



Towards the Galaxy of Neuroscience – The 46th Annual Meeting of the Japan Neuroscience Society

From August 1st to 4th, the highly anticipated Annual Meeting of the Japan Neuroscience Society 2023 took place at the Sendai International Center in Sendai, Japan. It was the first time in several years that the Society held its annual meeting in a face-to-face format. Distinguished scientists from the global scientific community, including both established and early career researchers, gathered to disseminate their latest discoveries, exchange fresh ideas and perspectives, discuss innovative paradigms, and establish professional connections. The event offered a comprehensive program, featuring exceptional Plenary Lectures, Special Lectures, Symposia and Educational Lectures, Workshops, Poster sessions, and extensive Industrial and Academia Exhibitions. Additionally, a series of Training Schools was organised for the next generation of scientists. Esteemed scholars presented their latest groundbreaking achievements in neuroscience and discussed emerging concepts in the field. Young scientists had unique opportunities to enjoy remarkable lectures, educational events and professional training sessions. This event has been a significant and memorable meeting for all attendees.



Main Hall at the Sendai International Center for Plenary and Special Lectures during the 46th Annual Meeting of the Japan Neuroscience Society.

From reflections on evolving neuroscience research to current discoveries

The meeting featured a unique set of lectures from renowned scientists who seamlessly integrated reflections on the history of evolving neuroscience research with current cutting-edge discoveries within the field. The audience, consisting of both young and senior scientists, were fascinated by exciting and knowledgeable narratives about intriguing research ideas that sounded mysterious at a time of around two decades ago and how creatively some methodologies were utilized at that times to resolve them, as well as how some methodological approaches were refined over time to become commonly used now. Labour attempts of investigating specific cell populations in the brain resulted in the development and implementation of stunning methodologies, such as genetically encoded opsins and genetic approaches for labelling targeted cell populations using cre-loxP system, among many other examples of dynamic research progress in the field. It has been a tremendous scientific curiosity powered with creative approaches that led to key discoveries in the field of neuroscience, some of which have been awarded the Nobel Prize in Physiology and Medicine, such as the discovery of TRPV channels, described by Professor Makoto Tominaga in his Special Lecture on TRP channel research.

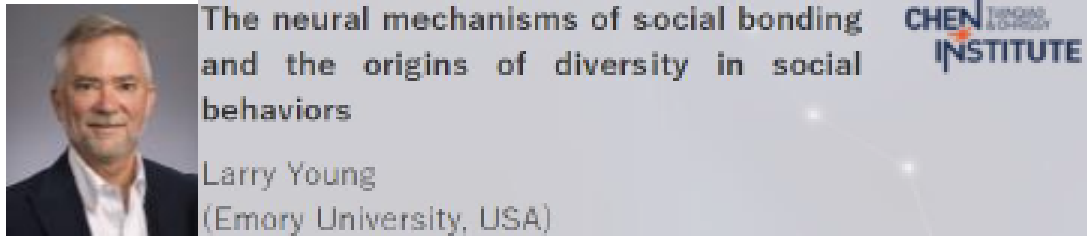


Thermosensitive TRP Channel Research - past, present and future

Makoto Tominaga
(Division of Cell Signaling, National Institute for Physiological Sciences, National Institutes of Natural Sciences)

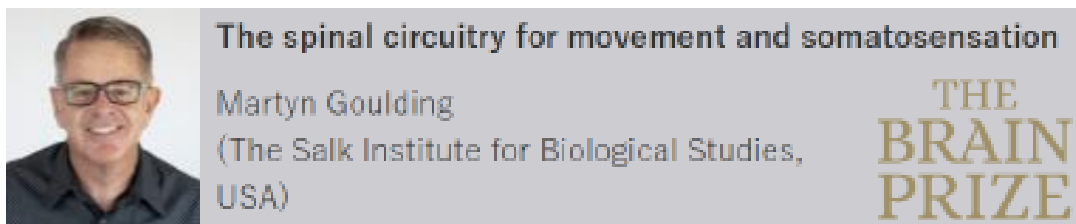
Picture is from the JNS Meeting 2023 website. <https://neuroscience2023.jnss.org/en/program.html>

The conference also provided a retrospective on what inspired senior scientists at the beginning of their careers, with a message to the younger generation that research is constantly evolving. As an example, Professor Makoto Tominaga highlighted in his Special Lecture on TRP channel research that the fields of system neuroscience and cellular neuroscience were once separate in the past, but now work synergistically and complement each other. Such interdisciplinary in neuroscience aids in deepening our understanding of the nervous system functioning, from receptor levels to system neuroscience, including social behavior. This was further exemplified by Professor Larry I. Young's Plenary Lecture, where he fascinatingly described the development of social patterns and behavior, such as pair bonding. Through the lecture, Prof. Young described the latest discoveries showing that diversity in oxytocin receptor expression patterns and oxytocin-mediated signaling in nucleus accumbens and prefrontal cortex contributes to diversity in social behaviors across and within species; this also apparently relates to autism spectrum disorder.



Picture is from the JNS Meeting 2023 website. <https://neuroscience2023.jnss.org/en/program.html>

Behavior is relatively dependent on movement – this was discussed by Professor Martyn Goulding from The Salk Institute in his Brain Prize Lecture. Starting his lecture by quoting Daniel Wolpert’s statement that the brain evolves to control movement, Prof. Goulding then went to explain how various motor behaviors, ranging from simple protective reflexes to complex forelimb movements and locomotion, are generated and controlled by specific cells. He shared insights from over 20 years of research on the motor-locomotor system, highlighting the relation between behavior and movement and the neural circuits in the spinal cord that govern movement and somatosensation. The lecture also touched upon the genetic programs that determine the identity of neurons and raised questions that still need to be explored in this field.



Picture is from the JNS Meeting 2023 website. <https://neuroscience2023.jnss.org/en/program.html>

Many lectures and discussions focused on functional connectomes and nerve cell diversity mechanisms. The central nervous system contains thousands of nerve cell types, individual brain tissue units, established for the first time by Santiago Ramón y Cajal in the 19th century. From this, Dr Tomasz Nowakowski from the University of California San Francisco raised the question of how several types of neural stem cells give rise to the diversity of nerve cells in the adult human brain, which contains probably the highest amount of cell subtypes as not any other tissue across the body. What does mediate such cellular diversity? In his Joseph Altman Award in Developmental Neuroscience Award Lecture, Dr Nowakowski provided the latest advances in neurodevelopment research and the current progress in creating a blueprint of normal human brain development.

Neurogenesis and human brain development have always been hot topics, and this meeting has proven the remaining focus on these studies and emerging technologies to capture the genetic, cellular and tissue level basis of how human brain operates.

Robotics and AI – will it accelerate Life Sciences?

Is it possible for robots to conduct experiments? During a Special Lecture, Dr Koichi Takahashi from RIKEN, Keio University, and Osaka University described a prototyping laboratory with LabDroid Maholo, a versatile humanoid robot system to carry out laboratory procedures and experimental actions.



*Picture is from the website of Dr Takahashi's Laboratory for Biologically Inspired Computing in RIKEN.
<https://www.bdr.riken.jp/en/research/labs/takahashi-k/index.html>*

The Robotic Biology Project utilizes computer science and AI-robot platforms to advance biomedical research. They have developed LabDroid to automate tasks in cell biology studies, including culturing and genomic tests. LabDroid also allows for flexibility in changing experimental protocols with up to a thousand protocols stored in the cloud. Moreover, the team has also created a closed-loop AI-robot system that uses model-based prediction to make decisions on the following experimental procedures without the need for human intervention. This fascinating direction and its current tremendous progress raise the question of whether creating AI platforms for automated experimental planning and optimization could transform conventional biological laboratories into cyber-physical systems.

A plethora of Research Symposia and Educational Lectures

During the 46th Japan Neuroscience Society Annual Meeting, multiple symposia were organised on various topics, running in parallel sessions. One of the particular focuses of this meeting was dementia, which is becoming a progressively heavy burden on society. Of note, Japan is known for its super-aged society, hence has a higher risk of dementia in its population impacting society. At the symposia, researchers disseminated their latest findings in the field, discussed various works that dissected molecular processes in various dementias, and shared their thoughts on promising therapeutic interventions for the future.

A plethora of educational lectures were organised during the Meeting to bridge the gap between theoretical knowledge and practical methodologies that support groundbreaking research. One of the focuses of these educational lectures was to provide participants with an in-depth understanding of the diverse technical approaches in neuroscience research. This included an introduction to cryo-electron microscopy, electrophysiology of synaptic transmission, animal models, genetic

analysis, and other related topics. Additionally, educational lectures discussed principles and concepts, such as the juxtaposition of human vision and machine vision, the principle of developmental neurobiology, neural mechanisms of time perception, the importance of mechanosensation for our body, among others. By covering both technical methodologies and conceptual frameworks, the Meeting aimed to offer attendees, especially young scientists, a comprehensive foundation to understand the ever-evolving neuroscience research.

Poster sessions, Industrial and Academia Exhibitions

Poster sessions are often a vital component of academic conferences as they offer researchers an excellent opportunity to meet in person and discuss their works in greater detail during face-to-face conversations. During this meeting, the poster sessions proved to be productive and served to reinforce the researchers' engagement in the scientific discussions.



Poster exhibition hall during the Annual Meeting of Japan Neuroscience Society 2023.

The Industrial and Academia Exhibitions were equally impressive, bringing together innovative businesses and educational institutions in life sciences. This conference segment provided a dynamic platform for renowned companies operating within the life sciences sector to showcase their cutting-edge achievement to solve biomedical requests. Notable industry leaders such as Leica Microsystems, Nikon Solutions Co., NARISHIGE SCIENTIFIC INSTRUMENT LAB., Thorlabs Japan Inc., Carl Zeiss Co., Alexion Pharma GK were among many other distinguished participants. Attendees had the invaluable opportunity to explore the latest advancements in technology, instrumentation, and methodologies shaping state-of-the-art research. Interacting with company representatives facilitated knowledge exchange and also provided chances for discussions about potential progress.



The company exhibition area during the Annual Meeting of Japan Neuroscience Society 2023.

Luncheon Seminars, Networking, and Japanese hospitality

The Meeting featured the Luncheon Seminars that were organised to foster further development in the field of neuroscience. Industry leaders generously sponsored these seminars, which included discussions on various topics such as the future development of microscopy imaging sponsored by Leica Microsystems, Thorlabs Japan Inc., Carl Zeiss Co.; diagnosis and treatment of Parkinson's Disease sponsored by AbbVie GK; recent advances in understanding neuronal activity sponsored by NARISHIGE SCIENTIFIC INSTRUMENT LAB; the latest techniques in microglial replacement sponsored by FUJIFILM Wako Pure Chemical Corporation, among others. Attendees were provided with lunch boxes and beverages, courtesy of the sponsors, which they could enjoy while participating in the seminars.

It is impossible to not mention the exceptional hospitality of our Japanese hosts during the event. The meeting organizers were incredibly welcoming and always attentive to the needs of all the participants. The genuine Japanese hospitality ensured that everyone felt valued and engaged in interactions and knowledge exchange. This created a special atmosphere throughout the conference, making it a truly memorable experience for all attendees. The conference venue and premises were exceptional and infused the event with a unique Japanese charm, providing an immersive cultural experience of the ethical richness of the region for everyone. It is certain, the attendees will eagerly anticipate taking part in the upcoming Annual Meeting of the Japan Neuroscience Society in 2024.



Sendai International Center Hall welcoming the attendees of the 46th Annual Meeting of the Japan Neuroscience Society.

What advice would you give to the younger generation?

At the Meeting, the younger generation of scientists received a lot of attention. Through various lectures and activities, the importance of young scientists in the groundbreaking research achievements of the world-renowned laboratories was acknowledged. Many lecturers conveyed messages to earlier career researchers. During a Special Lecture given by Professor Kenichi Ohki on the development of 2-photon imaging and study of functional architecture of the visual cortex, he was asked what advice he would give to the younger generation. He recommended cultivating an unwavering curiosity in science and generating intriguing hypotheses, regardless of whether they are proven correct or not. A positive attitude towards data analysis is the other important and integral part of complicated research in the field of neuroscience.

Acknowledgements

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Dr Kopach is a Science Writer at TCCI. Dr Kopach wrote this meeting report as part of the Tianqiao and Chrissy Chen Institute Science Writers Fellowship which aims to extend the conversation beyond the meeting with the hopes of sparking new ideas and collaborations.