includes artworks and architectural installations, frequently exhibited, among others, at the Ars Electronica Center.

#### DataScope: Immersive Exploration and Analysis of High-Dimensional Data in Virtual Reality

Christiane V. R. Hütter<sup>1,2,3</sup>, Felix Müller<sup>1,2,5,6</sup>, Sebastian Pirch<sup>1,4</sup>, Martin Chiettini<sup>1,4</sup>, Jörg Menche<sup>1,2,4,5,6</sup>

1 Max Perutz Labs, Vienna BioCenter Campus (VBC), Dr. Bohrgasse 9, 1030 Vienna, Austria

2 University of Vienna, Center for Molecular Biology, Department Structural and Computational Biology, Dr. Bohrgasse 9, 1030 Vienna, Austria

3 Vienna BioCenter PhD Program, a Doctoral School of the University of Vienna and the Medical University of Vienna, Dr. Bohrgasse 9, 1030 Vienna, Austria

4 CeMM Research Center for Molecular Medicine of the Austrian Academy of Sciences, Lazarettgasse 14, AKH BT 25.3, 1090 Vienna, Austria

5 Faculty of Mathematics, University of Vienna, Oskar-Morgenstern-Platz 1, 1090 Vienna, Austria

6 Ludwig Boltzmann Institute for Network Medicine at the University of Vienna, Augasse 2-6, 1090 Vienna, Austria

Data exploration is an important part of analysis in biomedical research, especially when facing vast amounts of high-dimensional and multimodal data. Tools to perform exploratory data analysis are often limited in compatibility (i) to interchange data modality, such as between spatial context and more abstract higher dimensionality, (ii) by visual language, such as interpretable representations of high-dimensional data in lower dimensions and (iii) by technological operation boundaries, such as limiting hardware. Rethinking the future of data analysis, we propose the DataScope, an instrument utilizing the VR visualization platform DataDiVR1 to perform interactive data exploration and analysis in a 3D immersive environment using virtual reality (VR). To extract knowledge from data, one operates on a transforming 3D data object with various interface modes, such as speech, text, graphical and natural interfaces empowered with an artificial assistant to guide the exploration. This synergistic approach between computational efficiency of machine learning tools, visual representations tailored to the cognitive abilities of human perception and natural interaction modes in a 3D environment leads to quantitative and qualitative insights and fosters novel hypotheses more efficiently compared to common, technologically limited methods. The DataScope aims to transform how we explore and derive insights from extensive data landscapes by decoding high-dimensional data into a 3D environment, designed for natural human language- and gesture-based interaction.

<sup>1</sup> Pirch, S., Müller, F., Iofinova, E., Pazmandi, J., Hütter, C.V.R., Chiettini, M., Sin, C., Boztug, K., Podkosova, I., Kaufmann, H., Menche, J. *The VRNetzer platform enables interactive network analysis in Virtual Reality*, Nat. Comm. 12, 2432 (2021)

Keywords: immersive data analysis, human-data interaction, data visualization, virtual reality, machine intelligence

Session: PhD Pitch Talk





### Hanno JENTZSCH | University of Vienna



Hanno Jentzsch is a political scientist specializing in Japanese politics. He currently holds a position as Lecturer for Global Political Economy of Japan at the Leiden Institute for Area Studies and will join the Department of East Asian Studies at Vienna University as an Assistant Professor for Politics of Japan in August 2024. His research interests include social and regional inequalities, the political economy of rural revitalization, social welfare, decentralization, and local governance. His monograph "Harvesting State Support" (University of Toronto Press, 2021) analyzed institutional change and local agency in Japan's agricultural sector. His current research project focuses on changing state-society relations in Japan's depopulating rural areas.

Session: Current Research on Japan's Society and Cultures

#### Takuya KAGEYAMA | Kyoto University



Takuya Kageyama is a Ph.D. student at the Center for Ecological Research and Ecosystems & Coevolution Laboratory, Kyoto University. His research interest pertains to how ecological interaction drive ecological dynamics and the consequent emergence of ecological community property. After joining his current place of affiliation, he started conducting research focusing on soil ecosystems. According to him soil ecosystems are fantastic because there are numerous kinds of organisms such as bacteria, fungi, and microorganisms that interact with each other, causing the emergence of complex dynamics. In his current research, he tried to entangle the process of emerging ecological population stability using time series analysis and metagenomics. He is also interested in other various ecosystems such as animal gut microbiome and flower nectar microbiome. He plans to expand research in the said areas.

#### The emergence of mechanism of ecological population stability

Soil ecosystems provide ecological function and services that form the foundation of all organisms living on Earth including human beings. However, the interactions among these organisms remain understudied. Moreover, population dynamics of organisms are also unknown. Ecological interaction is an important driver of ecological dynamics; therefore, it is important to understand the relationship between ecological interaction and dynamics for soil ecology. In my research, I obtained high-resolution population dynamics of soil prokaryotes (bacteria and archaea) by using DNA metabarcoding method. Then, I determined the interactions among the prokaryotes using time series causal estimation method employing neural network. In addition, I estimated their metabolic potential from 16S rRNA regions. By synthesising these results, I found a positive relationship between population stability and metabolic potential. This suggests that the portfolio effect is functioning between population stability and metabolic potential. **Keywords:** soil ecosystems, microbe, population dynamics, population stability, metabolic potential

Session: Microbiology and Microbe-host Interactions | PhD Pitch Talk





### Mariko KANAMORI | Kyoto University



Mariko Kanamori is an early-career researcher specializing in social epidemiology and public health and also a qualified veterinarian. She is a postdoctoral research fellow at the Japan Society for the Promotion of Science; she is working with Professor Uchida. She is currently visiting the Department of Public Health Sciences, Stockholm University. She has an excellent track record in research on society and health. She completed her Ph.D. at the University of Tokyo in March 2022. Her doctoral research on the social determinants of mental health in rural areas was awarded the IKUSHI Prize, the most prestigious award for doctoral students in all academic fields in Japan, with encouragement from the Emperor of Japan. Drawing from her experience as a clinical veterinarian, she conducted a study relevant to One Health, which received recognition for its number of downloads and citations. She is keen to collaborate across disciplines.

# Interdependent culture and older adults' well-being: Health and psychological happiness in Japanese communities

I will talk about our recent review of the well-being and health of older adults in Japan. Our focus is the impact of social capital and social relationships in local communities, considering both individual and societal factors. The prevailing values in Japanese culture tend to foster a sustained and stable form of interdependent happiness among older adults, suggesting that communal support systems play an important role. We highlight the value of multi-level datasets, such as the Japan Gerontological Evaluation Study (JAGES) dataset, for understanding the influence of social participation on the health and well-being of older adults. A growing body of evidence underscores the central role of social relationships in the health and well-being of older adults. *Here is the bibliographic information for this review.* 

Yukiko Uchida, Mariko Kanamori, Shintaro Fukushima, Kosuke Takemura. (2023). *Interdependent culture and older adults' well-being: Health and psychological happiness in Japanese communities. Current Opinion in Psychology.* https://doi.org/10.1016/j.copsyc.2023.101729

Keywords: Well-being, Health, Social capital, Multi-level dataset, Community

Session: Social Psychology | Current Research on Japan's Society and Cultures





### Wolfram MANZENREITER | University of Vienna



Wolfram Manzenreiter is Professor of Japanese Studies and Head of Department at the Department of East Asian Studies at the University of Vienna. His research is concerned with social and anthropological aspects of sports, emotions, work and migration in a globalising world. He is author of several books and numerous articles and book chapters on cultural globalization, body culture, transnationalism and well-being. Currently he is working on community happiness in Japan's rural peripheries.

Session: Current Research on Japan's Society and Cultures

### Sara MERINO-ACEITUNO | University of Vienna



Associate Professor at the University of Vienna since 2021, arrived to the university with a tenure-track position in 2018. Her research is inspired on emergent dynamics from interacting-particles systems in biology and social sciences. Lecturer at the University of Sussex (2018); post-doc at Imperial College London (2015-2018); PhD at the University of Cambridge (2015).

Modeling and kinetic theory to investigate biological systems: I will explain in a nutshell the type of biological questions that our research group is investigating and the tools that we use.

Session: Mathematical Biology and Medicine





### Léo MEYER | University of Vienna



I graduated in Mathematics for Life Sciences at the Ecole Polytechnique (Paris, France) in 2020 and I defended my PhD in 2023 at the Universite d'Orleans (Orleans, France). The subject of my PhD was the modeling of the size distribution of adipose cells, which are responsible for the storage of energy in the form of lipid vesicles. This involved adapting a pre-existing model, theoretical and numerical results as well as parameter estimation on data from rats. I am currently a postdoctorate working under Sara Merino Aceituno on models of collective dynamics and their application to biology.

I will be presenting some numerical exploration of a model for the migration of interneurons in the cortex as well as some image analysis for in vitro experiments.

Session: Mathematical Biology and Medicine

#### Carmella MOSCHELA | University of Vienna



I graduated in Applied Mathematics at the University of Rome, 'La Sapienza', and currently I am a PhD student in Mathematics at the University of Vienna under the supervision of Christa Bücker, Sara Merino-Aceituno, and Christian Schmeiser. During my doctoral studies, I have specialized in math-biology, focusing on modeling the collective motion of living agents. The approach I used includes both theoretical analysis as well as the use of numerical simulations to study microscopic systems where the agents are treated as particles. Additionally, through several collaborations in Paris, my research has explored Coagulation-Fragmentation models and Transport-Coagulation equations. These models are applied to characterize non-instantaneous biological processes and autophagy in cellular systems.

In this presentation I will introduce two distinct biological setups; the first scenario deals with the diffusion process of proteins within a complex geometric structure connecting the Endoplasmic Reticulum and the Nuclear Envelope in eukaryotes. In this context our mathematical model aims to elucidate how the geometry between these two organelles impacts the protein diffusion dynamics. In the second scenario, we investigate a mathematical model which has been introduced to describe the behavior of Escherichia Coli; in particular, we show how the model exhibits very different collective behavior according to different parameters values.

Session: Mathematical Biology and Medicine





### Claudia MUßNIG-WYTRZENS | University of Vienna



Claudia Wytrzens graduated in Technical Mathematics at the TU Wien and is currently doing a PhD in Mathematics under the supervision of Sara Merino Aceituno at the University of Vienna. In the course of her doctoral studies, she is deriving macroscopic models (PDEs) from underlying agent-based models for anisotropic particle interactions, which in the future might be applied to biological systems. In this way she is investigating how macroscopic structures in biological settings emerge from individual particle interactions. Moreover, she is also performing numerical simulations of these models as well as a model for network formation e.g. for blood vessels or leaf veins.

In this talk we will give a short introduction into how biological networks can emerge from particle interactions where nematic alignment is imposed directly in order to mimic volume exclusion interactions. An example of the emergence of such a network would be e.g. the networks of fibers. Moreover we will present an alternative formulation of an individual based model where we do not impose nematic alignment directly but rather introduce an anisotropic repulsion potential. We will see that this will also lead to nematic alignment at the macroscopic description of the system.

Session: Mathematical Biology and Medicine

### Masataka NAKAYAMA | Kyoto University



Masataka Nakayama received his Ph.D. from Kyoto University. After working as a postdoc at Kyoto University and Carnegie Mellon University, he joined Kyoto University as a faculty member. His research interest is collectively emerging dynamics of mind. He investigates different levels of dynamics: 1) emergence of cognition via collective computation by interconnected neurons, 2) emergence of cognition via interaction with environment, and 3) emergence of culture via interacting agents who recursively work as a social environment to each other. He is conducting these examinations using the methodology of psychological experiment and survey as well as artificial neural network modeling, including large language models. Currently, he is focusing on 1) how the emotion of awe relates to the transformation of values and cultures, 2) scientifically understanding the dynamic process of psychological counseling, and 3) how emotions emerge in daily life.

#### Decoding Daily Well-being in Japan

To comprehend "global" well-being, it is crucial to understand both cultural diversity and cultural universals. Wellbeing, an abstract concept, is intimately linked to cultural values and is rooted in daily events and activities within socio-cultural contexts. Understanding a culture, its values, and well-being involves observing daily life within that culture. While this bottom-up approach is beneficial for understanding underrepresented cultures, it is timeconsuming and costly. We have developed an automated, quantitative bottom-up methodology to decode the daily





basis of well-being, leveraging deep-learning techniques. We engaged Japanese participants in a two-week diary study, wherein 351 participants maintained a diary for more than seven days. The diary entries, which were in text format, detailed daily activities and events, and included ratings for the daily happiness level. Each text was encoded using a pretrained BERT model (a deep learning-based language model), and subjected to independent component analysis. The encoded texts were then regressed onto daily happiness and longer-term well-being. Our results demonstrated that daily texts could predict daily and longer-term happiness ( $r > \approx .40$ ). Therefore, we could extract interpretable components of daily happiness from the text.

Keywords: Well-being, culture, natural language processing, deep learning

Session: Social Psychology | Current Research on Japan's Society and Cultures

### Hiroyuki OGATA | Kyoto University



Hiroyuki Ogata is a professor of bioinformatics at Kyoto University. Prof. Ogata is an in bioinformatics, genomics, and metagenomics. He has been interested in the ecology and evolution of marine microorganisms, and "giant viruses." He has been a core member of the Tara Oceans Consortium, which realized the first global microbiome sampling expedition (2009-2013) and have consolidated outstanding achievements with over 150 papers including those in Science, Nature, and Cell. Since 2014, Ogata has been heading the Chemical Life Science Laboratory, the Bioinformatics Center, Institute for Chemical Research, Kyoto University. Currently, the laboratory comprises six staff scientists, 12 graduate students, and four bachelor students. The laboratory performs field sampling and wet lab experiments, with a focus on omics and bioinformatics.

#### Giant viruses - perspectives on their ecological and evolutionary impacts

It is believed that giant viruses have a major influence on the ecosystem and evolution of eukaryotes. In this symposium, I would like to summarize our results, obtained from large-scale metagenomic and statistical and phylogenomic analyses, regarding these intriguing viruses. First, large-scale metagenomic data have revealed their diversity, exceeding the level of the domain Bacteria; however, our recent survey has suggested that we have not yet reached even the characterization of major lineages of these viruses existing in nature. Indeed, we have recently uncovered a previously unrecognized viral phylum "Mirusviricota." A recent follow up study confirmed their hidden diversity and broad host ranges. Regarding its ecological roles, they are one of the major viral players that affect the global carbon cycle through enhancing or reducing the biological carbon pump. In terms of evolution, these viruses adapt to cold environments by altering their gene composition in a process decoupled with the adaptation of eukaryotic genomes. Furthermore, phylogenomic analyses revealed that they provided some important genes (such as DNApol, Actin, Histone, and tRNA synthetases) to early eukaryotes, metaomics, phylogenomics

Session: Microbiology and Microbe-host Interactions





### Isabelle PROCHASKA-MEYER | University of Vienna



Isabelle Prochaska-Meyer is a University assistant at the Department of East Asian Studies (Japanese Studies Section) at the University of Vienna. Her research expertise relates to the topics of religion (especially Okinawan religion), rural depopulation and revitalization in Japan, and digital transformation and ageing. With a methodical focus on ethnographic fieldwork, her previous research projects centered on spirit mediums in Okinawa (dissertation project) and older adults in depopulated rural municipalities in Nagano and Yamanashi (documentary movie "65+. Being old in Japan" available on YouTube). Her recent interest lies in digital habits of older adults.

Session: Current Research on Japan's Society and Cultures

### Florian PURKARTHOFER | University of Vienna



Florian Purkarthofer is a researcher interested in urban studies, hetero-/utopias as critique, and the social role of sensation and perception in contemporary societies, currently based at the Department of East Asian Studies, Faculty of Philological and Cultural Studies, University of Vienna (Austria). From 2018 to 2019 worked at the German Institut for Japanese Studies, Tokyo and from 2014 to 2016 he was at the Tokyo Metro-politan University (TMU), Department of Urban Science. At the moment he is finishing a project on urban space in western Tokyo as a nexus of conflicting individual perceptions and social constructions, by employing experimental methods from multisensory anthropology. Further projects aim at delving into human and non-human cocreation of urban spaces and the social life of digital sensations.

Session: Current Research on Japan's Society and Cultures





### Sungrim SEIRIN-LEE | Kyoto University



Professor Seirin-Lee completed her Ph.D. from the Graduate School of Environmental Studies, Okayama University in 2010, two years ahead of schedule. During her Ph.D., she was selected for the JSPS DC1 program and studied at Wolfson Center for Mathematical Biology, Mathematical Institute, University of Oxford, focusing on mathematical modeling of pattern formation. Afterward, she served as a JSPS PD at the Graduate School of Mathematical Sciences, University of Tokyo, and the RIKEN Institute. In 2014, she joined Hiroshima University's Department of Mathematics as an Assistant Professor, and was later promoted to Associate Professor. She served with JST SAKIGAKE researcher from 2016 to 2019. In 2020, she became a professor at the Graduate School of Integrated Life Sciences, Hiroshima University. In October 2021, she was appointed professor at the Institute for Advanced Study, Kyoto University. in January 2023, she was concurrently appointed professor at the Graduate School of Medicine, Kyoto University.

#### Mathematical Medicine: How Mathematics can Contribute to Medicine?

Medicine is broadly divided into basic and clinical fields. Basic medicine can be likened to basic biological science and has been recognized in a multidisciplinary fusion research field for decades. On the other hand clinical medicine is different from basic medicine in terms of its aims and methodologies. While basic medicine aims to be useful in the "future," clinical medicine focuses on the "present," prioritizing the treatment of patients in the present. Therefore, mathematical sciences that cater to the needs of clinical medicine must produce mathematics that are useful "now" rather than in the "future." This approach requires a different mindset even in mathematical modelling from conventional approaches. Drawing on over seven years of experience collaborating with clinical dermatologists on skin diseases, I would like to discuss the formation of collaborative research from encounters in the field, responses to needs, and the development of mathematical sciences that exceed expectations and are useful in the "now." Keywords: Mathematical Dermatology, Pattern formation, Skin disease

Session: Mathematical Biology and Medicine





### Genta SHIMA | Kyoto University



Genta Shima is a Ph.D. student at the Graduate School of Biostudies, Kyoto University, Japan. His research interests are inorganic chemistry and ecology, with a consistent focus on the dynamics, stability, and controllability of complex systems. His initial studies at a college of technology investigated the structure and properties of metal complexes. Subsequently, he transitioned to the field of ecology. As an undergraduate, he investigated the plasticity of tree traits in forest ecosystems. At present, his research centers on the stability of biotic community dynamics by analyzing the time-series dynamics of bacterial communities using amplicon sequencing.

#### Stable states and their shifts in freshwater bacterial communities

The stability of biotic communities as complex systems is a longstanding topic dealt with in ecology. However, attempts to understand the stability of complex systems remain difficult in ecology, although scientists have had considerable success in fields such as chemistry and physics. A major challenge has been the lack of sufficient data to test theories due to the complexity of the subject.

Recent remarkable advancements in DNA analysis techniques have made it possible to obtain large amounts of data, particularly for bacterial communities, allowing for practical testing of community stability.

In this study, metabarcoding methods using amplicon sequencing were used to obtain data on the dynamics of freshwater bacterial communities in commercial eel aquaculture tanks over a period of 377 days. Time series analysis revealed that the dynamics of these bacterial communities can be categorized into several stable states, with occasional shifts between these states.

Understanding the stability of biotic communities through the accumulation of extensive ecological data is the first step toward engineering and controlling these systems as desired.

Keywords: Community ecology, Community dynamics, Time series analysis, Alternative stable state, Regime shift

Session: Microbiology and Microbe-host Interactions | PhD Pitch Talk

### Maximilian O. STEININGER | University of Vienna



Maximilian O. Steininger is a PhD student in Psychology at the University of Vienna. He works at the Social, Cognitive, and Affective Neuroscience Unit (SCAN) and is keenly interested in environmental neuroscience. After completing his Master's in 2015, focusing on biological psychology and psychological assessment, Max was employed as a researcher at the Cognitive Science Hub. He then spent five years working as a psychometrician at a research and development department in the private sector, developing various psychological tests and assessments. Motivated by his curiosity and the freedom of academic research, Max returned to university in 2021 to pursue his PhD, which is funded by the Doctoral Program in Cognition and Communication.





Contact with nature offers numerous benefits for both physical and mental health. Beyond enhancing positive health indicators, evidence suggests that nature exposure also aids humans in processing adverse experiences. In my PhD research, I employ a systematic, multi-methodological approach to explore how nature influences the processing of acute stress and pain. My first project is a systematic review and meta-analysis, demonstrating that exposure to nature in medical and experimental settings results in a moderate reduction of subjective pain. In the second study, we replicate this finding in the laboratory using neuroimaging techniques, revealing that this reduction in pain is evident not only on a subjective but also at a neural level. By applying machine learning based approaches and analyzing neural responses from specific brain regions, we show that early stages of the pain processing hierarchy are modulated when individuals observe nature. The final study examines whether exposure to virtual natural environments can help participants better prepare for and recover from acute stress. The results of my PhD research highlight the potential of nature to alleviate aversive experiences and provide crucial insights into the cognitive and neural mechanisms involved.

Session: PhD Pitch Talk

### Tsubasa SUKEKAWA | Kyoto University



Tsubasa Sukekawa received a Ph.D. from the Department of Mathematics, Faculty of Science, Hokkaido University. He is a researcher at the Institute for the Advanced Study of Human Biology (ASHBi), Kyoto University. His work focuses especially on pattern formation phenomena described by reaction-diffusion equations. His Ph.D. thesis is related to stability analysis on mass-conserved reaction-diffusion equations used as model equations of cell polarity. Currently he has been working on applied mathematics. He has recently developed a method to interpolate experimental images using the Optimal Transport theory and phase-field model. This method is useful for simulating reaction-diffusion equations on realistic cell shapes.

#### Imaging data-based model description tool using optimal transport and phase-field model

Capturing the geometrical shapes of cells is essential for understanding biological phenomena. However, limitations of time resolution of live imaging and other experimental factors prevent us from obtaining sufficient information about cell shapes. In this study, we develop mathematical tools to infer intermediate cell shapes from time series data of experimental images to overcome this limitation. Our method is based on the combination of Optimal Transport (OT) and phase-field model. OT is a mathematical theory that gives distance and optimal matching between probability distributions. Using OT, we can perform interpolation and obtain velocity fields corresponding to intermediate cell shapes and deformation. However, the conventional methods may generate unnatural deformation, such as cracks. To improve this property, we combine the velocity field obtained by OT with a phase-field model. Our new method successfully regenerated more realistic cell shapes. Finally, we propose a new bio-chemical modeling defined on real cell shapes. Our research will open new avenues for mathematical modeling approaches to pattern formation phenomena, including cell dynamics based on live imaging data of cells. This study was conducted in collaboration with Sungrim Seirin-Lee from Kyoto University and Toshiaki Yachimura from Tohoku University.

Keywords: Reaction-diffusion equations, Interpolation, Optimal Transport theory, Phase-field model





### Hirokazu TOJU | Kyoto University



Hirokazu Toju's research interest is the ecological and evolutionary processes of species-to-species interactions. In nature, plants and animals interact with diverse taxonomic clades of bacteria and fungi; thus, he has been trying to understand the organization of the stability and functions of such plant- and animal-associated microbiomes. Currently, he is running an interdisciplinary project on the dynamics of species-rich microbial ecosystems.

#### Drastic shifts in microbial community dynamics

Microbial communities are often classified into discrete or semi-discrete sets of species compositions. Such "multi-stability" of microbiomes has been intensively discussed in theoretical studies, but empirical studies that statistically reveal the relationship between community compositions and stability remain scant. Here, I will talk about how we can infer the structure of "stability landscapes," on which "alternative stable states" of microbial community compositions are divided by tipping points of community dynamics. **Keywords:** Microbiomes, symbiosis, basins of attraction, regime shift

Session: Microbiology and Microbe-host Interactions

#### Yukiko UCHIDA | Kyoto University



Yukiko Uchida is the director and professor at the Institute for the Future of Human Society, Kyoto University. She has conducted empirical research in cultural psychology, such as international and regional comparative studies on "happiness and well-being" and "self and social relations."

Dr. Uchida has authored over 200 academic papers. She has served on the editorial boards of international journals and has been an invited keynote speaker at various international conferences. She has received many awards, including Kyoto University's Best Female Researcher Award, the Japanese Psychological Association International Encouragement Award, and she was selected as an APS Fellow. Dr. Uchida has established solid relationships with corporations and governments, showcasing outstanding abilities in research exchange and the social dissemination of research findings. She was a member of the Cabinet Office's Study Group on Well-being, contributing to the development of well-being indices.

#### Culture and Well-being: How Does an Interdependent Lifestyle Promote Health and Well-being?

This talk will explore perspectives on well-being and health in Japan, a nation renowned for its longevity. I will emphasize the impact of social capital and social relationships in local communities and workplaces, considering





both individual and societal factors. The prevailing values in Japanese culture tend to promote a sustained and stable form of interdependent happiness, suggesting the critical role of support systems.

We often recognize a universal drive toward happiness and well-being, but what are the mechanisms that guide this pursuit? As a cultural psychologist, I examine well-being not only as a universal desire, but also as a construct deeply shaped by cultural meanings and individual experiences within specific cultural contexts. I will highlight cultural psychological theoretical frameworks and data analyses from studies outside of WEIRD (Western, Educated, Industrialized, Rich, and Democratic) societies.

In particular, I will highlight the value of cross-cultural and cross-regional studies within Japan. Our team has drawn on multilevel datasets from over 400 local communities to understand the influence of social participation on health and well-being. In doing so, we aim to foster a dialogue about how motivational research conceptualizes and addresses the role of culture in shaping our pathways to well-being.

Keywords: Culture, Well-being, Community, Social Capital, Health

Session: Keynote Speaker | Social Psychology | Current Research on Japan's Society and Cultures

### Michito UJINO | Kyoto University



Michito Ujino is a 6th grade bachelor student at the Faculty of Medicine, Kyoto University. He belongs to the mathematical biology and medicine groups in Advanced Study of Human Biology (ASHBi), and is studying mathematical and computational methods for prediction of biological experiment and prognosis of various diseases in clinical situation. Under the supervision of Prof Sungrim Seirin-Lee, he is researching the numerical simulation of culture system of germ cell lineage and severity of bullous pemphigoid with differential equations and cellular automata. His research interest are applied mathematics, including numerical method of partial differential equations, and optimization algorithm with biological or clinical data.

# Integrated understanding of human PGCLC development using multi-scale mathematical modeling of gene-cell-BMP dynamics

Understanding germ cell fate is one of the most challenging problems in biology and medicine. Primordial Germ Cell (PGC) is the origin of germ cell lineage, which differentiates into spermatozoa or oocytes. Recently, many extracellular morphogenic substances, such as BMP and genetic regulatory networks required for PGC development have been identified through experiments. However, the spatial effect of BMP distribution in the dynamics of germ cell differentiation remains poorly examined. To understand the mechanism of germ cell development and its relationship with BMP, we developed a multi-scale mathematical model composed of genetic/transcriptomic networks of ordinary differential equations (ODE), stochastic model for differentiation decision, and BMP-individual cell interaction model of partial differential equation (PDE) combining discrete cellular dynamics. The model parameters were determined based on the scRNA-seq data and other experimental data with genetic algorithm. Using the model, we explored the spatial effect of BMP on PGC





development through in silico experiments using numerical analysis of the multi-scale model of PGC development. We found that the spatial pattern of BMP is crucial for the efficient production of PGCs. Accordingly, we propose a new in vitro experiment framework for PGC manipulation based on gene-cell-BMP dynamics.

Keywords: mathematical model, differential equation, germ cell

Session: Mathematical Biology and Medicine

### Wolfram WECKWERTH | University of Vienna



Wolfram Weckwerth is full professor at the University of Vienna, Head of the Department for Functional and Evolutionary Ecology and Director of the Vienna Metabolomics Center (VIME). He is a pioneer of metabolomics in systems biology and the application of multiomics and modelling technologies to plants, microbes, animals, human and their interactions. He is coordinator of the PHD program Molecular mechanisms of plant resilience in the climate crisis, funded by the Austrian Science Fund and the University of Vienna. He has published more than 320 papers with a H-index of 81. He also serves in many advisory boards and is president of the Austrian Society of Plant Biology.

#### Panomics of host-microbe interaction and beyond

Integration of multiomics analysis using metabolomics, proteomics, RNAseq, metabolic modelling, AI, machine learning - in short PANOMICS technology - applied to natural variation of host-microbe interaction goes beyond classical genomic techniques and offers valuable tools to characterize the system and understand evolutionary plasticity linking molecular regulation and phenotypes. In this lecture, I first explore the holobiont concept and its investigation by applying PANOMICS technologies. In a second part I will present data on macrophages as an example of "host-macrophage" interaction.

Session: Microbiology and Microbe-host Interactions





### Bernadett WEINZIERL | University of Vienna



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Bernadett Weinzierl was appointed full professor and Head of the Aerosol Physics and Environmental Physics Research Group at the University of Vienna in 2016. She worked as aerosol scientist at the German Aerospace Center (DLR) between 2004 and 2016, and obtained her doctorate at the Ludwig-Maximilians-Universität München (LMU) in 2008. She was awarded an ERC starting grant in 2014.

She is an expert in (airborne) in situ aerosol and cloud measurements and modelsupported data analysis. She has coordinated several large-scale airborne field experiments including SALTRACE and A-LIFE, and acted as instrument PI for coarse mode and cloud measurements in numerous NASA- and NOAA-led aircraft missions. Her scientific work has been recognized with several awards including a Presidential Rank NASA Group Achievement Award in 2024. Recently, she received the Weiss Award (2023) -Austria's most highly endowed privately funded research prize in the field of meteorology for studying microplastics in the atmosphere.

Since 2017, she organises the bi-annual international univie: Summer School "Basic Aerosol Science" in Vienna.

#### Aerosols: Tiny Particles, Big Impact

Atmospheric aerosols, tiny particles suspended in air, are an important constituent of the global climate system. They not only affect the atmospheric radiation budget through scattering and absorption of solar radiation and through their role in water and ice cloud formation, but also impact air quality and human health. According to a recent study, particulate matter pollution caused around 135 million premature deaths worldwide in the past forty years.

The research Group Aerosol Physics and Environmental Physics at the University of Vienna combines highlysophisticated laboratory, ground-based and aircraft experiments with innovative modelling to study the fundamental physical and chemical properties of aerosol particles and clouds during their formation and life cycle. It has a long history of collaboration with researchers of Kyoto University going back to the 1980-ies. In this presentation, I will briefly introduce the role of atmospheric aerosols in climate and public health issues, discuss the role of aerosol research during the Covid-19 pandemic, and show recent results from airborne and laboratory measurements of mineral dust and microplastics. The presentation will close with an outlook on high-priority research questions to be addressed in the future so that aerosol science can contribute its share to solving grave issues faced by the global community.

Session: Keynote Speaker





### Liu WENWEN | Kyoto University



Liu Wenwen is a second-year Ph.D. student at Kyoto University, who has research experience in both wet lab and bioinformatics techniques. Her academic journey began at the Chinese Academy of Agricultural Sciences, where she studied plant molecular genetics (2017–2020). Her undergraduate research focused on the role of Chlorophyllide a Oxygenase in altering plant color and reducing biomass, which got her interested in evolutionary biology. Continuing her work in the Ogata lab, she delved into marine biology and conducted field sampling and bioinformatics works. Her doctoral project aims to explore the ecology of giant viruses in deep ocean, by generating time-series metaomics data regarding their evolution and adaptation within the mesopelagic dark water layer. She hypothesized that giant viruses evolved unique mechanisms to maintain stability and activity in the dark ocean. Her study will offer insight into currently unrecognized viral survival strategies and their ecological impacts.

#### The ecology and evolution of giant viruses in mesopelagic layer

Giant viruses (GVs) are pivotal components of marine ecosystems, yet their roles in the mesopelagic zone remains underexplored compared with those in the photic layer. In this symposium, I would like to introduce my research on GVs ecology in the deep ocean. Using seasonal samples of mesopelagic seawater from Muroto in Kochi Prefecture, we generated a comprehensive dataset that includes 18S rRNA/rDNA metabarcodes, metagenomes, and metatranscriptomes. Our data revealed the presence of active GVs, particularly those from the Imitervirales and Algavirales lineages, in the mesopelagic layers. Analyses of the seasonal variations in the community compositions of both GVs and their potential hosts (microeukaryotes) suggest adaptive behaviours in response to environmental and biotic shifts. In terms of evolution, we identified a clade of GVs that appears to be exclusive to the deep oceanic environment. This discovery implies that GVs might have evolved distinct mechanisms to adapt to the mesopelagic layer, and underscores their possible roles in the deep-sea ecological dynamics and evolutionary processes.

Keywords: Giant viruses, mesopelagic layer, season dynamic

Session: Microbiology and Microbe-host Interactions | PhD Pitch Talk





### Ruixuan ZHANG | Kyoto University



Ruixuan Zhang is a third-year Ph.D. student at Kyoto University and is supervised by Prof. Hiroyuki Ogata. He holds a research fellowship from the Japan Society for the Promotion of Science (JSPS DC2). His research interests are evolutionary biology, genomics, and bioinformatics. Currently, he is focusing on the interaction between giant viruses and their host amoeba. He investigates the strategies that viruses use to reprogram the cellular metabolic network for virus progeny production, the resource limitations and competition between the host and virus, and the underlying evolutionary processes.

#### A giant virus creates its own subcellular environment to overcome the codon-tRNA mismatch

A codon usage consonant with the cellular tRNA pool is important for efficient protein synthesis. Typically, this tRNA supply and codon frequency in mRNAs are well balanced in cells. In contrast, viruses, that rely on host translation machinery, may use codons that are not frequently used in the host. However, how these viruses overcome the imbalance of tRNA supply and codon usage remains ambiguous. In this study, we surveyed the transcriptome, translatome, and tRNA statuses in mimivirus-infected amoeba through RNA-seq, Ribo-seq, and tRNA-seq. Despite the huge difference in viral codon usage (A/T biased) and host one (G/C biased), viral genes were efficiently translated as found in host genes. Ribosome traversal on viral genes was not interrupted even with a mismatch in cellular tRNA supply. Our data suggest that the translation of the mimivirus genes may occur in the unique cellular environment tailored for viral codon usage. **Keywords:** Giant viruses, host-virus interaction, evolution, codon-usage, tRNA

Session: Microbiology and Microbe-host Interactions | PhD Pitch Talk