Research Report

1. Name: Susan NEMBHARD （ID No. SP25001）

2. Current affiliation: John Jay College of Criminal Justice/CUNY Graduate Center

3. Research fields and specialties:
Social Sciences

4. Host institution: Rissho University

5. Host researcher: Yutaka HARADA

6. Description of your current research

In the United States, it has become a priority to understand structural violence, particularly when there are harms perpetrated by police officers. This has been a rising concern for people of color broadly, but especially African Americans because statistics have shown that they are disproportionately harmed by police violence (Edwards et al, 2019). In the United States, this focus has become prominent in the wake of excessive force and violence used by the police in addition to the physical harm that is experienced by the victims involved. This structural violence also results in psychological, emotional, and community harm (Alang et al., 2021; Nembhard et al., 2022; Turney et al., 2022; DeVylder et al., 2020). Further, it can lead to a decrease in community trust and a decline in police legitimacy (Carroll & Yu, 2022). To better understand the factors and variables associated with this issue, my current research is focused on understanding both the prevalence and perception of police violence across communities.

My current research is using Chicago police misconduct data and census data for a combination of individual level factors and group level factors, and I am conducting a spatial analysis where the group level factors are at the zip-code level. This allows me to investigate whether there are group-level location attributes, such as population percentages, income levels, and other structural disadvantage factors, that are associated with more sustained misconduct allegations, or more community-made complaints. The literature on police misconduct has largely focused on the role of identity factors, the race of the complainant or the race, gender, and tenure of the accused officer. This research will fill in some of the gaps by focusing on those group-level factors, as well as studying additional variables such as complainant gender, and officer rank.

Police misconduct data from Chicago and other potential jurisdictions will be combined with Census data to create a multi-level dataset of incidents nested within zip codes. This study will investigate the individual and group level factors that 1) Impact the number of complaints particular zip codes have, and 2) Increase the likelihood of sustained police misconduct. The combined dataset will include a range of variables including accused officer information, complaint details (location, complaint type, outcome), complainant demographics, as well group-level factors including population proportions on race, income, education, employment, and community resilience. Using hierarchical linear modeling, the analysis will incorporate understandings of social disorganization, critical race, and minority threat theory to investigate how the variables associated with these theoretical frameworks contribute to both the number of complaints made, and the complaints outcome. In doing so, this research seeks to provide important insights to understanding the community-level factors that lead to police misconduct and inform policy to prevent and reduce misconduct instances.

7. Research implementation and results under the program

Title of your research plan: The Environment's Impact on Perceptions of Safety: An Analysis of Community Safety Walk Observations and Field Notes

Description of the research activities:

Dr. Yutaka Harada developed a phone application called the Kiki-Gaki Map that could be used for a research method called Participatory Photo Mapping (PPM), where community members are partners in the research, and go around their community to take pictures of what they see. The Kiki-Gaki map stores the photos and allows participants to record voice memos that are matched to the photos and tracks the route the participants take. In Dr. Harada's research, participants used the Kiki-Gaki map on their community safety walks where they explored their neighborhoods and conducted safety checks and collect narratives on local conditions in pursuit of making community-informed safety improvements.

Over the summer I worked with Dr. Harada to learn how to install and use the app and conduct a research project on the data previously collected on community safety walks using the application. The data included photos taken during the walks by the participants as well as the voice memos. The walks focused on different activities such as inspecting the fire hydrants in the neighborhood and identifying where community boards were placed in the neighborhood. The project focused on understanding how the Kiki-Gaki map application can be used for Participatory Photo Mapping, and additionally what community safety walks look like in Japan. Coming from the context of American-Japan comparisons, in the U.S. while we have similar groups such as neighborhood watches, they often are not patrolling the neighborhood to inspect preventative safety measures, instead they focus on trying deter crime from happening. In comparison, based on the data collected on the community safety walks, in Japan the focus is on larger safety concerns like natural disasters, and how to be proactive about safety. The current research hopes to investigate this approach to understand one idea of how safety is understood in Japan, and what safety priorities can look like.

My research project was a content analysis of the Kiki-Gaki images. Content analyses are used to systematically analyze a type of message or media, in this case the photos. One of the goals of Dr. Harada's previous work and methodology was to facilitate public participation in research, while another is to help facilitate the planning and implementation of strategies that improve well-being/community safety. My research sought to determine how using the application could be used for this purpose. To keep track of the different themes that came about in the data. After creating a complete list of common themes, I conducted a content analysis of photos from 10 community walks, each of which had about 40 photos taken. My research found that by incorporating community members in the research project, they can help to really frame what is important and use their expertise to shape the research being done.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

During my stay in Japan I was also able to take part in some of the experiences Japan has to offer. For example, thanks to JSPS I was able to take part in a homestay program where I got to experience life with a Japanese family, we visited Kawagoe, had traditional Japanese food, and I was able to practice having full conversations in Japanese. This summer I also was able to explore other areas of Japan. I took a river cruise in Nagatoro, ate sweet potato treats in Kawagoe, and watched the sunset over the beach in Kamakura. Additionally, I visited cultural sites in Kyoto like Sanjūsangendō Temple, Kinkaku-ji, Fushimi Inari Shrine, and others, all while wearing a rental yukata. Thanks to JSPS, I was able to have an amazing summer, learning, building my research portfolio, and exploring Japan.

9. Adviser’s remarks (if any):

Research Report

JSPS Summer Program 2025
Research Report

1. Name: Malak Rayes （ID No. SP25002）

2. Current affiliation: Penn State University

3. Research fields and specialties:
Chemistry

4. Host institution: Institute of Science Tokyo

5. Host researcher: Dr. Atsushi Shishido

6. Description of your current research

Structural color, or color generated by the interaction of light with the physical properties of a material to produce interference events, holds significance in a variety of modern-day applications including optical displays, sensors, and anticounterfeit technologies. The most well-known mechanisms of structural color that have been extensively studied utilize periodic nanoscale features to induce interference events. However, these materials often encounter industrial complications such as high fabrication costs, poor scalability, and limited color tunability. Recently, we discovered a structural color mechanism on the microscale that offers a unique platform to engineer highly tunable and dynamic coloration shifts while enabling simplified and cost-effective fabrication.

My research focuses on the design and optical characterization of iridescent structural color from curved microscale geometries. Within these systems, interference develops through a sequence of multiple internal reflections along the curved optical interface, giving rise to angle-dependent coloration. To fundamentally understand and predict this behavior, we use a combination of far-field reflection spectral analysis and computational ray tracing. The color produced by multi-bounce reflection interference is influenced by multiple variables including the refractive indices at the optical interface, the interface geometric profile (e.g. contact angle, radius of curvature) and the light incidence angle. By systematically altering these parameters, we demonstrate that multi-bounce interference can be used for highly tunable iridescence.

7. Research implementation and results under the program

Title of your research plan:

Engineering Tunable Structural Colors Through Fabricating Multi-Bounce Interference Microstructures with Liquid Crystal Polymers

Description of the research activities:

This summer, I investigated the integration of liquid crystals into curved microscale geometries as a strategy to achieve additional color tunability within the multi-bounce reflection interference mechanism. My primary focus was on developing the experimental basis for this work through the optical characterization of liquid crystals, with particular attention to how alignment and birefringence influence interference pathways. By refining methods to monitor and control liquid crystal orientation, I established protocols to evaluate their suitability for incorporation into microgeometries. These efforts represent an important first step toward fabricating liquid crystal polymer-based microstructures to combine multi-bounce interference with optical anisotropy for dynamic modulation of interference-driven iridescence.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Joanna G. SEVERINO （ID No. SP25003）

2. Current affiliation: Temple University

3. Research fields and specialties:
Medical, Dental and Pharmaceutical Sciences

4. Host institution: Chiba University

5. Host researcher: Prof. Ayako TONOKI

6. Description of your current research

Opioid misuse is a major public health concern in the United States, and OUDs (opioid use disorders) are often characterized by cycles of relapse and remission, making them difficult to treat. Previous research examining cocaine use disorder patients has shown that there is a link between cognitive functioning and treatment outcomes, and this may apply to substance use disorders more broadly. There is ample data to suggest that opioid exposure has detrimental effects on cognitive functioning, therefore, my graduate research project builds on this to explore a rodent model of this phenomenon using intravenous self-administration and object-based memory assays. Previous literature demonstrating cognitive deficits following chronic opioid use has been reliant on experimenter delivered opioids, which does not accurately model the drug-taking behavior observed in the patient population. There are distinct neural pathways engaged during volitional drug-taking; thus, self-administration is a clinically relevant model. In addition, the object-based memory assays used in my dissertation research are neutral assays that do not rely on stress-inducing or rewarding stimuli to examine cognition.

For my studies, Long Evans male and female rats self-administer either sucrose pellets (control) or heroin infusions (experimental group) for 15 days. During forced abstinence, the subjects do an object location memory assay or novel object recognition assay. Our results suggest that there is a sex-dependent, brain region-specific effect of chronic heroin self-administration on memory. Male rats exposed to heroin are unable to recognize that objects were moved around in the object location memory assay, suggesting a hippocampus-dependent short-term spatial memory deficit. Female rats, on the other hand, perform similarly to their control counterparts. This project is currently exploring a molecular mechanism driving this observed behavior. If a particular mechanism is found, this pathway can be targeted to rescue the cognitive deficit, which could potentially be used as a therapeutic for OUDs.

I have a deep interest in learning and memory models and want to use a *Drosophila melanogaster* (fruit fly) model for my postdoctoral research, so this summer program offered me the perfect opportunity to begin this transition. Dr. Tonoki has extensive experience publishing on learning and memory in fruit flies. Her research explores aging-related cognitive decline and uses novel and innovative approaches to explore the underlying mechanisms behind this phenomenon. Fruit flies are a powerful genetic tool, and learning from Dr. Tonoki and her team this summer has been a privilege

7. Research implementation and results under the program

Title of your research plan:

Exploring the Link Between Immune Pathways in Adipose Tissue and Aging-Related Cognitive Decline

Description of the research activities:

Dr. Tonoki's laboratory has been able to demonstrate that innate immune pathways are activated in adipose tissue during aging, and antimicrobial peptides (AMPs) are increased with age. In the laboratory, transgenic flies with decreased signaling of these pathways exhibit improved intermediate-term memory. Previous literature suggests that AMPs work synergistically, so my summer project has focused on examining intermediate term memory and sleep in mutant flies with an array of AMPs knocked out, termed "Group AB." My experiments examined intermediate term memory by pairing an electric shock with exposure to odor A and no shock when exposed to odor B. Flies are returned to their vials for 3 hours, after which they are tested in a T-maze containing odor A in one arm and odor B in another. The number of flies that choose one odor over the other is calculated into a performance index, revealing their intermediate term memory. In my experiment, young Group AB flies did not reveal increased memory compared to control flies, suggesting that this combination of AMP deletions is not sufficient to modulate intermediate term memory. In addition, I ran a sleep assay using a Drosophila Activity Monitor (DAM), and this assay revealed that the AMP deletions specific to Group AB flies lead to decreased total sleep and may modulate sleep quality as well. Lastly, I was able to confirm the efficacy of this mutant model via qPCR experiments. Taken together, Group AB AMP deletions do not modulate intermediate term memory but do decrease sleep, which is extremely important for memory consolidation. Thus, if I had more time in Japan, I would be interested in exploring Group AB flies' long-term memory performance.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I am so grateful to JSPS for providing me with the opportunity to experience life in Japan, not only to grow as a scientist but to grow as a person. While Japanese architecture is beautiful and the transportation system is unlike anything I have ever experienced, I am blown away and moved by the warmth I have been welcomed with. My lab mates accepted me with so much kindness and with open arms. I felt at home from the moment I stepped foot in Chiba, Japan. They went out of their way to include me and make me feel like I was a part of their team. They showed me Japan through their eyes, and I am so grateful and forever changed because of their hospitality and kindheartedness.

9. Adviser's remarks (if any):

Joanna conducted her summer research with diligence and intellectual curiosity, contributing meaningfully to our ongoing studies on an effect of antimicrobial peptides on memory in Drosophila. Her experimental skills, collaborative spirit, and insightful discussions enriched the lab environment. She actively engaged with other staff and students, fostering a positive and stimulating atmosphere during her stay. I am pleased to host her and look forward to future collaborations.

Research Report

1. Name: Michelle Sheen （ID No. SP25004）

2. Current affiliation: Brown University

3. Research fields and specialties:
Biological Sciences

4. Host institution: Ehime University

5. Host researcher: Prof. Richard Culleton

6. Description of your current research: I am currently a global public health researcher with interest in infectious disease and tropical medicine. Malaria is a single-celled eukaryotic parasite that currently exists in several tropical countries and is responsible for the deaths of over 400,000 people each year. I have modeled public health initiatives in Sabah, Malaysia, and Kebbi, Nigeria by creating a public health educational initiative for the population of Malaria to combat the current rise of Plasmodium falciparum, knowlesi, and vivax.

7. Research implementation and results under the program

Title of your research plan: Can the rodent Malaria Parasite (P. Yoelii & P. Chabaudi) sense when the vector (Anopheles mosquitoes) is biting the host to produce more gametocytes?

Description of the research activities: We modeled Plasmodium chabaudi and Plasmodium yoelii in ICR and C57 mice. We then took blood smears each day post-infection to document the parasitemia and gametocytemia. We performed a final feed to female anopheles mosquitoes and waited eight days for oocysts to develop in the midgut of the mosquitoes. We then dissected the mosquitoes to count oocysts and see if there is a correlation between bites of the mosquitoes and gametocyte production of the parasite.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I was able to visit Hiroshima, Miyajima, Tokyo, Osaka, and Kyoto during my stay in Ehime. I was able to enjoy the summer night market in Matsuyama, eat watermelon during the Hanabi festival, and wear a Yukata. I made many friends, joined university clubs, and enjoyed the local cuisine. I hope to come back to Ehime!

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Mayson Whipple （ID No. SP25005）

2. Current affiliation: Michigan State University

3. Research fields and specialties:

Chemistry

4. Host institution: Osaka Metropolitan University

5. Host researcher: Professor Kohji Ohno

6. Description of your current research

My current research is based on developing new drug delivery methods by combining compositionally controlled polymers and nanoparticles. Specifically, I have developed new ways to synthesize hetero-bifunctional polymers which we can graft to surfaces via simple bioconjugation schemes, I synthesized immune active polymers towards the treatment of opiate use disorder, and I have formulated new iodinated polymers for medical imaging applications. As part of this, we have recently shown the surface-initiated polymerization of polyethers from nanoparticle surfaces.

7. Research implementation and results under the program

Title of your research plan:

Characterization of polyethers synthesized from aluminum-based catalyst and initiator systems.

Description of the research activities:

The research focused on two systems for synthesizing polyethers and polyether-based materials. First, we aimed to optimize the synthetic route for high molecular weight (>100 kg/mol) poly(propylene oxide) (PPO) from an aluminum-based initiator and catalyst system. Experimental parameters were varied to determine their influence on the effective polymerization of PPO at high molecular weights. Monomer conversion was measured by ^{1}H NMR spectroscopy and polymer molecular weights and dispersity were measured by Gel Permeation Chromatography. Varying the ratios of monomer to initiator and catalyst to initiator influenced monomer conversion, polymerization speed, and final molecular weights. Other parameters, including experimental setup were varied (e.g., temperature and varying methods of securing vials to prevent evaporation). Overall, we discovered potential limitations in experimental design that caused low monomer conversion and low molecular weights and recommendations were provided to improve polymerization outcomes.

Second, we examined the structure of polyethers synthesized from functionalized AlNP surfaces via a novel surface-initiated approach. Target poly(epichlorohydrin) (PECH) molecular weights were varied at ~2.3 kg/mol, ~13.4 kg/mol, and ~45.7 kg/mol. The three sizes of PECH brushes were cleaved from NP surfaces using hydrofluoric acid and the free polymer was analyzed with Gel Permeation Chromatography. The results here revealed deeper insights in polymerization mechanism; however, further intricacies in the synthetic route were discovered given that polymer size was significantly lower than the target. The analysis informed future studies on the cleaved polymers, which should provide full elucidation on PECH brush characteristics.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

Cultural experiences included frequent meals with colleagues from the lab in which we discussed differences in American and Japanese culture and my introduction to many traditional Japanese meals. My homestay experience provided insight into Japanese family life and the household customs of a typical Japanese family. Finally, trips to Shirahama, Kyoto, Hiroshima, and Tokyo revealed deeper insights into Japanese culture.

9. Adviser's remarks (if any):

Through this program, the members (students) of my lab also learned many things from Ms. Whipple. I believe it was a highly fruitful two months for both sides. I hope that this program will continue.

【SP25006】

JSPS Summer Program 2025
SP25006 Research Report

1. Name: Nicole HERNANDEZ （ID No. SP25006）

2. Current affiliation: Arizona State University

3. Research fields and specialties:
Social Sciences and Interdisciplinary Sciences

4. Host institution: University of Ryukyus

5. Host researcher: Professor Kosuzu ABE

6. Description of your current research

My dissertation, *Pathways to Puerto Rican Studies of the Pacific*, examines how Puerto Rican communities in California and Hawai‘i preserve and transmit cultural heritage across generations. I ask how diasporic communities sustain identity, memory, and belonging outside of their Caribbean homeland. The project focuses on cultural festivals, foodways, and community archives as key sites where heritage is performed and reimagined. These cultural practices create ecosystems that reinforce Puerto Rican presence in the Pacific. Ethnographic methods such as participant observation and interviews ground the project in lived experience. Archival research uncovers community records and photographs that reveal migration histories often overlooked in official collections. Oral histories provide intergenerational perspectives on migration, identity, and cultural practice. Together, these methods bridge written, oral, and embodied forms of knowledge. In California, I examine festivals as spaces of cultural expression, visibility, and community gathering. In Hawai‘i, I highlight how Puerto Ricans established inter-island networks that connected families through labor, music, and social life. These networks demonstrate how migration histories endure through everyday practices and communal ties. Community collaboration is central to my approach, ensuring that knowledge returns to the people who produce it. This includes supporting digital archives that safeguard fragile materials for future generations. My research contributes to anthropology, diaspora studies, and museum studies by foregrounding community-driven heritage work. Ultimately, I argue that Puerto Ricans in the Pacific show how diaspora is actively recreated through cultural practice and collective memory.

7. Research implementation and results under the program

Title of your research plan:

Archipelagic Belonging: Latin American Cultural Expressions in Okinawa

Description of the research activities:

During my fellowship period, I conducted ethnographic research on Latin American cuisine and cultural expressions in Okinawa. My methods included participant observation, fieldwork, and semi-structured and impromptu interviews with chefs, restaurant owners, patrons, university professors, cultural organizers, and other community members.

I conducted fieldwork at 21 restaurants and cultural spaces, ranging from Peruvian to Mexican establishments, including multiple taco shops. At these sites, I carried out 15 impromptu interviews with patrons, staff, and owners, covering topics such as Okinawan cuisine, histories of migration, knowledge of Latin America and the Caribbean, foodways, music, and family histories. I also conducted informal interviewed cultural organizers about the history and practice of Latin social dancing in Okinawa.

Academic Engagement: I attended the *Intersectionality and Feminism Symposium* at the Okinawa Institute of Science and Technology, where I learned about the history of Okinawa's diaspora in Brazil and Peru. This event allowed me to network with graduate students and faculty engaged in both local and international research on migration and identity. I have met with Professor Noiri Noami, and popular writer Masami Tamaki of the book "Okinawa Food & Life Story." I also visited multiple cultural and municipal museums, including village, city, and prefecture museums and exhibitions, to contextualize Okinawan cultural heritage within broader transnational frameworks.

Program Comments: The JSPS Summer Fellowship provided unparalleled academic, institutional, and financial support, enabling me to expand my dissertation research and professional network. The opportunity to conduct research of this caliber at the University of the Ryukyus has been invaluable for my scholarly development. I am sincerely grateful for the support and guidance offered throughout the fellowship period.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

My homestay family provided in-depth cultural immersion, introducing me to karate, traditional Ryukyu dance, Okinawan cuisine, calligraphy, and Okinawa music. I also attended cultural festivals, such as the Yonabaru Matsuri, Peruvian Independence Day festivities, and the Okinawa Latina Festival, which enriched my understanding of Okinawan cultural life and its intersections with Latin American communities.

9. Adviser's remarks (if any):

007JSPS Summer Program 2025
Kaoru Tamura - Research Report

1. Name: Kaoru Tamura （ID No. SP25007 ）

2. Current affiliation: University of Oregon

3. Research fields and specialties:
Humanities

4. Host institution: Waseda University

5. Host researcher: Dr. Hitomi Yoshio

6. Description of your current research

My research focuses on Japanese children's literature of the interwar period. My doctoral dissertation, which I am in the process of writing, examines both high-brow fairy tales (*dōwa*) and more popular, low-brow, boys' literature (*shōnen shōsetsu*), the direct precursor of post-war manga. In particular, I look at the stories through the lens of contemporary science, especially the somewhat mystical implications of relativity and quantum mechanics. I argue that these new discoveries in physics had a liberating effect on the Japanese imagination, tapping into a reservoir of spiritual, unscientific thought suppressed by the Meiji program of rational modernization. One can see this especially in *shōnen shōsetsu* stories: while they are famously militaristic, sci-fi, and weapon heavy, they also feature strange, unrealistic, quasi-religious plot elements. My research argues that this peculiar juxtaposition of science/technology, worshiped in official culture, with old-world mysticism, correspondingly frowned upon, springs from the liberating influence of the latest physical models, whose somewhat spooky conclusions captivated contemporary imaginations. Thus, ironically, science enabled mysticism.

This summer, my research revolved around the work of Ogawa Mimei (1882–1961), the subject of my dissertation's second chapter. Ogawa is widely credited with elevating Japanese children's literature to the level of "pure literature." Much of his work, furthermore, contemplates the topic of death, either directly or through allusion. I argue that his writing deliberately creates a liminal space between science and "death," posing the question of what death really is. Indeed, has modern science in the twenty-first century really succeeded in explaining it? Although Ogawa benefits greatly from Western literature, explicitly styling himself a neo-Romantic, he nevertheless maintains an ambivalent stance toward science and the scientific industry. By tracing his intellectual commitments, I explore Ogawa's relationship to science through the lens of death.

7. Research implementation and results under the program

Title of your research plan:

Science, Mysticism and Fantasy: Japanese Children's Literature of the Interwar period.

Description of the research activities:

My research this summer consisted largely of solitary library reading and writing. Perhaps somewhat unbelievably in this modern age digitization, my work cannot really be conducted outside of Japanese libraries, which alone have complete or nearly complete collections of the interwar boys' magazines that constitute my primary source. Unfortunately, these collections have not be scanned, so one must study them the old-fashioned way: coming to Japan and sitting in a library, which is exactly what I did this summer. Primarily, I worked in the Waseda University library, which was more than adequate for my needs, although I sometimes ventured further to the National Diet Library, which has even more comprehensive collections. I definitely made the most of my short time in Japan. In addition to this solitary work, I also tried to be more communal by attending a conference, a public lecture, and conducting a research trip Joetsu City, Niigata Prefecture, primarily to visit the Ogawa Mimei Memorial Library but also to meet with a local professor, Ono Yuji, who specializes in Ogawa. I was also able to visit the Donald Keene Center in Kashiwazaki City. In Ojiya City I visited Nishiwaki Junzaburo Memorial Hall. Like Ogawa, Nishiwaki is the subject of one of my dissertation's chapters.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

Working with my advisor, Dr. Hitomi Yoshio, was definitely a highlight of my summer. Although I had corresponded with her for several years, and knew each other through mutual connections, this was the first opportunity for me to spend any time with her in person. Her advice and guidance was immensely helpful to my research. Although I did not have much time for tourism, I would also mention the pleasant time I spent at the museums close to my Waseda University, my home base this summer, such as The Yayoi Museum, the Natsume Soseki Memorial Museum, and Kodansha Noma Memorial Museum. I also managed to visit the Japanese gardens at Kansenen Park, Higo Hosokawa Park, and Shinjuku Gyoen. It was a great pleasure.

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: TAI,Alex,Tianchi （ID No. SP25008 ）

2. Current affiliation: Massachusetts Institute of Technology

3. Research fields and specialties:
Engineering Sciences

4. Host institution: The University of Osaka

5. Host researcher: Prof. Shigenobu OGATA

6. Description of your current research

I am developing a machine learning interatomic potential for the Zr-Si-B-O system to study the ablation behavior of ultra-high temperature ZrB2-SiC coatings. Machine learning interatomic potentials are trained on high-fidelity quantum mechanical calculations to predict the forces and energies of atomic structures. They allow for highly accurate predictions at the atomic scale at a fraction of the cost of first principles calculations.

Of particular interest for the coating application is the transport of oxygen in the various phases that may be present in the system. Oxidation consumes the coating, so formation of a protective layer of stable oxide is desirable (this is the mechanism for stainless steel). At the relevant temperatures for the study, borosilicate glass and ZrO2 form when the coating is exposed to oxygen. Of these, the borosilicate glass is expected to have faster oxygen transport/ Thus, I am focusing first on constructing a potential with a good description of the borosilicate glass system, in particular the B-O bonding, which is challenging to describe with classical empirical interatomic potentials. Currently, I am exploring strategies to construct the training dataset for interatomic potentials such that bonding and oxygen transport in the system is well-described. The potential will be validated by MD simulation of the system and comparison of structural features with experiment.

7. Research implementation and results under the program

Title of your research plan:

Computational modeling of oxidation in ZrB_2-SiC coatings

Description of the research activities:

Performed literature review of experimental and computational work on ZrB2-SiC coatings, identifying standing questions and challenges in characterization.

Discussed strategies for capturing oxygen transport behavior with simulations.

Executed density functional theory calculations for ZrB2 and borosilicate glass.

Trained machine learning interatomic potentials on density functional theory calculations.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I enjoyed my stay in Japan and was able to experience many classic summer events like Koshien, Gozan no Okuribi, and Comiket.

9. Adviser's remarks (if any):

Research Report

1. Name: Megan HINKS （ID No. SP25009）

2. Current affiliation: Texas A&M University

3. Research fields and specialties:
Engineering Sciences

4. Host institution: Yokohama National University

5. Host researcher: Prof. Taiga MITSUYUKI

6. Description of your current research

The Nile River has been a source of geopolitical tension for hundreds of years, and this is expected to worsen with climate change and the global water crisis (Arsano, 2005). Egypt is the most downstream country on the river that serves nine other countries. With developments upstream, Egypt is in dire need of diversifying and increasing its water sources. Desalination has been evaluated as a solution to water scarcity in Egypt and has been utilized in tourist-heavy locations of the country where the cost to treat water is offset by the economic value of treated water (Kendie, 1999). Coupling desalination with an energy generation system allows it to operate independently of the electric system and mitigates for the high energy demand of desalination devices. Wave energy has been assessed as a renewable energy source to develop both technologies and to meet the global goals for net-zero carbon emissions.

Wave-powered desalination systems have been evaluated as a solution to the global water crisis and to mitigate the electricity demand required for reverse osmosis (RO). In the case for membrane-based desalination processes, wave energy converters (WECs) have the potential to produce the pressure required to feed saltwater through the system in order to convert it to freshwater (Yu and Jenne, 2018). Coupling these technologies results in an independent system that can operate adjacent to the coastal communities that they serve. Integrating WECs and RO desalination allows for advancements to be made in both sectors concurrently, creating opportunities for open water testing that is currently lacking in the field of WECs (Yu and Jenne, 2018). However, the ability for wave energy systems to produce power is contingent on the wave characteristics of the operation site. For the Egyptian coasts, there is a lack of long-term hydrodynamic modeling that is necessary to estimate the impact of a wave-powered desalination system. This research plan details the procedure for addressing this knowledge gap in wave data and using this to determine the feasibility for a wave-powered desalination system in Egypt.

7. Research implementation and results under the program

Title of your research plan: Wave resource assessment and feasibility for wave-powered desalination in Egypt

An extensive literature review was conducted to understand the knowledge gaps needed to be filled by this research. This informed the duration, domain, chosen software, and key parameters to be evaluated. The main goal of this research is to develop numerical databases for wave characteristics off of the northern coast of Egypt in the Mediterranean Sea and the entire Red Sea. MIKE 21 Spectral Waves (SW) is a leading software for modeling spectral waves and was utilized for this project.

First, bathymetric meshes were constructed for the project regions in the MIKE Zero interface. These used inputs for latitude, longitude, and water depth and were compiled to build unstructured meshes for both domains. Wave models are also dependent on atmospheric and tidal data, which were used to force the model. A scaled-down version of the full 42-year simulation was tested for a one-month run to properly debug and determine the required computational resources for the project. This run provided estimations for spectral wave energy, wave direction, wave heights, and wave periods.

The values for wave height and wave period were used as inputs for the Wave Energy Converter SIMulator (WEC-Sim) to model the performance of wave energy converters. WEC-Sim has a module specifically for desalination, but its default setup needs to be reconfigured for this case. Future work consists of running MIKE 21 SW for longer durations and validating these results with in-siu measurements. These will then be input to the WEC-Sim desalination module to determine the amount of freshwater that can be produced by these devices annually and ultimately, the feasibility of installation and operation in Egypt.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I participated in the homestay program through JSPS and got to meet my lovely friend Yayoi who hosted me for a weekend and again for lunch near the end of my stay. Through the Summer Program I got to explore a lot of Japan and immersed myself in Japanese culture through conversations, meals, museums, and festivals. I stayed in a ryokan in Hakone and also got to experience cultural sites and national treasures through numerous shrines and temples, art museums, and history museums. My favorite places that I visited during my time in Japan were the Yokohama Museum of Art, Seikado Bunko Art Museum in Tokyo, Hakone Ashinoko Museum Narukawa Art Museum, Tokyo National Museum, Yayoi Kusama Museum in Tokyo, Sumida River Fireworks, Katsuoji Temple in Osaka, Komyoin Temple in Kyoto, and Sennyuji Temple in Kyoto.

9. Adviser’s remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Giovanni Ferrer （ID No. SP25010）

2. Current affiliation: The Ohio State University

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: The University of Tokyo

5. Host researcher: Yasuyuki Kawahigashi

6. Description of your current research

The mathematical foundations for quantum mechanics lie in the study of operator algebras, which were first established by pioneers such as David Hilbert and John von Neumann. More explicitly, time evolution for a quantum system is described by unitary operators in a von Neumann algebra acting on a Hilbert space. One may think of these as lower quantum symmetries on the space of observables. As the field matured, researchers discovered a higher level of symmetries for these quantum objects, which themselves assemble into richer mathematical structures such as higher Hilbert spaces and unitary tensor categories. One of the pioneers in this development is Professor Kawahigashi, who co-authored the authoritative book Quantum Symmetries on Operator Algebras. Recently there has been a push towards even higher levels of unitary quantum symmetries. Indeed, one driving force up this mathematical “staircase” is the connection to topologically ordered phases of matter. Due to their remarkable robustness to noise, these phases of matter are especially valuable for quantum computing and error correcting codes. Moreover, higher Hilbert spaces are also expected to serve as the appropriate receptables for fully-extended topological quantum field theories. These not only hold physical significance, but also provide invariants for geometric objects as in knot theory. Through the research we conducted at the University of Tokio, our aim was to unify and describe the algebraic and geometric tools used in the study of operator algebras through the lens of higher unitary quantum symmetries.

7. Research implementation and results under the program

Title of your research plan: Higher Unitary Quantum Symmetries

Description of the research activities: In mathematics, dualities between algebra and geometry are powerful tools connecting seemingly different areas of study. Through these bridges, one can reinterpret a problem to exploit results and visualizations established by others.

Some fruitful examples of such duality theorems include

- *Gelfand duality and the spectral theorem*: This result at the level of so-called1-categories is a cornerstone theorem for operator algebras, relating commutative operator algebras to topological spaces through the well-known Yoneda embedding 米(ℂ).
- *The Serre-Swan theorem*: This result at the level of tensor categories (or 2-categories) relates algebraic K-theory to topological K-theory.
- *The Dauns-Hofmann theorem*: This result relates operator algebras to "relaxed" AQFTs.

In previous work, we constructed an abstract 3-dimensional mathematical structure 森(Hilb,2), known as a 3-category, whose

- OD points: correspond to commutative operator algebras,
- 1D lines: correspond to operator algebras,
- 2D discs: correspond to Hilbert modules, and
- 3D balls: correspond to module maps.

This construction is operator algebraic in nature and contains representation theoretic data about these operator algebraic objects. During our work this summer, we describe an alternative 3-category AQFT, where have

- 0D points: correspond to spaces,
- 1D lines: correspond to "relaxed" algebraic quantum field theories,
- 2D discs: correspond to sectors, and
- 3D balls: correspond to sector maps.

This construction is geometric on the other hand and contains homological data about these geometric objects. We then describe a duality between these algebraic and geometric objects which generalizes the previous three examples. Namely, we provide an equivalence between 森(Hilb,2) and AQFT.

JSPS Summer Program 2025
Research Report

1. Name: Phoebe Amy Ho （ID No. SP25011 ）

2. Current affiliation: University of California, Berkeley

3. Research fields and specialties:
Engineering Sciences

4. Host institution: The University of Tokyo

5. Host researcher: Professor Giancarlos Parady

6. Description of your current research

The theme of my doctoral research is understanding and enhancing resilience in transportation systems, addressing both individual behaviors and the robustness of the research practices used to study them. Resilience is the ability to withstand, adapt, and recover from disruptions. In previous research, I analyzed the resilience of public transit systems by examining how transit agencies adapted services in response to COVID-19-related ridership disruptions. My current research investigates the pandemic's long-term effects on activity-travel patterns, focusing on potential sociodemographic differences in recovery and adaptation across various mobility dimensions. I am also currently reviewing literature on the conceptualization of transportation resilience within the travel behavior literature. These projects recognize the dynamic nature of travel behavior under uncertainty and the inherent drive to restore stability.

In studying resilience, I see a broader parallel between the themes in my dissertation research and research practices within the field of travel behavior research. Resilience is core to the field since the ultimate goal of the field is to better understand travel behavior to inform policy, planning, and design of transportation systems. Yet, without reliable conclusions that hold up under different conditions, it raises concerns over the use of such results in applications with concrete impacts on society and the environment. As a young researcher, I am mindful of my role in the scientific community—not only to produce new knowledge but also to contribute to advancing research practices that align with our field's goals.

7. Research implementation and results under the program

Title of your research plan: Towards Robust Model Validation: A Toolkit for Validating Discrete Choice Models in Travel Behavior Research

Description of the research activities: During my time at the University of Tokyo, I developed a first iteration of a code base to calculate a set of standard validation performance metrics that can be used to evaluate travel mode choice models estimated using a commonly used software package called Biogeme. The performance metrics include the log-likelihood, rho-square, accuracy, percentage of predictions clearly correct/unclear/wrong (as defined by a user-specified clearness

threshold), fitting factor, mode share, aggregate and disaggregate error metrics, and a context-specific metric called the Value of Time. Importantly, this set of metrics goes beyond the standard set of goodness-of-fit metrics that are commonly reported in the literature (which are not sufficient to fully evaluate the validity of the modeling results). The current code setup is a starting point for integrating it into the software package, DCMBench (Discrete Choice Model Benchmarking), a broader benchmarking effort. More testing is required to complete this integration.

In the second half of the summer, I also reviewed literature on validation studies from various fields such as computer science and used this to inform a validation study for models used specifically in the travel behavior context, using the code that was developed during the fellowship. This study is motivated by the lack of guidance for selecting appropriate validation methods and the lack of empirical studies comparing validation methods in the travel behavior context. The objective of the study is to compare different validation methods (holdout validation, cross-validation, and bootstrapping) across various open-source datasets and model specifications of varying complexity. Together with my advisor, we have outlined the different experiment configurations to test and have begun setting up the experiment for the tests on the first dataset (Swiss metro).

In addition, I was able to attend and present in two seminars hosted at the University of Tokyo and Hiroshima University. I am grateful to have been given a platform to share this research effort with academics in the field, as well as the opportunity to meet peers and other academics in the field.

Overall, the JSPS summer fellowship enabled me to make significant progress on the validation work, an area that is a critical yet overlooked area of research in the travel behavior field, as well as build my academic network.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

The JSPS program has been an invaluable experience – both professionally and culturally. I have enjoyed working at a new environment at the University of Tokyo – everyone in the lab has been very kind, welcoming, and accommodating. One highlight is traveling to Hiroshima University for a seminar and enjoying some sightseeing on Miyajima afterwards, as well as visiting the Peace Memorial Park during the 80-year anniversary. I have had many other great experiences including climbing Mount Takao with my JSPS peers, a homestay with a young Japanese family, seeing the Sou Fujimoto (architect of the Grand Ring in Osaka) exhibit with my lab mate, going to a live jazz bar, rafting along the Tama River, visiting a wasabi farm in Okutama, and attending the Summer Sonic music festival (amongst many other memorable experiences!).

9. Adviser's remarks (if any): N/A

JSPS Summer Program 2025
Research Report

1. Name: Minh Duc Hoang (ID No. SP25012)

2. Current affiliation: University of California, Davis

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: ATR Neural Information Analysis Laboratories

5. Host researcher: Dr. Okito Yamashita

6. Description of your current research

Dopamine (DA) plays a key role in hippocampal functions such as spatial orientation, memory formation, and neurological disorders. Despite numerous studies uncovering the important role of dopamine in hippocampal function in spatial orientation, memory formation and even neurological disorders such as schizophrenia, its influence on hippocampal neural networks remains elusive.

Recent work by Hoang et al. (2025) using experimental data and computational spike train analysis demonstrated that dopamine decreases hippocampal network synchronization, promoting more diverse firing patterns. This suggests that DA modulates hippocampal neural coding and information flow by reshaping network activity. However, the underlying mechanisms through which dopamine shapes hippocampal functional networks remain elusive.

To address this gap, I develop a data-driven computational model of hippocampal networks that captures the effects of dopamine signaling on functional connectivity and dynamic activity patterns among hippocampal neurons. Using the Adaptive Exponential Integrate-and-Fire (AdEx) model, we constructed a two-dimensional grid network with distance-dependent connectivity designed to replicate patterns observed in experimental data (Hoang et al., 2025). By incorporating dopamine's influence on network connectivity, we anticipate that the model capture key changes in population dynamics observed in experiments, such as increased background firing rates and altered synchronization in neuronal networks.

The computational model is expected to provide a validated framework that reproduces hippocampal network activity and reveals how dopamine modulates excitatory/inhibitory balance, neuronal excitability, and plasticity. Through analyzing the model's dynamics, we aim to uncover the fundamental principles of dopamine's influence on neural representations in the hippocampus, offering key insights into its roles in spatial navigation, memory formation, and learning. Additionally, the model will generate testable predictions regarding dopamine-dependent changes in burst dynamics, synchrony, and network flexibility, bridging synaptic mechanisms to emergent network behavior and guiding future experimental investigations.

Reference

Hoang, H., Matsumoto, N., Miyano, M., Ikegaya, Y., Cortese, A. Dopamine-induced relaxation of spike synchrony diversifies burst patterns in cultured hippocampal networks, *Neural Networks*, 181:106888 (2025)

7. Research implementation and results under the program

Title of your research plan: Data-Driven Neural Network Modeling of Hippocampal Activity Under Dopaminergic Modulation

Description of the research activities:

During the research period, I attended and presented at multiple international conferences to present data and discuss results. Conferences attended included The Computational Neuroscience meetings in Florence, Italy and Niigata, Japan.

During the research period, I had bi-weekly one-on-one meetings with Dr. Hoang, discussing various aspects of the project such as methodologies, data analysis, figure generation, and participating in multiple group meetings with the ATR Neural Information Analysis Laboratories.

I shared my findings using figures during weekly in-person and hybrid group meetings with PowerPoint presentations. The meetings also included discussions on relevant journal articles.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

During my trip to Japan, I had the chance to live and work in a research environment. This experience allowed me not only to collaborate and interact with other researchers but also to enjoy casual moments together, like BBQ picnics, which offered deeper insights into Japanese culture and the character of its people.

Additionally, I had the opportunity to explore many of Japan's famous tourist destinations, including Himeji Castle, Kinkaku-ji, Expo 2025 in Osaka, and Niigata. A particularly memorable experience was visiting natural hot springs, or **onsen**, which are deeply ingrained in Japanese culture and renowned for their relaxing and healing qualities.

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Maia Williams (ID No. SP25013)

2. Current affiliation: Virginia Commonwealth University

3. Research fields and specialties:
Chemistry

4. Host institution: RIKEN BDR

5. Host researcher: Yoshihiro Shimizu

6. Description of your current research

I am a third-year PhD candidate in Chemistry at Virginia Commonwealth University. My research focuses on expanding the genetic code to create new opportunities in protein engineering. In particular, I study specially designed DNA and RNA components that allow cell-free translation systems to incorporate building blocks beyond the natural set of amino acids. My work involves developing transfer RNAs (tRNAs) that can recognize these new codons and faithfully add the correct amino acids during translation. By improving the efficiency and accuracy of these tRNAs, I aim to establish a foundation for new peptide discovery methods that could eventually produce molecules with therapeutic applications.

7. Research implementation and results under the program

Title of your research plan:

Reconstitution of E. coli tRNA modifications for in vitro transcribed tRNAs to improve ribosomal decoding

Description of the research activities:

During my stay at RIKEN BDR in the Shimizu Lab, I focused on improving the performance of in vitro transcribed (iVT) tRNAs by reintroducing post-transcriptional modifications that are absent in iVT systems. These modifications are critical for stabilizing tRNA structure and ensuring accurate decoding by the ribosome.

I reconstituted select *E. coli* tRNA modifications using purified enzymes, including pseudouridine synthases (TruA, TruB) and the methyltransferase TrmD, and incubated them with iVT tRNAs. To evaluate modification, I employed multiple complementary approaches: (i) a reverse transcription-based assay with CMCT treatment to detect pseudouridine, (ii) LC-MS analysis to confirm the modification state, and (iii) a reconstituted MTase-Glo assay in which we expressed and purified all necessary proteins and detected S-adenosylhomocysteine (SAH) as a readout of methyltransferase activity. The modified tRNAs were then tested in translation reactions using the PURE system, where their activity was compared directly with unmodified controls.

The results showed that enzymatically modified tRNAs have the potential to produce measurable improvements in both translation efficiency and fidelity relative to unmodified iVT tRNAs. While not all modification reactions reached full completion, these experiments established practical assays for monitoring modification and demonstrated that iVT tRNAs can be functionally enhanced through targeted reconstitution. Importantly, this work provides a foundation for extending the same strategy to unnatural base pair tRNAs, which will be central to my doctoral research on expanding the genetic code.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

In addition to research, one of the most rewarding aspects of this program was the opportunity to immerse myself in a new laboratory environment. I greatly appreciated how welcoming and open my colleagues were in sharing both their science and their culture with me. Learning to navigate a new culture and striving to understand it more deeply was both challenging and rewarding, and I feel that this experience has helped me grow not only as a researcher but also as a person. My Japanese language ability improved greatly

through daily life, and I am especially grateful for the time I was able to spend with my host family, with whom I remain closely connected.

The personal relationships I have built during this fellowship feel long-lasting, and I sincerely hope to return to Japan in the future to continue strengthening these connections. I also enjoyed exploring many parts of Japan, including Kochi, Awaji, Hiroshima, Osaka, Tokyo, Lake Biwa, and Kyoto. These travels, combined with daily experiences in Kobe, gave me a deep appreciation of Japan's history, culture, and natural beauty. Altogether, my time in Japan has been transformative, and I look forward to continuing both scientific and personal ties here in the years to come.

9. Adviser's remarks (if any):

JSPS Summer Program 2025
(SP25014) Research Report

1. Name: James SUN （ID No. SP25014）

2. Current affiliation: University of California, Berkeley

3. Research fields and specialties:
Social Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof. Yu TOKUNAGA

6. Description of your current research

The history of food and agriculture has come to the fore in recent years, especially as climate change threatens crop production around the world. However, despite its transnational nature and how prevalent rice is in both cultures and food, it is surprising how little literature exists on rice. Although a few pieces of literature exist on how Asian farmers cultivated rice in the U.S., very little exists on how they consumed rice and the ways that rice shaped their culture and identities. As a result, existing scholarship treats Asian farmers primarily as economic units (crop producers) as opposed to social and cultural units (people who produce, sell, and eat rice). Moreover, the important influence Japan had on U.S. rice cultivation throughout history—and the current rice trade between the U.S. and Japan—is often neglected. At Kyoto University, I will, through archival research in both Japan and the U.S., remedy this gap by analyzing 1) how rice came from Japan to the U.S. and 2) the ways in which rice was meaningful to the first Japanese immigrants bringing rice and rice cultivation techniques to the U.S. and how those attitudes changed over time.

I will, primarily through archival research in both Japan and the U.S., remedy this gap by analyzing 1) how rice came from Japan to the U.S. and 2) the ways in which rice was meaningful to the first Japanese immigrants bringing rice and rice cultivation techniques to the U.S. and 3) how those attitudes and practices changed over time.

7. Research implementation and results under the program

Title of your research plan:

The Transnational History of Japonica Rice in the U.S.

Description of the research activities:

I closely examined archival material at the National Diet Library, Japan Center for Asian Historical Records, Tokyo National Museum's archives, and the Diplomatic Archives of the Ministry of Foreign Affairs of Japan. I also met scholars related to my field, which will sow the seeds for a productive future longer-term research visit in Japan, when I hope to conduct interviews and an ethnography. Ultimately, I started to uncover the history of Japanese rice in the U.S. by studying 1) how Japanese migrants initially brought Japanese rice and rice culture to the U.S. 2) how rice shaped Japanese migrants' cultural identities before they migrated to the U.S. and how these ideas changed after migrating and 3) how the sociopolitical dimensions of rice trade and politics in Japan influenced the history of Japonica rice in the U.S. and how Japonica rice shaped Japanese migrants' identities. This research will contribute to a published journal article as well as a chapter of my dissertation, because Japanese farmers comprised a significant and important portion of Asian farmers in the U.S.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

For both research and cultural experience, I visited many museums, including the Tokyo National Museum. The Tokyo National Museum has a famous collection of archival materials that they place on display and materials that they store, including materials about agriculture.

9. Adviser’s remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Claire BRABANDER （ID No. SP25015）

2. Current affiliation: City University of New York, Graduate Center & Queens College

3. Research fields and specialties:
Social Sciences, Biological Sciences

4. Host institution: Hamamatsu University School of Medicine

5. Host researcher: Prof. Kenji TSUCHIYA

6. Description of your current research

My current research investigates the gene-environment interactions and the underlying mechanisms connecting prenatal stress exposure to future neurodevelopment and behavior in children. As global temperatures are rising, we aim to investigate the effect of prenatal heat stress on a child's future risk for psychopathology and the underlying biological mechanisms. In a New York City-based birth cohort (Stress in Pregnancy study), we have found that increased expression of gene modules regulating placental heat shock proteins was related to reduced effortful control (a psychological construct representing emotional regulation and executive functioning) in 12-month-old children in heat vulnerable neighborhoods. These findings showed that children who are prenatally exposed to high heat vulnerability may have a greater risk of altered neurodevelopmental trajectories in a diverse American population. However, most research is conducted in a Western population, which ignores heat prevention practices and possible biological adaptations of other regions, notably Asia. Thus, my research during the JSPS summer fellowship aimed to investigate gene-environment interactions and the role of heat in a Japanese population, namely using data collected from the Hamamatsu Birth Cohort for Mothers and Children (HBC Study). Here, we aimed to examine how prenatal heat exposure may exacerbate the relationship between the genetic risk for ADHD and internalizing and externalizing behavior in childhood. Preliminary results using polygenic risk scores (PRS) to indicate genetic risk for attention deficit hyperactivity disorder (ADHD) show an association with emotional problems at 50 months (β=0.194, p=.014), peer problems at 66 months (β=0.120, p=.032), and conduct problems at 99 months (β=0.174, p=.005). Our continued collaboration will aim to develop a measure of prenatal heat exposure for the HBC Study, which will allow us to investigate if global warming poses additional risk for child mental health and neurodevelopment.

7. Research implementation and results under the program

Title of your research plan:

Associations between polygenic risk scores for attention deficit hyperactivity disorder and externalizing and internalizing behaviors in 4- to 8-year-old children: the moderating effect of heat

Description of the research activities:

During the summer fellowship, I have met weekly with Dr. Kenji Tsuchiya and Dr. Abir Nagata, who is a collaborator on this project. They have both provided guidance to develop the current research question. Drs Tsuchiya and Nagata provided considerable insight into the antecedents of neurodevelopment and improved my understanding of the relationship with the environment.

I reviewed the extant literature from the HBC study to familiarize myself with the cohort, existing data, and remaining questions. Furthermore, I conducted a literature search to broaden my understanding of the genetic underpinnings of ADHD by learning about PRS. Additionally, in an attempt to determine heat exposure status for the HBC participants, I have familiarized myself with different heat indices and publicly available data on the Japan Meteorological Agency (JMA) website.

I have received training in Stata and familiarized myself with the HBC dataset. I applied my skills by performing structural equation modeling in Stata to produce the preliminary HBC results.

Future collaboration efforts will aim to identify prenatal heat exposure for HBC participants using JMA public data.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

Working with Dr. Kenji Tsuchiya and the team at Hamamatsu University was a great pleasure and honor. I thoroughly enjoyed my time understanding the perspectives of Japanese researchers, enjoying social gatherings with other students and professors, and taking advantage of asking professors questions one-on-one.

The opportunity to explore Japan and participate in a homestay were some special highlights of the time spent here. Looking forward to (hopefully) being back soon!

9. Adviser’s remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Alasdair Tew （ID No. SP25103）

2. Current affiliation: University of Cambridge

3. Research fields and specialties:
Mathematical and Physical Sciences
Chemistry

4. Host institution: University of Tokyo

5. Host researcher: Prof. Nobuhiro Yanai

6. Description of your current research

My research has focussed on the sensitisation of lanthanide nanoparticles with organic ligands for up and downconversion. I have synthesised novel organic sensitisers and lanthanide nanoparticles to gain understanding of the energy transfer process and maximise its efficiency. I have also worked to develop more rigorous and feasible quantification methodology to understand ligand binding dynamics, aggregation and accurately measure sensitisation efficiency. Mechanistic insight into the sensitisation process has been gained through advanced spectroscopic techniques such as transient absorption to reveal energy transfer pathways, rates and efficiency. Currently, we are examining the full series of lanthanides to understand the basis of the complex influence that lanthanides exert onto organics.

7. Research implementation and results under the program

Title of your research plan:

Application of lanthanide doped nanoparticles to triplet-triplet annihilation based ultraviolet upconversion systems.

Description of the research activities:

Two molecules were studied, a novel acid modified TIPS-naphthalene and perylene dicarboxylic acid both synthesised by a member of the Yanai Lab, Kenta Kanazawa. Then hybrid organic-inorganic systems were constructed via ligand exchange with $NaGdF_4$ and $NaCeF_4$, in both polar (HCl treated) and non-polar (oleic acid covered) environments. Photophysical measurements and characterisation of the novel hybrid systems including absorption, fluorescence and lifetime measurements revealed some interesting properties. The TIPS-napthalene – Gd hybrid showed a potential strong room temperature phosphorescence (roughly 20% the strength of the singlet emission). The perylene diacid showed strongly quenched singlet emission intensity and lifetimes, almost fully quenched by the Ce HCl sample. The fluorescence lifetime of the perylene was quenched from 4.9 ns in neat solutions to 2.9 ns for Gd HCl and 1.74 ns for Ce HCl, although the Ce HCl sample showed a clearly biexponential lifetime indicating multiple environments or possibly a back transfer from the Ce 5d state. There was a small peak shift in the absorption spectra for adsorption onto acid treated particles (both solvents in this case was DMF) but the untreated oleic capped particles showed a larger red shift. The emission spectra were different from the free perylene in both cases with both being redshifted although the spectra of the respective acid or untreated samples were similar in both cases.

The perylene triplet state could be tracked using transient absorption. The triplet PIA was found centred at 534 nm and in the oxygen free neat perylene sample the lifetime of this triplet was found to be 507 μs. The triplet lifetime was quenched to 20 μs for Gd samples and even shorted for Ce samples at around 1 μs although these measurements will need to be repeated on a setup with increased time resolution to confirm this. Following this, measurements of the triplet lifetime were made in magnetic fields up to 650 mT which showed no difference in triplet lifetime due to the magnetic field which may aid in the classification of interaction mechanism, for example local magnetic perturbation or exchange interaction however stronger magnetic fields will likely be needed to confirm this.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

Experiencing Japan first hand over an extended period was a fantastic experience and way to absorb the local culture. Everyone showed great kindness towards me and welcomed me everywhere. I really enjoyed visiting Onsen and experiencing the large variety they show.

9. Adviser's remarks (if any):

It was a great fortune for our research group to welcome Alasdair through the JSPS Summer Program. During his stay, we were able to gain a deep understanding of the characteristics of both lanthanide-doped nanoparticles and organic upconversion molecules, and took important initial steps toward combining the two. We plan to continue our joint research after he returns to the UK and publish our findings in a paper.

JSPS Summer Program 2025
Research Report

1. Name: Ryan Singh （ID No. SP25104 ）
2. Current affiliation: University of Sussex
3. Research fields and specialties: Interdisciplinary and Frontier Sciences
4. Host institution: RIKEN Centre for Brain Science
5. Host researcher: Team Director, Taro Toyoizumi
6. Description of your current research My current research sits at the intersection between computational neuroscience and machine learning. Specifically trying to assess the fundamental trade-offs faced by resource constrained decision-making systems. I am particularly interested in how local-learning algorithms interact with time and space constraints.

7. Research implementation and results under the program

Title of your research plan:

Complementary Encodings for Ameliorating the Speed-Accuracy Tradeoff in RBMs

Description of the research activities:

Recent work used Hopfield Networks with both dense and sparse encodings as a mathematical model of memory which can alternate between recalling specific examples and higher-level concepts. Here, we investigate whether similar complementary properties are observed for generative models. Specifically, we examine Restricted Boltzmann Machines (RBMs) and the effect of complementary encodings on the speed-accuracy tradeoff.

We introduce a toy model based on the topological difficulty of the XOR problem in which we can study the trade-off between mixing time and accuracy analytically. Allowing us to demonstrate sparse and dense encodings have complementary properties. Numerically, we demonstrate the benefit of alternating sparse and dense chains in both the toy model and larger random problems. We show that this strategy can outperform both sparse and dense networks individually.

More broadly this work points towards the importance of maintaining multiple ‘redundant’ sets of weights to speed up computational inference in local learning systems. An insight that may prove useful to understanding neural circuits and for designing energy efficient machine learning systems.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

9. Adviser’s remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Karan RUPARELL （ID No. SP25105 ）

2. Current affiliation: University of Reading

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Yamazaki Labs, University of Tokyo (Todai)

5. Host researcher: Associate Professor Dai Yamazaki

6. Description of your current research

My background is in mathematics and machine learning. Over the course of my PhD, I have been working on how to apply my knowledge from these areas to hydrological forecasting, having the privilege to work closely with the leading operational forecasting agency the European Centre for Medium-Range Weather Forecasts (ECMWF). My research focuses on adapting machine learning techniques to address critical challenges in hydrological forecasting, particularly where traditional hydrological or machine learning modelling approaches fall short (i.e., where an understanding of both is required to correctly address a problem).

My first paper involved developing Hydra-LSTM, a novel architecture that addresses the trade-off between global learning and local specificity. This technique allows the majority of a forecasting system to learn from a global database, while enabling specialized sections to be trained exclusively for individual rivers or subsets of rivers. This allows us to be able to specialise our models for particular regimes, or use data available only at specific places, while still using knowledge gained by the model through global training.

I have also focused on methods to generate statistically correct and easily communicable forecasts spanning 1 to 10 days ahead. This addresses the gap between model output and actionable information for water managers and stakeholders.

Currently, my research centres on creating models capable of simulating river flows in areas heavily influenced by human intervention. These managed systems present unique challenges because reservoir operators' decisions remain largely opaque and are inadequately represented in existing forecasting frameworks. Yet these upstream management decisions directly determine water availability for farmers, municipalities, and ecosystems downstream. My work aims to develop predictive models that can capture these human-influenced flow patterns, moving beyond the natural flow predictions that current LSTM approaches handle well, toward understanding and forecasting the managed water systems that increasingly define our global hydrological landscape.

7. Research implementation and results under the program

Title of your research plan:

The Secret Life Of Dams: Using Machine Learning To Predict Global Reservoir Discharge

Description of the research activities:

During my fellowship I worked in Yamazaki Laboratory. There, I presented my work in fortnightly reports to the team of 20 researchers, and seperately attended fortnightly discussions between our lab and Yoshimura Laboratory

The core technical contribution we made during this time was in developing an initial prototype for a global river model designed to predict river flow past Dams and other heavily regulated areas. This prototype used the Hydra-LSTM architecture that I previously developed.

My host researcher was also able to introduce me to many other academics outside of the laboratory. I took part in a workshop on Human Flood Interaction, which included researchers from institutions across Japan and internationally. This workshop provided valuable insights into the societal dimensions of flood management and the critical role of human decision-making in flood risk mitigation.

A particularly productive collaboration emerged through a one-week intensive working period with Dr. Tristan Hascoet from RIKEN Kobe. This collaboration focused on three interconnected challenges: communicating uncertainty in river flood forecasts, advancing spatial modelling techniques, and creating improved models for dam operation rules. As experts in machine learning Dr Hascoet and his team were incredibly valuable to work with, and I intend to carry on working with them, as I do with Yamazaki Labs.

The fellowship also included field-based experiences. I visited the Underground Water Temple, where I learned about the creative approaches designed to protect the Tokyo metropolitan area from flooding, having a 10 kilometre underground ‘shortcut’ for water to bypass Tokyo and be removed into the ocean. Additionally, I presented my research findings at an intensive laboratory conference held in Shiga Prefecture, which included an educational tour of the Fukui Prefecture Varve Museum

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

My time in Japan was incredibly enriching both personally and culturally. I stayed with a host family in Hachioji, which gave me a wonderful window into daily Japanese life, and we got to see the temples in Takao San and I learned about the mathematics exams for young kids as I helped my host siblings study. My host dad was a drummer, and through this and my own exploration I learned about Tokyo's live music scene, particularly in Shimokitazawa.

The intimate venues there have such a unique atmosphere, many things were cheap or free, I spent several evenings exploring different clubs and was amazed by the diversity of genres and the playfulness of performers. I also had the chance to attend a beautiful harp recital, which was a completely different but equally memorable musical experience.

The fellowship took me to some fascinating places beyond Tokyo. The Fukui Prefecture Varve Museum was particularly striking – seeing those ancient sediment layers gave me a whole new perspective on geological change, which connected nicely to my hydrology research.

I tried to embrace traditional Japanese culture whenever possible. I learned to make onigiri (which became my go-to lunch!), participated in several tea ceremonies, and went to several tea tastings where I developed a real appreciation for the subtlety of different green teas. I also hosted my own tea tastings, something that I also do back home in the UK.

All of these experiences made my fellowship feel like much more than just a research opportunity, it was a chance to really immerse myself in Japanese culture and build connections.

9. Adviser’s remarks (if any):

During the Summer Program, Mr. Karan worked with exceptional energy and dedication on his research activities. Given his background in mathematics, collaborating with the Yamazaki Laboratory—where numerical flood forecasting is developed from the physical processes—required mutual effort toward understanding each other’s approaches, but this exchange proved highly stimulating. He deepened his understanding of the physical aspects of floods and dam operations that must be considered when developing and evaluating machine learning models, and was able to identify promising directions for improving AI-based models.
He also engaged actively in discussions both within and outside the lab, and is expected to co-author multiple studies on AI flood forecasting. Beyond research, he interacted enthusiastically with lab members about British history, culture, and pop culture, quickly becoming a central mood-maker in the lab despite his short stay. His fellowship period can be evaluated as a highly successful one.

JSPS Summer Program 2025
(SP25106) Research Report

1. Name: Julie Tavernier （ID No. SP25106 ）

2. Current affiliation: University of Bath

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: University of Osaka

5. Host researcher: Professor Takehiko Yasuda

6. Description of your current research

My research is centered around counting number fields using various techniques taken from class field theory, harmonic analysis and most recently via counting rational points on a geometric object called a stack. Counting number theoretic objects using geometry is part of a field called arithmetic geometry. I also find conditions for the existence of number fields with prescribed ramification using a type of Brauer-Manin obstruction on the stack BG.

7. Research implementation and results under the program

Title of your research plan: Malle's conjecture on algebraic stacks

Description of the research activities:

Although our original plan was to study S3 extensions in characteristic 3, we decided to generalise to a wider class of extensions to make our results more general. In order to count field extensions, one must choose a height function to count by, which is determined by a raising function. In our case, we decided to construct a new class of height functions, which are determined by a function called a "v-function", and this comes from the representations of the group G defining the extensions, obtained in our case by modular representation theory, as we are working in positive characteristic. We used these representations to construct a v-function, depending on the characteristic of the field, the dimension of the representation and the generators of the group G. To determine the correct asymptotic formula, we calculate the a- and b- invariants. This is done by stratifying the moduli space that the v-function is defined on and calculating the dimension of each stratum. To calculate the a- and b-invariants, we used Python code to make our calculation more efficient, in particular to identify which groups give interesting invariants. Next, we will work on counting these extensions using algebraic stacks, via the inductive frameworks methods/

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I was fortunate to be invited to speak at Osaka One-day Workshop on Arithmetic of Stacks and Coverings held at the University of Osaka while I was there, where I had the opportunity to talk about my work to researchers from different universities across Japan. I also was able to go to Kobe University on a research visit to meet Professor Takashi Taniguchi and was invited to give a seminar at Kyoto University on my recent preprint, all of which were amazing opportunities.

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Lewis Cole （ID No. SP25107）

2. Current affiliation: Durham University

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: University of Tokyo

5. Host researcher: Prof. Masahito Yamazaki

6. Description of your current research

My research investigates the systematic construction and analysis of integrable field theories through higher-dimensional gauge theories. This framework allows us to generate new integrable theories with controlled mathematical properties and to study their fundamental properties. In addition, the higher-dimensional perspective provides insight into the geometric origins of integrability and facilitates new approaches to quantization.

Ongoing work focuses on expanding the theoretical framework to encompass broader classes of field theories and exploring applications to quantum field theory and string theory contexts. For example, recent work extended these techniques to gravitational systems, with applications in the construction of exact solutions to Einstein's equations. The long-term objective is to develop a comprehensive understanding of integrable structures across different physical systems and their geometric foundations.

7. Research implementation and results under the program

Title of your research plan:

Applications of Holomorphic-Topological Gauge Theories to Quantum Integrable Systems

Description of the research activities:

Over the duration of this program, we have explored holomorphic-topological gauge theories and their gravitational counterparts – an essential ingredient in the quantization of these systems. Recent work has shown that there is obstruction to the direct quantization of the holomorphic-topological gauge theories, known as an anomaly. Furthermore, the presence of an anomaly in the gauge theory has been shown to be equivalent to the failure of integrability in at associated field theory at the quantum level.

However, in certain circumstances it has been shown that it is possible to resolve this obstruction by coupling the gauge theory to a gravitational counterpart, thereby recovering the quantum integrability of the associated field theory. Understanding these gravitational counterparts is therefore of utmost importance in the long-term objective of understanding quantum integrability.

During this research visit, we have studied these gravitational counterparts and their coupling to holomorphic-topological gauge theories. In particular, we have consider the examples of Kodaira-Spencer gravity and Mabuchi gravity, and compared these theories to established results in the literature. We have made first steps towards connecting these theories to other known integrable models, and established a practical framework for addressing these questions. We expect this framework to provide a fruitful foundation for ongoing and future work.

JSPS Summer Program 2025
Research Report

1. Name: Leah S. Clare （ID No. SP25108）

2. Current affiliation: Lancaster University

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Planetary Plasma and Atmospheric Research Center, Tohoku University

5. Host researcher: Professor Fuminori Tsuchiya

6. Description of your current research

The duration of my PhD, titled Plasma-Neutral Interactions in Giant Planet Magnetospheres, has been focused on Saturn and its atmospheric and magnetospheric dynamics. The current study constitutes analysis of data from the Japanese ultraviolet telescope, Hisaki, and aims to constrain the H_2 emitted ultraviolet power from the atmosphere. Hisaki was a Japanese Space Exploration Agency (JAXA) space telescope that was dedicated to planetary science, observing solar system targets from low-Earth orbit for a decade. Due to the nature of the orbit, all observations are contaminated by foreground emissions from the Earth's extended atmosphere. A particularly careful reduction of the data for Saturn is required, as the signal in UV is weak compared to other targets observed by Hisaki. The analysis further extends to include comparisons to data from the flagship Cassini mission and the Hubble Space Telescope. Studying the emitted power provides an analysis of the response of the atmosphere to the solar activity, as well as furthering our understanding of the complex saturnian system. The overall goal of this study is to quantify the temporal variation of the emitted power and determine the mechanism that controls this. By including data from Cassini, and the Hubble Space Telescope, we can further determine the contribution of the aurorae to the overall power emitted from the planetary disk. Furthermore, these analyses provide an opportunity to evaluate the performance of Hisaki for observations of the outer planets, an important consideration for Hisaki's proposed successor, LAPYUTA.

7. Research implementation and results under the program

Title of your research plan:

Planetary Glow: Exploring Atmospheric Emissions of Solar System Planets

Description of the research activities:
A key goal of my research programme was to assess my analysis of Hisaki's Saturn observations. Discussions with Professor Tsuchiya and Japanese colleagues were invaluable (including meetings at Tokyo University of Science and Tohoku Gakuin University), leading to small but important improvements in my methods. The Saturn Hisaki analysis is now complete. Jupiter was a primary target for Hisaki. Io supplies neutral material that forms the Io plasma torus, which Hisaki observed alongside the northern aurora for over 2000 days. During my tenure, I analysed a 3-month period of higher-level data, complicated by the failure of Hisaki's guide camera. As Jupiter is plasma-dominated, its spectra differ from Saturn's, and analysing these data improved my skills with Hisaki methods while deepening my understanding of the Jovian system, moon–planet interactions, and their contrast with Saturn. During a visit to JAXA's Institute of Space and Astronautical Science, I met members of the Hisaki team I had previously only known by email, and I learned to use a Python package for astrophysical spectroscopy that will support my ongoing Jupiter study. I extended my study of Earth's atmospheric emissions to include helium, enabling comparisons with helium emission at Venus. This work aims to deepen understanding of how terrestrial atmospheres respond to different drivers on both magnetised and unmagnetised planets.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

This experience has fostered and strengthened research partnership and collaboration, and brought opportunities to consolidate my study and expand my skills with various resources. My coworkers at the laboratory have been more than welcoming, taking every opportunity to socialise, share their favourite restaurants, and insights to Japanese language and culture. I experienced Tanabata and I partook in the Homestay Programme; it was a fantastic opportunity to experience Japanese life and my homestay family greeted me with generosity and kindness.

9. Adviser's remarks (if any):

Leah Clare's two-month stay in our laboratory was highly beneficial. Her analysis of the HISAKI satellite data was thorough, and we are grateful for her significant contribution to our research. For the Japanese students in our lab, her presence also provided an excellent opportunity for international communication. We look forward to continuing our collaboration with her in the near future.

JSPS Summer Program 2025
Research Report

1. Name: Rufus E. DICKINSON （ID No. SP25109 ）

2. Current affiliation: Loughborough University

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof. Michio SANJOU

6. Description of your current research

The focus of my PhD project is on the complex anatomy of riverine and marine plants, and how it affects their interaction with aquatic currents. This has involved the development of a computational method for predicting this interaction (requiring novel mathematical models for simulating fluid-filament dynamics), as well as many different case studies to confirm method accuracy and explore plant anatomies, and theoretical work describing how the fluid interactions of leafy vegetation differs to simpler grasses. This work has so far considered relatively small scales – so in applying to JSPS, my goal was to use the flume laboratories in Kyoto for studying larger scale phenomena.

7. Research implementation and results under the program

Title of your research plan:

Does Small-Scale Aquatic Plant Morphology Matter at Large Scales?

Description of the research activities:

In the hydraulic flume laboratories at Kyoto University, we have studied fluid interaction with synthetic plants possessing leafy stems, and the wake characteristics of collected patches of these plants. This has been to investigate whether such nuanced details as leaf flexibility can impact the larger scale phenomena that allow aquatic vegetation to have a significant impact on ecohydrological processes, the null hypothesis being that there is a length scale of concern below which the effect of morphological detail is drowned out by the turbulent dynamics of river flow.

Early analyses of our laboratory data indicates that leaf flexibility significantly affects the drag produced by vegetation, and the manner in which it streamlines itself. In particular, we have seen that flexible foliage reconfigures in a way that potentially allows high velocity channels between and around plants in a patch, which would reduce nutrient transport in the vertical water column, and decrease sediment entrainment. Further analysis of our data will closely investigate this.

The primary method of our laboratory work has been to use Particle Image Velocimetry to record fluid motion: A laser light sheet illuminates a 2D plane of fluid within the 3D flume, and a high-speed camera films the movement of microscopic, buoyant and illuminated “seed particles” which display the fluid motion. Over 250 flow measurements have been taken, and at 5GB for each high-speed recording, this represents a vast quantity of data to analyze, and a particularly high-fidelity investigation into our research question.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

My favorite part of staying in Kyoto has been its beautiful landscape. Crossing wide, rushing rivers is a daily enjoyment, always surrounded by mountains along the horizon. These two features combine both in Uji and Arashiyama, where the feeling of cooling your feet in the clear waters whilst marveling at the tremendous peaks and valleys ahead is wonderful. In the myriad of historic buildings that Japan has to offer, one can see that admiration of this fine scenery has of course been held for hundreds of years – often found are screen paintings which depict these views in a powerfully atmospheric light.

9. Adviser’s remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Alexander James Wright （ID No. SP25110 ）

2. Current affiliation: Imperial College London

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: University of Tokyo

5. Host researcher: Tomosato Hioki

6. Description of your current research

Artificial spin ice (ASI) systems, arrays of frustrated interacting magnetic nanobars, are rich in nanomagnetic phenomena, owing to tuneable inter-bar interactions, non-linear responses, and the vast number of magnetic states accessible across the arrays. The magnetic states of the nanobars can be excited into resonant, coherent precession about the equilibrium magnetisation direction creating spin-waves (or their quasi-particle analogue "magnons"). The study and manipulation of these states offers a route towards highly efficient, low energy next-generation computing devices: neuromorphic computing using ASI has already been demonstrated by our group, successfully performing signal transformation and prediction tasks [1]; meanwhile ASI shows potential for wave-based phenomena, such as magnon frequency combing, in the technologically relevant GHz-THz regime.

My current research is exploring these phenomena in ASI systems formed from ferromagnet (FM)–non-magnetic spacer (NM)–ferromagnet trilayers, exploiting interactions between FM layers arising from stray magnetic fields. One such system is a continuous thin film of FM material that is coupled to ASI fabricated on its surface: stray, dipolar fields from the ASI imprint into the FM thin film, periodically modifying the local magnetisation texture. This structure simultaneously allows reconfigurability *via* the ASI while providing a continuous medium for facile optical or electrical readout *via* the thin film. We anticipate such a structure to be ideal for neuromorphic computation applications, superseding earlier structures that sacrifice either readout or reconfigurability in favour of the other. Our measurements of spin-wave resonance (using the spin-torque ferromagnetic resonance technique) show the emergence a rich spectrum of spin-wave modes in the magnetic thin film, compared with the single "Kittel" mode present in the unmodified film. Our micromagnetic simulations develop this picture further, revealing complex spin-wave dispersion, with magnonic bandgaps and Dirac-cone–like dispersions that are reconfigurable by setting the ASI state into different configurations. These early results are highly promising, but experimental measurements of these complex dispersions requires a metrology technique that can probe the spin-wave dynamics with sub-nanosecond (GHz) temporal resolution and nanometre spatial resolution.

[1] Gartside, J.C., Stenning, K.D., Vanstone, A. *et al.* Reconfigurable training and reservoir computing in an artificial spin-vortex ice via spin-wave fingerprinting. *Nat. Nanotechnol.* **17**, 460–469 (2022)

7. Research implementation and results under the program

Title of your research plan:

Magneto-optical readout of dipolar-coupled magnonic crystals for neuromorphic AI

Description of the research activities:

The Saitoh group at UTokyo is unique in the world in having developed a time-resolved, wide field magneto-optical microscopy system, run by Dr Tomosato Hioki. The system is able to measure mdeg rotations in the of polarised laser light from magneto-optical interactions between the laser and a magnetic sample. During my time at UTokyo, I have optimised the system to significantly improve the measurement time from one week to ~8 hours; coarse scans for exploring the parameter space can be taken in just 15 minutes. Taking advantage of these improvements, I have demonstrated magneto-optical imaging of spin waves in $Ni_{80}Fe_{20}$ thin films, down to thicknesses of 5 nm – significantly thinner than our previously estimated limit of 100 nm.

Meanwhile, I developed a recipe for electron beam lithography of ASI, to define arrays of nanobars ranging 300 – 800 nm in length and 150 – 300 nm in width. Using this recipe, I fabricated sets of NiFe ASI on NiFe thin films and started to measure their magneto-optical properties. Early results appear to show suppression of the resonant frequency of the NiFe film by the ASI, and a modification of the spin-wave precession in the ASI region: deeper analysis is ongoing.

We have also fabricated ASI on LuIG films – LuIG is an Iron Garnet ferrimagnet that exhibits strong magneto-optical properties. The ASI on these samples are reconfigurable from a simple saturated state to a complex periodic modulation. We have not had time to measure these samples yet, but intend to do so as part of an ongoing collaboration.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

9. Adviser's remarks (if any): During the first two weeks of his visit, Dr. Alexander Wright quickly mastered the required instruments and then conducted experiments independently. His example motivated our students. He also joined our sub-group meetings, engaging students and offering practical advice on experimental techniques, which energized and advanced our discussions. Beyond these technical contributions, his professionalism and collegiality earned the full confidence and respect of our members. I am very much grateful to have met such an outstanding researcher through this program and look forward to continued collaboration.

JSPS Summer Program 2025
Research Report

1. Name: Ellie C. PALMER DAVULCU （ID No. SP25111）

2. Current affiliation: University of Edinburgh

3. Research fields and specialties:
Humanities

4. Host institution: Waseda University

5. Host researcher: Prof. Masahiro MORIOKA

6. Description of your current research

The working title of my PhD project in philosophy is 'Being After Death: The Ethical and Temporal Implications of an Extended Spatial Identity in Japanese Philosophy', and I have mostly been working on Watsuji Tetsurō 和辻哲郎 and Tanabe Hajime 田辺元. The focus of my research is in 3 key stages: identity, death, and ethical impact. First, I argue that the primary obstacle of 'the problem of personal identity' concerns spatiality, stemming from ambiguously defined physical and conceptual boundaries of identity, sameness and material constitution. The first section is therefore focused on attempting to revise a more complete, metaphysical account of identity that I call the 'extended self view', through expanding the idea of the social and spatial self to encompass a notion of identity which can be found embodied in both our interpersonal relationships, as well as our relationships with material artefacts. This is the underlying thesis that is the foundation of the rest of my research. I ground this theory primarily using the work of Watsuji. Many consider Watsuji's philosophy of self, grounded in 間柄 to focus on human beings and natural environment but he also talks about artefacts too as "the self-externalization of human beings" which is less talked about by scholars so their role in betweenness is one of the focuses of my research in Japan.

On the back of this extended notion of identity, the second part of my project then explores the temporal implications of, for example, the self embodied by artefacts which may long outlive our bodily death and what this means for the existence and persistence of the self in the world after death, particularly how the can facilitate the continuation of our self-defining relations with the world. I also analyse the problems with present c□ncepti□ns □f self and beliefs in imm□rtality; if s□me immaterial n□n-worldly element like consciousness or a soul alone persists, either in a religious afterlife or uploaded into the digital cloud by what I term the 'silicon valley immortalists', whether this can be considered the persistence of self. I argue it cannot, due to the importance of the survival of our relations to things in the world that I mention in my account of self.

The aim and impact that then stems from these considerations concerns the ethical implications, and the hope that this stance will aid the world in departing from such extreme individualist ethics and provide motivation for us to have more concern for the environment and other people, both during our lives and after death.

7. Research implementation and results under the program

Title of your research plan:

The Continuing Relations of the Dead and the World in Japanese Philosophy

Description of the research activities:

I have focused on researching the relationships between the dead and the world through the relationships persons have with artefacts. I have attended around a dozen talks during my stay which has greatly aided my research, especially a talk by my host professor on Inochi, and a conference all about Watsuji. I have given several guest lectures and conferences presentations all around Japan including in my host institution of Waseda, a trip to the Kansai region and Akita. I had research meetings with my own host and met with other specialists in my field such as Prof. Cerda in Kyoto University, Prof. Kageyama in Kwansei Gakuin, Prof. Liederbach in Kwansei Gakuin, Prof. O'Muireartaigh in Aichi University and Prof. Shuttleworth in Akita University. I have done research into mementos and historical artefacts at museums around Japan. We hosted a workshop with another philosophy JSPS fellow at Waseda University. I have drafted a paper based on my research and hope to submit it for publication. Overall this experience has been absolutely invaluable for my research topic and I will do everything I can to maintain the relationships I have made on my trip and one day return to further this research.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I did homestay and attended Japanese classes as well as lectures in Japanese to improve my listening skills.

9. Adviser's remarks (if any):

The JSPS Fellow, Ellie C. PALMER DAVULCU, has nearly completed her project during her stay at Waseda University. We have engaged in several discussions concerning her research topics, through which our collaborative work has made significant progress. I am confident that her study of Kyoto School philosophers, together with her research on the philosophy of death and the self, has successfully achieved the objectives she set at the outset of her fellowship.

August 20th, 2025.
Masahiro Morioka, Professor at Waseda University

JSPS Summer Program 2025
Research Report

1. Name: Andrea VERGANTI （ID No. SP25112）

2. Current affiliation: University of St Andrews

3. Research fields and specialties:
Humanities, Art History

4. Host institution: University of Kyushu

5. Host researcher: Prof. Anton SCHWEIZER

6. Description of your current research

As art history is taking a 'global turn' (Farago, 2017), cross-cultural exchange and connected histories in the early modern period are increasingly becoming the subject of analysis (Riello, 2019; Rothman, 2021). However, European encounters with Eastern Asia at the time and the creation of an Asian 'other' are still understudied (Biedermann, 2017; Tripepi, 2022). By examining the modalities of representation of the Japanese on the unique occasion of two ambassadorial visits to the pope in 1585 and 1615, my PhD thesis will offer a much-needed correction to this critical neglect.

Crucially, this thesis will also investigate the construction of ethnic 'otherness' in Japan, thus positing the Japanese experience as equal to the European one while recognising the two-sided responses occasioned by early modern intercultural encounters (Bhabha, 1994). This analysis will thus present an unconventional perspective on the creation of Eurocentric narratives (Subrahmanyam, 2005) and act towards their deconstruction.

7. Research implementation and results under the program

Title of your research plan: **The Creation of a Japanese 'Other' in Early Modern Europe and of an Ethnic 'Other' in Japan**

Description of the research activities: The fellowship at Kyushu University proved crucial for my analysis of both the representation of the Japanese in Europe and of the Europeans in Japan. Through exchanges with Prof. Schweizer, I could significantly improve my knowledge of Japanese art history and visual culture, particularly in relation to the depiction of foreigners. I was then able to examine a folding screen representing Westerners held at the Fukuoka City Art Museum. This work, created in conjunction with the Jesuit school of painters for the ruling Kuroda family and combining elements of both the European and the Japanese pictorial tradition, provided me with important insights into the role art played in the exchanges between the European missionaries and local daimyo around the turn of the seventeenth century. Despite the Western figures being secular, they ambiguously hint at Christian iconography derived from European prints, thus revealing that they were created at a time of increasing religious tension. A group of students and

professors from the University of Kyushu accompanied me in the viewing of this work, which resulted in a fruitful exchange of ideas.

Research trips to Nagasaki and Kyoto allowed me to examine depictions of 'nanban' figures and to begin analysing the polyvalent ways in which the Europeans were incorporated into Japanese iconography to signify military power, evoke talismanic protection or invite wealth and economic success.

During my fellowship, I was also able to view the portraits of Ito Mancio - the main representative of the 1585 embassy to the pope – and of Father Mesquita – the Jesuit priest who accompanied the legates – held at the Nagasaki Museum of History and Culture. I could analyse how the artist has rendered distinguishable Eastern Asian features on Mancio's face, while also trying to evoke the shape of his kimono. This work betrays the fact that the painter was unfamiliar with how a Japanese person and their costume would look, yet he/she portrayed Mancio in a way that made him relatable to a European audience, avoiding putting an emphasis on his physical difference and opting not to depict the foreign-looking ornamentations of his kimono seen in other drawings of the legate. Viewing the portraits in person allowed me to appreciate the draughtsmanship of their creator and better understand the circumstances in which they were made; as the artist who drew them is unknown, I am now able to attempt an attribution.

Significantly, during my fellowship at the University of Kyushu I could benefit from discussions with members of the department as well as from the use of relevant materials in the university library; I also had access to literature in Japanese, which I felt more comfortable reading thanks to the improved language skills I could develop during my stay in Japan.

8. Please add your comments, including any cultural experience during your stay in Japan:

The JSPS Summer Program proved invaluable in deepening my understanding of Japanese culture and of life in Japan. I particularly enjoyed experiencing the Hakata Gion Festival in July and the Shōrōnagashi held in Nagasaki for Obon. I became interested in Japanese traditional theatre and attended Kabuki and Noh performances, the latter proving quite relevant for my research, as it offered me the opportunity of seeing costumes of the period I am studying. The homestay organized as part of the program afforded me the precious opportunity of participating in the life of a family, and I could hugely benefit from the kindness and warmth of the many Japanese people I have met, many of whom also patiently helped me improve my languages skills.

9. Adviser's remarks (if any):

The sojourn of Mr. Verganti was accomplished according to plan, all hopes were fully realized. The sojourn provided manyfold occasions for scholarly interaction with regular meetings, online consultations, and introductions to collections and source material. Beyond one-on-one interactions, there also was a special viewing session realized together with graduate students and an additional colleague from the host department. On-site visits of this kind are indispensable for close analysis of artworks. Taken together, this short-term collaboration has set the stage for continuous collaboration in the near future.

JSPS Summer Program 2025
Research Report

1. Name: Chloe FIELDING （ID No. SP25113）

2. Current affiliation: Durham University

3. Research fields and specialties:
Social Sciences

4. Host institution: Hamamatsu University School of Medicine

5. Host researcher: Professor Atsushi SENJU

6. Description of your current research

Increasing numbers of pupils are experiencing school attendance difficulties globally (Department for Education, 2024; Havik & Ingul, 2021; Ministry of Education, Culture, Sports, Science and Technology, 2024), which may have also been exacerbated by the COVID-19 pandemic (e.g., Hamilton, 2024). Research has highlighted that school distress, defined as when a young person cannot attend school due to the emotional distress they experience, is an important reason underpinning attendance difficulties (e.g., Totsika et al., 2020; Connolly et al., 2023). Research also suggests that a significant number of pupils experiencing school distress and attendance difficulties are neurodivergent (e.g., Connolly et al., 2023). My doctoral research therefore explores neurodivergent pupils' experiences of school distress and attendance difficulties.

Most of my doctoral research to date has been qualitative. My research has involved interviewing (1) 30 neurodivergent young people (Fielding et al., 2025); (2) 44 parents of neurodivergent young people; and (3) 16 members of staff working with school pupils, to explore their insights into neurodivergent pupils' school distress and attendance difficulties in UK mainstream schools. Through reflexive thematic analyses of the interviews with young people and parents (the analysis of the interviews with school staff is ongoing), I have constructed some important themes. Firstly, young people explained that the UK mainstream school environment is difficult for them, and that the difficult aspects of the school environment, such as being around lots of people, sensory differences, and change, interact with one another. Pupils described different presentations of school distress, and the different impacts that school distress had on them. Pupils also described a lack of understanding and support, especially from staff in their schools. The final theme explored the lack of alternatives to mainstream school for some neurodivergent pupils in the UK. Complementing the findings from the interviews with young people, parents also spoke about the misalignment between UK mainstream schools and their children's needs, a dysfunctional support system, and a devasting impact on their child and their wider family network. Parents also considered how we could change the UK education system to foster inclusion for neurodivergent pupils.

7. Research implementation and results under the program

Title of your research plan:

Japanese Pupils' Experiences of School Distress and Attendance Difficulties

Description of the research activities:

Our first goal was to develop research questions based on a pre-existing dataset about school attendance in Japan, which was commissioned by the Ministry of Education, Culture, Sports, Science and Technology, to explore if the challenges experienced by UK pupils are also experienced by Japanese pupils. Alongside academic staff in Hamamatsu and Osaka, we planned several papers to investigate different aspects of this dataset. We submitted an ethics application to the ethics board of Hamamatsu University School of Medicine, and will start data analysis once we obtain ethics approval. In the future, we hope to plan a cross-cultural exploration of neurodivergent pupils' experiences of school distress and attendance difficulties across Japan and the UK. Our research activities have resulted in a long-term collaboration between researchers in the UK and Japan in this research area.

Our second goal was for me to meet other researchers in Japan who are conducting relevant research. Since I was based at Hamamatsu University School of Medicine, I learnt from students and staff about the many ongoing research projects exploring development in the Centre. I also visited Prof Masahiro Hirai at Nagoya University, and Prof Kosuke Asada at Toyo University. At these universities, I met students and staff working on various developmental and social psychology projects. I also gave research presentations at all three Universities about two studies from my doctoral research, which enabled me to participate in meaningful discussions about my research and its relevance in Japan.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I have had an incredible time in Japan. Not only have I developed academically, but I have had many opportunities to experience Japanese culture. A particular highlight was my homestay with a Japanese family. I would like to thank Prof Senju and everyone in the centre for hosting me, as well as Prof Hirai and Prof Asada for welcoming me to their research centres. I would also like to thank Emi Higashimoto for all her organisational help before arriving in Japan and during my fellowship.

9. Adviser's remarks (if any):

Chloe has made outstanding achievements during her short visit. She has made a clear research plan and helped us submit ethics application for this project. This project will lead to an innovative research which I'm sure will be published as a peer-reviewed research article. She also gave three seminar talks in Hamamatsu, Nagoya and Toyo Universities, and engaged in active research discussions with faculties, research staff and students in these universities. I believe it will lead to Japan-UK collaboration in developmental psychology and beyond, and could contribute to further inter-institutional relationship between Durham University and Hamamatsu University School of Medicine.

【SP25114】

JSPS Summer Program 2025
Research Report

1. Name: Dr Kate Elizabeth WALKER （ID No. SP25114 ）

2. Current affiliation: Independent scholar

3. Research fields and specialties:
Humanities

4. Host institution: Kyoto City University of the Arts

5. Host researcher: Prof Mitsuko KAWABATA

6. Description of your current research

My research explores how music and dance are used as nation branding tools at international Expos. These gatherings bring together nation states from around the world, each seeking to showcase their culture, values, and priorities on a global stage. Performances of music and dance often play a central role in this, shaping how audiences perceive a country.

At the same time, Expos and similar events increasingly link their programmes to global themes such as sustainability, innovation, and social development. I am particularly interested in how performances are used to highlight — or sometimes to sidestep — objectives such as environmental protection, gender equality or decent work.

To explore these questions, I combine on-site fieldwork with hybrid and digital performances and media. I observe concerts and workshops, and speak with musicians, dancers, and organisers about their aims and experiences. My research examines how decisions about who performs, what is performed, and how it is presented reflect wider political and commercial priorities.

7. Research implementation and results under the program

Title of your research plan: Choreographing Change: The Role of Music and Dance in Nation Branding and Sustainable Development at Expo 2025 Osaka

Description of the research activities:

My research focused on three nation states at Expo 2025 — Austria, Burkina Faso, and Jamaica — examining both their in-person and digital activities, with particular attention to the role of music and dance and their interconnections with the Sustainable Development Goals (SDGs). I attended, documented, and analysed the National Days and associated concerts for Burkina Faso and Jamaica, and also attended concerts hosted by the Austria Pavilion, exploring differences between in-person and online attendance.

In addition, I studied two major events organised by Japanese institutions which were in-person only. The first was the *1,000 Taiko* performance, which brought together more than 1,000 drummers from every prefecture in Japan as well as Brazil and Taiwan. The second was a workshop on *Music and the SDGs*, organised by faculty and students at Rikkyo University, which explored the interconnections between music and the SDGs.

To carry out this work, I visited the Expo site seven times and combined these in-person observations with digital fieldwork conducted through the official Expo app. This hybrid ethnographic approach allowed me to capture both the live, embodied aspects of performance and the ways in which music and dance are presented and consumed in digital spaces.

By selecting three countries with very different resources and approaches, I aimed to capture geographic, political, and artistic diversity. Despite these differences, all three incorporated both music and dance into their programmes, offering distinct perspectives on how performance can be used as a tool of nation branding and as a means of engaging with global agendas.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I very much enjoyed my homestay experience with Yuki-san and her family, including their three beautiful dogs, in central Kyoto. I also served as a volunteer at *Sukiyaki Meets the World*, Japan's largest world music festival, in Toyama Prefecture, where I looked after visiting musicians from Réunion Island, a French department in the Indian Ocean. During my stay, I improved my Japanese language skills through daily communication with locals, which greatly enriched my experience. In addition, I visited various museums and art galleries, including an excellent exhibition at the Kyoto Museum of Modern Art titled *Secrets of the Kimono: The Advent of Yuzen Dyeing*.

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Nicola KELLY （ID No. SP25116 ）

2. Current affiliation: University of Cambridge

3. Research fields and specialties:
Mathematical and Physical Sciences

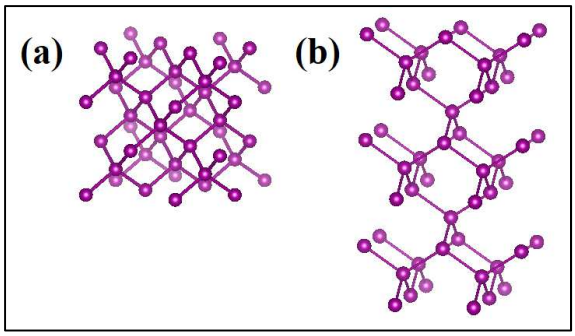
4. Host institution: National Institute for Materials Science (NIMS), Tsukuba

5. Host researcher: Dr Yoshihiro TSUJIMOTO

6. Description of your current research

I am a postdoctoral research fellow in the area of solid-state physics. I have been studying the relationships between crystal structure and magnetic properties of solid oxides and borates containing lanthanide (rare earth) ions. These compounds may have future applications in magnetic refrigeration technology.

I have recently studied the lanthanide tantalates and niobates, LnTaO$_4$ and LnTaO$_4$. The magnetic Ln^{3+} ions in these compounds are arranged in a diamond-like network which is distorted or "stretched" from perfect cubic symmetry:



(a) Cubic diamond lattice. (b) Stretched diamond lattice.

This kind of arrangement of magnetic ions produces a phenomenon called geometric magnetic frustration, which results in very low magnetic ordering temperatures compared with other lanthanide compounds. I found that no magnetic order occurs above 3 kelvin in any of the compounds LnTaO$_4$ with Ln = Nd–Er. However, I was unable to synthesise YbTaO$_4$ in this structure type during my PhD, because it favours a different structure when made using normal laboratory furnaces. Recently there has been significant interest in YbNbO$_4$ as a quantum spin liquid candidate (where there is no magnetic order at any temperature, however cold – the researchers measured down to 300 millikelvin) and in the related compound Na$_{0.5}$Yb$_{0.5}$WO$_4$, so I was keen to investigate YbTaO$_4$ using high-pressure synthesis.

7. Research implementation and results under the program

Title of your research plan:

High-Pressure Synthesis of Ytterbium-Based Quantum Magnets

Description of the research activities:

NIMS is a world-class location for high-pressure synthesis: its 30,000 ton press is the key source for ultra-pure hexagonal boron nitride crystals, used in laboratories all around the world for research into 2D materials. I used one of the smaller presses (1,500 ton) to prepare my samples under high pressure, high temperature conditions.

After varying the reaction conditions, I successfully synthesised $YbTaO_4$ in the target "M" structure type at 6 GPa and 1800 °C. We measured its magnetic properties using susceptibility and heat capacity and found that it does not show any magnetic order above 2 K. It has a Kramers doublet ground state with effective quantum number J=1/2, which is typical of Yb^{3+} compounds.

I also investigated the series of compounds $YbNb_xTa_{1-x}O_4$ ($0 < x \leq 1$) under the same synthetic conditions. Interestingly, the samples made at high pressure with $x > 0$ were coloured, unlike the white colour observed under ambient pressure synthesis. We have not yet determined the cause of this behaviour, which will be an avenue for future research.

I am currently writing a journal article about our study of $YbTaO_4$ and hope that it can be submitted before the end of the year.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I felt warmly welcomed to Japan by everybody I met: at the lab, church services, parkrun events, and tourist destinations. With the research group in Tsukuba we had a Japanese-style BBQ, a lunch at an Indian restaurant, shaved ice dessert, and baked sweet potato – a regional speciality. Using the network of my PhD supervisor I was able to visit laboratories in Tokyo, Osaka, Kyoto and Nagoya to give presentations and do sightseeing. I also visited Yokohama, Hakone, and Nanyo. I tried many different and delicious foods – my favourite experience was nagashi-somen (flowing noodles) with the wonderful host family. Thank you to JSPS and to my hosts, Tsujimoto-san and Yamaura-san, for this great opportunity.

9. Adviser's remarks (if any):

I was really happy to host Dr. Kelly through this program. At first, I was a bit worried about whether her research would go smoothly given the short stay, but once she got started, she quickly optimized the experimental conditions and achieved results that went beyond what I had expected.

I was also impressed by how actively she made use of the program – visiting labs at different universities and connecting with researchers there. There's so much I could say about her time here, but one thing that stood out was how her presence at NIMS had a positive impact on my group students. It was great to see how encouraged they were by her research and attitude.

JSPS Summer Program 2025
Research Report

1. Name: Isabella R. GAIR （ID No. SP25117 ）

2. Current affiliation: University of Southampton

3. Research fields and specialties:
Engineering Sciences

4. Host institution: Kyushu University

5. Host researcher: Prof. Hiroyoshi TANAKA

6. Description of your current research

This PhD project investigates Nanol®, a copper nanoparticle-based additive patented by Nanol Technologies Oy, which forms a low-shear copper layer on steel surfaces to reduce friction and wear. The work at Kyushu University focuses on its potential to mitigate hydrogen wear, a major issue in bearings for hydrogen-based technologies where atomic hydrogen penetrates steel, causing embrittlement and fatigue. Experiments were conducted using polyalphaolefin (PAO32) oil with and without Nanol® in a rolling contact fatigue (RCF) rig under high load, 120 °C, and a 99.98% hydrogen environment. Performance was evaluated based on fatigue life, tribofilm characteristics, lubricant chemistry, and hydrogen concentration measured via Thermal Desorption Spectroscopy (TDS).

7. Research implementation and results under the program

Title of your research plan:

Copper Nanoparticles – a Sustainable Additive for Lubrication of Hydrogen Technology

Description of the research activities:

Lubricating oil (PAO32) with and without Nanol® was tested for 6, 12, and 24 hours in a Rolling Contact Fatigue (RCF) tribotester with a thrust roller bearing to evaluate hydrogen wear and the effect of Nanol® over time. Rollers lubricated with Nanol® showed no flaking up to 24 hours, while PAO32-only specimens flaked at both 12 and 24 hours. White etching cracks (WECs) were observed in all 24-hour rollers, suggesting that while Nanol® leads to a potential improvement in fatigue life, it does not fully prevent hydrogen wear under prolonged exposure. Specimens lubricated with Nanol® had a higher hydrogen concentration than those with PAO32 only, which is unexpected and does not explain this improved performance.

Post-testing analysis confirmed the formation of a copper layer on Nanol®-lubricated specimens, peaking at 12 hours and thinning afterwards (Fig. 1a). This layer forms via a redox reaction between the copper oleate and steel, creating copper and iron oleate. 3D profilometry showed localised steel depletion on rings and copper buildup on rollers, also peaking at 12 hours (Fig. 1b). By 24 hours, the wear tracks became significantly smoother. The smoothness and high thermal conductivity of the copper-coated areas reduce friction and localised heating, which limits the thermal expansion of the roller. This likely explains the absence of flaking in Nanol®-lubricated specimens.

Fourier-Transform Infrared Spectroscopy (FTIR) showed a reduction in oleic acid (OA) after 24 hours, corresponding to the thinning of the copper layer. Raman spectroscopy confirmed the presence of copper oxide on the wear tracks, indicating that OA was consumed and oxidised.

In conclusion, Nanol® reduces hydrogen wear and delays flaking, but complex mechanisms such as the copper-steel interaction and increase in hydrogen concentration present opportunities for further study into optimising Nanol® for hydrogen-rich environments.

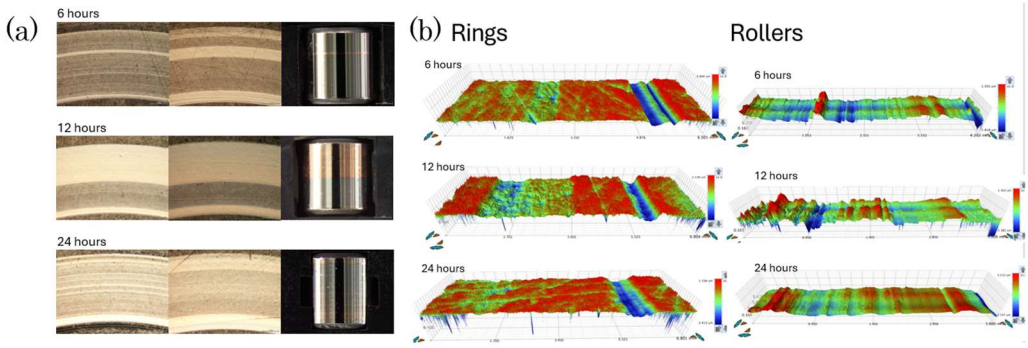


Fig. 1(a) Optical images of specimens lubricated with Nanol® at different time intervals. From left to right: bottom ring, top ring, roller.

(b) 3D profilometry measurements of top ring (left) and roller (right) lubricated with Nanol®.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

The JSPS program has been an incredible experience, helping with my understanding of my research and also allowing me to immerse myself in Japanese culture. I had the opportunity to go to some amazing places and events such as the Hakata Gion Festival, Meinohama fireworks, Nanzo-in Temple and Miyajima Island.

One of my personal highlights was visiting Okunoshima, also known as Rabbit Island. This was a place I first saw in a documentary when I was 12 and never imagined I would visit in person. Despite a 40-minute detour after arriving at the wrong port, the island was beautiful, feeling like a tropical paradise, with friendly rabbits approaching from all directions.

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: CACHARD Garance (ID No. SP25202)

2. Current affiliation : Muséum National d'Histoire Naturelle

3. Research fields and specialties:
Biological Sciences

4. Host institution: The University of Tokyo

5. Host researcher: Prof. KONDO Osamu

6. Description of your current research

My current research investigates the evolution and migration of ancient hominins on the Korean Peninsula. By leveraging my proficiency in Korean, I analyze Paleolithic skulls from sites such as Ryonggok, Mandal, Sungrisan, and Sangsi through the translation of excavation reports and morphological, metric, and statistical analyses. Preliminary findings suggest that these fossils, dated between 75,000 and 30,000 years ago, exhibit unique cranial traits that may reflect distinct evolutionary paths and raise important questions about the arrival of *Homo sapiens* in East Asia. My methodology combines geometric morphometrics, 3D modeling, and statistical analysis to assess craniofacial variation, linking phenotypic diversity to adaptive and migratory processes. Supported by fossil collections from various institutions, this research contributes to our understanding of human diversity and the complexity of Homo sapiens' expansion across Asia.

7. Research implementation and results under the program

Title of your research plan: Bioarchaeological Insights from a Late Jomon Collective Burial in Hokkaido

During my stay in Japan, I studied two archaeological sites: the Iyai rock shelter and Usu-Moshiri. This report focuses on the research conducted at the Usu-Moshiri site. Located on a small islet (~10,000 m²) in Usu Bay near Mount Usu in Date City, Hokkaido, Usu-Moshiri offers a rare and valuable insight into the funerary practices of late Jomon and Epi-Jomon populations in a dynamic coastal volcanic setting. Excavations, first carried out from 1985 to 1989 and resumed between 2018 and 2025, revealed a complex stratigraphy composed of shell-rich deposits, volcanic ash, and clay, reflecting both environmental processes and human activity. One of the most significant discoveries at the site is Grave 18, an annular burial structure encircled by a distinctive white sand ring. This grave was arranged in a manner suggesting collective reburial (saisōbo), a funerary practice associated with the Esan cultural tradition (ca. 2300–1700 BP).

My study focused on the 11 individuals recovered from Grave 18. I analyzed human cranial remains, including skulls, mandibles, and teeth. The research was conducted in several stages. First, I examined each preserved anatomical element, documented it using anatomical drawings, and created a preservation table for all individuals. I then identified and classified all preserved teeth, determining whether they were maxillary or mandibular, and distinguishing their side (left/right). This identification process was guided by established dental and anatomical references (White et *al*. 2012, Schaefer et *al*. 2009…).

When necessary, I carried out reconstructions of fragmented elements. These reconstructions are not only crucial for preservation but also facilitate morphological and metrical analyses.

Next, I photographed each specimen, capturing five standard views of the skulls and mandibles, to ensure a complete visual record. With these preparatory steps complete, I began detailed analyses including metric measurements, morphological assessment, CT scanning, 3D modeling, and geometric morphometrics. I also performed sex and age estimations for each individual.

For the metrical analysis, I followed the standardized protocol established by Martin (1928) and widely used in biological anthropology. I also created a personal comparative dataset using reference specimens I had previously studied abroad, for both cranial and mandibular metrics. In addition, for certain traits specific to the Japanese archaeological context, such as the flatness of the midface, often used to characterize Jomon remains.

Comparative analysis (ACP) shows that Usu-Moshiri individuals overlap with Jomon and Ainu populations, suggesting morphological continuity, while remaining distinct from the Yayoi group, which tends to show smaller and more gracile cranial features. Modern humans display a broad distribution, but some cluster near the Usu-Moshiri and Jomon individuals, supporting partial continuity. Taforalt specimens, from Maroc, were clearly separated from all East Asian samples, highlighting geographic and morphological divergence.

Specific metric variables further support these findings. Maxillary chord length (zmCH) shows high variability among Usu-Moshiri individuals, with median values close to those of Ainu and Yayoi populations. The Jomon group displays the highest values, while modern Japanese exhibit the lowest, suggesting a reduction of the midfacial region over time. Frontal chord length (FrCH) also varies, with Usu-Moshiri individuals presenting some of the highest values observed, possibly indicating a greater frontal projection. These cranial traits may reflect both archaic characteristics and regional adaptations.

Overall, the results suggest that the Usu-Moshiri individuals exhibit a combination of archaic traits, regional continuity with Jomon and Ainu populations, and phenotypic variability that could reflect both cultural practices and evolutionary processes within ancient coastal communities of northern Japan.

8. Please add your comments, including any cultural experience during your stay in Japan :

During my stay in Japan, I had the opportunity to immerse myself in traditional Japanese culture through several enriching experiences. I attended multiple Kabuki performances, which allowed me to appreciate the complexity of this classical form of theater, combining dramatic storytelling, elaborate costumes, and stylized movements. These performances provided valuable insight into Japanese aesthetic principles and historical narratives. In addition, I participated several times in the Japanese tea ceremony, a highly ritualized practice that emphasizes harmony, respect, purity, and tranquility. My interest in the tea ceremony deepened to the point that I even purchased a book on the principles of tea, allowing me to further study and understand its cultural significance. Through these cultural activities, I gained a deeper understanding of Japanese traditions, values, and the subtle refinement that characterizes many aspects of daily life in Japan.

JSPS Summer Program 2025
Research Report

1. Name: Laura CHEVET （ID No. SP25203）

2. Current affiliation: Université de Rouen Normandie

3. Research fields and specialties:
Chemistry

4. Host institution: Tohoku University – Graduate School of Pharmaceutical Sciences

5. Host researcher: Prof. Yoshiharu IWABUCHI

6. Description of your current research

The goal of my PhD is to develop novel and sustainable strategies for the formation of carbon-carbon bonds ($C(sp^3)$-$C(sp^2)$ and $C(sp^3)$-C(sp)) to push the boundaries of cross-coupling reactions. In my PhD I use boron, which is the 5th atom in the periodic table. Boron if found in glass, fiber glass, ceramics, soaps and in agriculture.

I also use electrochemistry, a green and non-expensive way to do organic synthesis. The main advantages of electrochemistry are the use of an electron as a green, cheap and renewable reactant; it is an alternative way to toxic and/or expensive metals; and it is easy to set up. The use of electrochemistry organic synthesis can allow and improve reactions usually performed with a fully chemical mechanism. And to push the atom economy and reaction efficiency, my projects are also studied in flow chemistry.

In my research, I developed a first reaction in electro and flow chemistry, involving a molecule containing a boron atom and another compound. This project allowed the formation of 29 different products with yields between 10 to 98%, and 5 of them were also tested in flow chemistry with a better productivity.

Another project in my group is to develop a coupling reaction also in electrochemistry between the same molecule with a boron atom, another compound and a catalyst at both electrodes in the same time, also called paired-electrolysis.

7. Research implementation and results under the program

Title of your research plan:

Alkynylation through addition of alkyl radicals with HAT generation via electrochemistry

Description of the research activities:

The goal of my project is to use a molecule with four adjacent nitrogen atoms as a catalyst (here it helps the electrons or hydrogen atom to travel) to create a carbon-carbon bond via an electrochemical reaction. My research activities consist in doing practical experiment in the lab.

This is exploratory research: the goal is not to make a new molecule, but to able to synthesize a described compound via a new method. The interest resides in finding a method using less solvent and molecules. Also, the electricity is a cheap reagent, that also allows reaction to proceed faster than in a chemical way.

First the molecule with four adjacent nitrogen atoms must be synthesized in seven steps. Then this molecule is added to a reaction mixture with two substrates and a current is applied between two electrodes. The resulting reaction mixture is analyzed to study the formation or not of the desired product.

The main aspects of my research activities are organic synthesis (with reaction setup, extraction and purification of the molecule), analyses of the compound/crude reaction mixture (characterization via ^{1}H NMR, GC-MS) and bibliographic research.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

This program allowed me to discover and experience the work life in Japan. It is interesting to discover another way to work, and other habits. Japanese people are very welcoming and always helpful. The life in Sendai is very pleasing. In August there is the Tanabata festival in Sendai, which is a big celebration with fireworks and decorations/events in the city.

9. Adviser’s remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Charles CONDEVAUX （ID No. SP25204）

2. Current affiliation: University of Nîmes

3. Research fields and specialties:
Engineering Sciences

4. Host institution: Kokugakuin University

5. Host researcher: Pr. Nobuyuki Takahashi

6. Description of your current research

This research project focuses on developing specialized Large Language Models (LLMs) tailored for French and Japanese nuclear law. Its primary objective is to enhance the transparency and accessibility of complex legal and technical information within this highly regulated sector. This involves training and fine-tuning open-source LLMs on extensive, domain-specific legal corpora, including statutes, regulations, case law, and technical documentation from both jurisdictions.

A secondary objective is to develop a Retrieval Augmented Generation (RAG) system. This system will provide LLMs with access to legal and technical documents while significantly mitigating the risk of hallucinations. This framework relies on a database and a retriever/reranker to extract relevant documents related to the user queries, which are then fed to the LLM.

This project also adress critical challenges such as processing long sequences of text, optimizing information extraction (e.g., identifying key legal entities, regulatory provisions, and technical specifications), and generating coherent, legally relevant outputs. This work aims to leverage the advanced comprehension capabilities of LLMs to facilitate legal research, compliance analysis, and comparative legal studies.

This initiative represents a novel application of Natural Language Processing (NLP) within the legal domain. Its bilingual scope (French-Japanese) further enables comparative legal analysis, fostering international collaboration in legal AI. Ultimately, this research seeks to establish a robust computational framework to improve regulatory compliance and facilitate decision-making for stakeholders in the nuclear energy sector.

7. Research implementation and results under the program

Title of your research plan:

Developing Large Language Models (LLMs) for French and Japanese Nuclear Law to Enhance Transparency and Accessibility

Description of the research activities:

This research project aimed to develop a specialized AI for navigating French and Japanese nuclear law. This initial phase successfully focused on the creation of an information retrieval system. While the original plan expected the fine-tuning of a Large Language Model (LLM), this work ended with a Retrieval-Augmented Generation (RAG) prototype, which provides a robust and factually grounded alternative for accessing complex legal information.

The foundational work began with a comprehensive data collection, where all laws were scraped from Japan's e-Gov and France's Légifrance portals. This extensive corpus was then carefully curated to isolate legal texts pertaining to environmental and nuclear regulations. To prepare the data for analysis, each law was systematically segmented into smaller, coherent chunks at the article level, creating a structured and manageable dataset suitable for RAG applications.

To train an accurate retrieval system, a specific training dataset was generated from these legal articles. Each article was enriched with metadata and a summary/contextual sentence. Using the Qwen3 32B model, we synthetically generated diverse queries for each article, including descriptions and questions, and extended this to include cross-lingual queries to facilitate bilingual comparison. The dataset was further enhanced by mining hard negatives, a technique that trains the model to discern subtle differences between relevant and irrelevant documents.

With this rich dataset, a two-stage retrieval pipeline was trained using contrastive learning, guided by LLM-generated similarity scores (Qwen3 32B). First, an embedding model was fine-tuned (Snowflakes) for fast retrieval of potentially relevant articles. Second, a reranker model was trained (Ettin 0.6B) to rerank these results, ensuring the most accurate documents are presented first. The performance of both models was evaluated, confirming their effectiveness in both monolingual and cross-lingual contexts.

The complete retrieval system was integrated with the Gemini API to create a functional RAG prototype. This system successfully retrieves the most relevant legal articles and provides them as context to the LLM, enabling it to generate accurate and referenced answers to user queries. While time constraints prevented the fine-tuning of a dedicated LLM, and challenges in processing complex PDFs delayed the inclusion of technical documents, the developed RAG system stands as a decent prototype. It effectively addressed the core project goal of enhancing access to nuclear law and provides a solid foundation for future development.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

9. Adviser’s remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Hugo DA CUNHA （ID No. SP25205）

2. Current affiliation: CNRS, Université Lyon 1

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Graduate School of Mathematical Sciences, The University of Tokyo

5. Host researcher: Prof. Makiko SASADA

6. Description of your current research

So far, my research focused on Scaling Limits of Interacting Particles Systems, and especially on one such model called Facilitated Exclusion Process. In this model, particles are situated on the vertices of a one-dimensional lattice and randomly hop to nearest-neighbour vertices provided it is pushed by another neighbouring particle, and the target vertex is unoccupied. More precisely, I was interested in proving the so-called hydrodynamic limit for this model, that corresponds to the average behaviour of this model, the typical picture that we observe when we look at it from very far and when there is a huge number of particles. I especially considered this model in the presence of boundary conditions, that can be open or closed. Namely, we show that the evolution of the macroscopic density of particles is described by a fast diffusion equation, a partial differential equation with different boundary conditions depending on the strength of the boundary interactions.

7. Research implementation and results under the program

Title of your research plan:

Fluctuations in Exclusion Processes with several conserved quantities

Description of the research activities:

During my stay in Japan, we worked on a novel model of Exclusion Process with energy. In this model, particles can randomly hop between sites of a lattice, and when two particles are adjacent, they may transfer energy to each other. Besides the particle density, the system features another conserved quantity, namely the energy. The hydrodynamic limit - that is the typical macroscopic evolution of these quantities - can be easily characterized. Our focus was on the fluctuations of this model around its typical behavior, since many questions remain open regarding fluctuations in systems with several conserved quantities. Although the model is quite simple, it is also remarkably rich: it appears that several distinct types of fluctuation behaviour may arise, including some that have not yet been mathematically derived.

I also visited Prof. Kohei Hayashi at Osaka University, with whom I had very interesting discussions about this model, and about equilibrium fluctuations more broadly.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

This experience has been highly enriching, both from a mathematical and a cultural perspective. It was a great occasion to discover Japan, and Japanese culture.

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Samuel DECORPS （ID No. SP25206 ）

2. Current affiliation: Ecole Normale Supérieure de Lyon

3. Research fields and specialties:
Chemistry

4. Host institution: Kyoto University

5. Host researcher: Prof. Kenji MATSUDA

6. Description of your current research

One great challenge nanoscience is facing is the difficulty to transpose molecular-scale phenomena into macroscopic properties finding application in everyday-life devices. One way to overcome this problem is to develop metamorphic molecular and supramolecular systems, in which an external stimulus triggers a drastic structural reorganization. By controlling this process, it should be possible to develop materials for which macroscopic properties can be modulated at will. As a PhD student at the Laboratoire de Chimie of ENS de Lyon, my research is focused on fluorescent compounds that exhibit switching of chiroptical properties in supramolecular self-assemblies. The collaborative research with Kyoto University will generate valuable fundamental knowledge and innovations in the design of “smart” functional materials. We expect that switching processes in supramolecular assemblies could lead to unprecedented on-surface modulation of chiroptical properties upon light or electrical stimulation, as demonstrated by complex analysis. This will be a major breakthrough towards the development of devices in optoelectronics and photonics with potential long-term application in quantum technologies for cryptography, memory and computing.

7. Research implementation and results under the program

Title of your research plan:

Metamorphic Approaches for On-surface Switching of Chiroptical Properties

Description of the research activities:

The purpose of my stay in Japan was to synthesize and study a photo-switchable molecular system.

The concept relies on the fact that photoswitch possess two stable states whose interactions with fluorophores should lead to two distinct emitting states: the ‘open’ form allowing a high light emission and the ‘closed’ form inducing a transfer of energy with fluorescence quenching. Research activities were mainly composed of isolation and characterization of both states to rationalize the quenching system.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

JSPS Summer program was the opportunity to expand scientific knowledge by strengthening bonds between affiliated and host institutions. Discovering Japanese culture through food, history and habits was part of this fellowship, warmful welcoming of Japanese helps to overcome the language barrier.

9. Adviser’s remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Iris DEVAURE （ID No. SP25207）

2. Current affiliation:

LSCE (CNRS – CEA – Université Paris Saclay), MITATE Lab, and Department of Geography of Université Paris Cité

3. Research fields and specialties:

Interdisciplinary and Frontier Sciences

4. Host institution: Tohoku University

5. Host researcher: Prof. Naoya Takahashi

6. Description of your current research

My research focuses on wildfire management in Japan. The first aim of the study is to understand the practices to manage wildfires and their historical development. The second aim is to analyze the Rifu wildfire of 1983 and find out whether sediment accumulation in agricultural reservoirs found at the site could be used to retrace the evolution of sediment yield and vegetation before and after the fire.

To achieve this, I am working on three major aspects of wildfire research. Firstly, I work on the evolution of wildfire disasters in Japan since 1950 and the possible future trends in wildfire risk. Secondly, I study the legislation, management strategies, and prevention measures related to wildfires in Japan. Thirdly, I analyzed the case studies of two specific wildfires (the 1983 Rifu wildfire and the 2025 Ofunato wildfire) to understand the environmental impacts of such events and to understand if this studied case can be used to retrace the evolution of sediment yield and vegetation before and after the fire.

The main methodology includes a bibliographic analysis to study both the organizational structure of wildfire management and the historical context of wildfire disasters in Japan. Additionally, I use GIS and R as tools for analyzing the spatial characteristics of the two case studies and for examining temperature and precipitation data before and after the wildfire events. Interviews were also conducted with individuals involved in wildfire management in Miyagi Prefecture during the summer program.

7. Research implementation and results under the program

Title of your research plan:

Wildfire management in Japan

Description of the research activities:

During the summer program, we evaluated the effectiveness of wildfire management strategies previously identified and investigated how these are implemented in practice. We also conducted a preliminary study of the 2025 Ofunato wildfire.

To support this work, I reviewed archive materials and academic publications on historical wildfire events to enrich the historical analysis. I conducted two field visits: a two-day field study in Ofunato, in the wildfire-affected area, and a one-day visit to Rifu, also focused on the corresponding case study area. I also interviewed a professional involved in wildfire and forest management in Miyagi Prefecture.

In preparation for further fieldwork focused on environmental impacts, I carried out a climatological data analysis and a GIS analysis of spatial landscape attributes. Finally, I also established academic connections and explored potential opportunities for future research collaboration between France and Japan.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

During my stay in Japan, I had the opportunity to join the Homestay program offered by my internship. This was a truly enriching experience, as I was able to exchange with a Japanese family and discover the beauty of the local nature. I also took part in the Tanabata Matsuri in Sendai, enjoying its vibrant decorations and festive atmosphere, and I had the chance to relax in traditional onsens, which allowed me to appreciate an important aspect of Japanese culture.

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Charlène DUPRE （ID No. SP25208）

2. Current affiliation: University of Strasbourg, France

3. Research fields and specialties:
Interdisciplinary and Frontier Sciences (Chemistry and Biological Sciences)

4. Host institution: Osaka University

5. Host researcher: Prof. Michiya Matsusaki

6. Description of your current research

In response to the challenges of organ transplantation, 3D bioprinting is emerging as a promising solution in regenerative medicine and tissue engineering. This technology involves the incorporation of living cells into a hydrogel, called bio-ink, that mimics the extracellular environment. Using pneumatic pressure, these bio-inks are printed through extrusion to create biological models that replicate the structure and properties of native tissues. However, the pressure applied during printing can cause shear stress, leading to significant cell death. To counter this, porous microparticles (mPs) made of the polymer poly(lactic-co-glycolic acid) (PLGA) have been incorporated into bio-ink to protect cells from these mechanical damage.

A major challenge remains: the mPs could interfere with the formation of a tissue. After printing, cells initiate remodeling of the bio-ink and degrading the mPs. However, depending on the cell type and the complexity of the tissue, this degradation could require several months, incompatible with the urge and safety required for tissue formation in the context of organ transplantation.

My PhD project aims to develop "smart" microparticles with accelerated degradation and in response to the cells themselves. The strategy involves chemically coupling PLGA to a peptide that contains a cleavage site sensitive to matrix metalloproteinase (MMPs), enzymes secreted by cells for tissue growth and remodeling. These enzymes will cleave the enzymatic site of the peptide to trigger rapid and controlled degradation, facilitating cell proliferation and maturation to obtain fully biological and functional tissue.

After the synthesis and the validation of PLGA-peptide conjugate by different characterization technics, the modified mPs were put in direct contact with cells to monitor the designed degradation. The aim of the Summer Program is to enhance direct interactions between cells and modified mPs using a specific multi-coating strategy. This approach is designed to promote cell adhesion onto mPs, thereby stimulating cell proliferation, tissue formation, MMPs secretion, and, ultimately, the complete degradation of the mPs.

7. Research implementation and results under the program

Title of your research plan:

Creation of 3D-printed Injectable Prevascularized Adipose Tissue with Layer-by-Layer Coated and Functional Microparticles to Study Adipose Tissue Innervation.

Description of the research activities:

The objective is to coat the modified mPs using the Layer-by-Layer (LbL) technique, developed in the Matsusaki laboratory, to create new iPATs (Injectable Prevascularized Adipose Tissues) and study adipose tissue innervation.

To enhance cell adhesion and proliferation, collagen-laminin and gelatin-laminin coatings were prepared using the LbL method. For this, mPs were successively immersed in collagen or gelatin solutions, followed by laminin solution, with 2, 4 or 8 LbL and different immersion times tested (2, 5, or 15 minutes). The coated mPs were then characterized by Scanning Electron Microscopy (SEM) to observe potential changes in surface morphology.

The different coated mPs were put in contact with SH-SY5Y cells (neuroblastoma cell line) to assess cell behavior, particularly adhesion and proliferation. The cells and coated-mPs were cultured in low adhesion environment, to force the direct contact, or incorporated into a hydrogel, in preparation for future bio-ink formulation and 3D bioprinting applications. After, 3 or 5 days at 37°C, 5% CO_2, cellular adherence is observed, using fluorescence cells-staining over confocal microscopy.

For now, promising results were obtained with the 8 LbL-5 min gelatin–laminin coated mPs, both in direct contact and within hydrogel 3D culture. SH-SY5Y cells appeared to adhere the most on mPs surface, compared to uncoated mPs or to collagen-LbL coatings. Further experiments should be carried out with iPATs to investigate cell behavior in the presence of mPs, as well as 3D bioprinting with tested hydrogel formulations.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

This two-month experience was highly enriching both professionally and personally. The integration within the laboratory and the interactions with researchers from diverse fields contributed to strengthen my skills, particularly in cellular biology. In addition, immersion in a new work environment provided valuable training for my thesis work and my future professional experiences.

As this was my first trip to Asia, the opportunity to discover Japan was truly unforgettable. Exploring Japanese culture, gastronomy, and lifestyle, as well as visiting emblematic sites across Japan, greatly enhanced my personal development. A particularly memorable moment was my stay with a Japanese host family, where I experienced their kindness and hospitality while enjoying traditional homemade dishes such as okonomiyaki. Finally, discovering Osaka was a unique experience: from the dynamism of Umeda, the lively atmosphere of Dotonbori with karaoke, to the spirituality of Katsuo-ji Temple and the excitement of the Expo2025.

9. Adviser’s remarks (if any):

The integration into the dynamic laboratory was perfect. Despite the difficulty and multidisciplinary of the research project, Charlène was very autonomous and proactive. It was pleasant to see her curiosity and interest in discovering Japan.

JSPS Summer Program 2025
Research Report

1. Name: Enzo JEAN-WOLDEMAR （ID No. SP25209）

2. Current affiliation: Sorbonne Paris Nord University – Laser Physics Laboratory

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Kyushu University - Center for Organic Photonics and Electronics Research (OPERA)

5. Host researcher: Prof. Chihaya Adachi

6. Description of your current research

Organic photonics and optoelectronics are emerging fields that have recently driven significant advances in areas such as photovoltaics, lighting, and displays. In contrast, organic lasers are still at an early stage of development. A major challenge lies in the availability of efficient materials, ideally “designed” to meet the specific requirements of laser operation. However, a material that performs well as a light emitter (for instance in OLEDs) is not necessarily well-suited for lasers, and vice versa. Until now, there has been a fundamental lack of understanding of what truly defines a “good” organic laser material.

This thesis is part of a multidisciplinary and international project involving collaboration between physicists, chemists, and technologists from France and Japan. The aim is to refine the study of these materials, from their integration into laser systems to their detailed characterization.

My recent research has focused on an optical characterization method known as the ASE threshold measurement (Amplified Spontaneous Emission). This technique makes it possible to compare the ability of different molecules to sustain stimulated emission, the key physical phenomenon underlying the laser effect. However, the method is subject to numerous variations and interpretations within the scientific community. For this reason, the first part of my thesis has been dedicated to developing a deeper understanding of the ASE threshold measurement, supported by theoretical models and validated by experiment.

Once the method was firmly established, the next step has been to systematically screen a wide range of organic materials, with the goal of comparing them efficiently and ultimately identifying potential correlations between molecular structure and laser performance.

7. Research implementation and results under the program

Title of your research plan:

Characterization of Organic Materials for Efficient Laser Design

Description of the research activities:

During my stay in Japan, my goal was to learn a new characterization technique to expand my toolkit for comparing organic materials and their potential to work as efficient laser sources. At the OPERA laboratory at Kyushu University, I focused on a method called Transient Absorption Spectroscopy.

In simple terms, spectroscopy is the study of how materials interact with light. Transient absorption spectroscopy looks at how a material behaves after being excited with a laser pulse, revealing how its electronic properties change over very short timescales. These insights can help us understand whether a material has the right characteristics to be used in a laser.

Once I had learned the method and set up the necessary equipment, I applied it to a series of promising molecules. The results were then compared with the data I had previously gathered in France, giving me a broader perspective on how different organic materials perform as potential laser candidates.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

Japan has been an extraordinary experience for me. During the Obon holiday, I had the chance to travel and visit incredible places such as Nara and Kyoto. I came back feeling enriched by the experience and deeply grateful for it.

9. Adviser’s remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Maxime MASSON （ID No. SP25210）

2. Current affiliation: University of Pau and the Adour Region, France

3. Research fields and specialties:
Engineering Sciences

4. Host institution: Kyushu University

5. Host researcher: Prof. Tsunenori MINE

6. Description of your current research

Overtourism is a significant global issue affecting many countries. The concentration of tourists in a few popular destinations leads to overcrowding, environmental degradation, strained local infrastructure, a diminished visitor experience, and negative impacts on local residents (e.g., visitors being unaware of local customs and disturbing locals, or engaging in dangerous behaviors). Meanwhile, abundant smaller municipalities and lesser-known areas, despite their rich cultural, historical, and natural resources, often remain under-visited, missing opportunities for economic development. Traditional tourism management strategies have proven insufficient in tackling the growing problems associated with overtourism. The need for innovative approaches is pressing.

This research aims to develop an explainable recommender system that integrates diverse heterogeneous data sources to suggest Lesser-Known Points of Interest (LKPs) to travelers. These recommendations should go beyond merely serving as substitutes for Well-Known POIs (WKPs), in many cases, LKPs can offer more valuable, unique, and satisfying experiences tailored to individual travelers. Visiting WKPs often requires significant time and money, and the experience may not always justify these costs for every traveler. In contrast, many LKPs, such as hidden restaurants, film locations, historic landmarks, and the birthplaces of famous figures can provide more personalized, memorable, and rewarding experiences that better align with a traveler's specific interests. The system will provide both individual LKP recommendations and comprehensive travel itineraries that blend popular and lesser-known destinations. By identifying and promoting LKPs, the system seeks to redistribute tourist traffic more evenly, revitalizing smaller municipalities while alleviating pressure on overcrowded attraction.

Given the complexity of the research and the limited timeframe of the summer program, we decided to collaborate with Dr. Rajaonarivo, a former JSPS postdoctoral researcher of Prof. Mine, who has extensive experience on this topic.

The first step was to evaluate existing baseline approaches for next POI category estimation, which can broadly be grouped into four main categories: (1) traditional methods, (2) graph-based methods, (3) transformer-based methods, and (4) prompt-based methods. Most of these approaches were originally designed for next POI recommendation, so adaptations were necessary for our specific task. We observed that recent prompt-based methods achieved strong performance even with limited training data. Consequently, we decided to focus on investigating prompt-based approaches for next POI category estimation. These methods exploit the generalization capabilities of Large Language Models (LLMs) to predict the most probable next category of POI a user will visit.

7. Research implementation and results under the program

Title of your research plan: *Explainable Recommender System to Promote Lesser-Known POIs for Tourism and Small Municipality Revitalization*

Description of the research activities:

Within the summer program, we set the following research objectives:

- Assessing how prompt formulation affects model performance, given the well-documented sensitivity of LLMs to prompt structure.
- Determining the optimal data requirements for prompt-based approaches in comparison with traditional training-based methods.

For our experiments, we used the FourSquare (a location-based social network) dataset and conducted a series of investigations to address these questions. We examined:

- How the number (history) of check-in included in the prompt affects prediction,
- Whether incorporating popularity and distance information improves accuracy,
- Whether including data from similar users provides additional benefits,
- The impact of applying offline policy evaluation (OPE),
- The effect of combining prompting with fine-tuning,
- How results vary depending on POI popularity, distance and category,
- If prompting can be extended to predict distance and popularity of the next POI.

The results demonstrate that LLMs can capture sequential and contextual patterns in user mobility when guided by well-structured prompts. We find that encoding spatial-semantic features, such as POI popularity and transition distances, yields better performance than relying on raw category sequences. Moreover, medium-length histories of around 20 check-ins strike the best balance between contextual richness and computational efficiency. Finally, augmenting user profiles can further improve predictions, although the degree of improvement varies depending on the specific setting used. A research paper titled "*Prompt Engineering for Fine-Grained Next Point-of-Interest Category Estimation*" was written about this topic during the fellowship and will be submitted to the BDCAT 2025 international conference.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I arrived in Fukuoka on Friday, June 20, 2025, and was welcomed by Prof. Mine upon my arrival. I stayed at the Ito Guest House during my fellowship. Throughout my stay, I participated in laboratory activities, including academic events such as master's student weekly paper presentation seminars and Ph.D. students' monthly report meetings, as well as social gatherings such as a drinking party. We had weekly meetings with Prof. Mine and Dr. Rajaonarivo to assess the progress of the research. I gained insights into the organization of research laboratories in Japan, which differs significantly from the system in France. I was impressed by the involvement of master's students in research activities.

Together with Prof. Mine, I also took part in a business trip to the Nagoya Institute of Technology on August 5 and 6, where we exchanged ideas with Prof. Ozono and Kikuchi.

Additionally, I connected with another French fellow specializing in computer science and machine learning. We had the opportunity to visit each other's universities, which allowed us to share experiences and foster future collaboration. Lastly, I also attended a homestay with a Japanese family, which was a truly enriching and memorable experience.

JSPS Summer Program 2025
Research Report

1. Name: Jérémy MATEOS （ID No. SP25211 ）

2. Current affiliation: CNRS

3. Research fields and specialties:
Biological Sciences, Interdisciplinary and Frontier Sciences

4. Host institution: University of Tokyo

5. Host researcher: Associate Pr. Kim Soo Hyeon

6. Description of your current research

DNA is a promising alternative to traditional storage media due to its remarkable data density and long-term stability. However, challenges persist in developing efficient and scalable DNA data retrieval systems. A key obstacle is enabling random access, retrieving specific information from large pools of DNA sequences. This is typically achieved through the integration of unique primer sequences, which serve as molecular addresses for identifying stored files. These primers must be designed in accordance with strict biochemical constraints to prevent the formation of secondary structures that can interfere with amplification and data recovery.

To support the development of an automatized DNA-based memory system, we propose an approach that combines high-stringency primer design with physical compartmentalization strategies. Specifically, DNA strands are encapsulated within hydrogel microbeads using microfluidic technologies. This microencapsulation not only preserves the integrity of the DNA over time but also introduces a physical layer of data partitioning, enhancing the organization and accessibility of the storage system. The integration of these physical and biochemical methods represents a step toward more efficient, robust, and scalable DNA-based memory solutions.

7. Research implementation and results under the program

Title of your research plan:

Screening materials for droplet-based encapsulation of synthetic DNA in data storage

Description of the research activities:

Material Screening and Characterization

- Systematic evaluation of **biopolymers**, **synthetic polymers**.
- Assessment of **cross-linking mechanisms, permeability, and chemical compatibility** with DNA.

Microfluidic Encapsulation

- Design and use of **PDMS microfluidic chips** to produce **monodisperse W/O or W/O/W droplets** containing DNA.
- Optimization of flow rates, surfactants, and channel geometries to achieve stable, reproducible droplet formation at the **50 µm scale**.

DNA Stability and Integrity Testing

- Encapsulation of DNA to study **long-term stability under stress conditions** (temperature, UV).
- Monitoring **DNA leakage, degradation, and chemical modifications** using PCR amplification, qPCR quantification, and sequencing.
- Fast-aging experiments to simulate **long-term archival storage**.

Release and Retrieval Mechanisms

- Development of **controlled release strategies** (chemical dissolution, enzymatic degradation, phototriggered release) to recover DNA on demand.
- Testing the **compatibility with Nanopore sequencing workflows**.

Comparative Performance Analysis

- Benchmarking materials based on **encapsulation efficiency, protection efficacy, ease of DNA retrieval**.
- Establishing a **ranking of candidate materials** for integration into scalable DNA data storage pipelines.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: MEHENAOUI Karim （ID No. SP25212）

2. Current affiliation:

CNRS :

-Institut Charles Gerhardt Montpellier (ICGM)

-Interfaces, Confinement, Materials and Nanostructures (ICMN)

3. Research fields and specialties: Chemistry

4. Host institution: Nagoya University

5. Host researcher: Prof. KAMIGAITO Masami

6. Description of your current research

The development of nanostructured materials is a major challenge, particularly in microelectronics, where transistor miniaturization is essential. While EUV lithography enables sub-10 nm resolutions, its high cost motivates the search for alternatives, such as self-assembling block copolymers (BCPs). These materials can form various ordered nanostructures, especially when composed of highly incompatible blocks with low molar mass (High χ – Low N BCPs). Here, χ represents the incompatibility between blocks, and N the degree of polymerization.

This behavior is well-known in systems where both blocks are amorphous. However, introducing a semi-crystalline block requires careful consideration of crystallization effects. Depending on the glass transition temperature (Tg) of the amorphous block and the crystallization temperature (Tc) of the semi-crystalline one, the nanostructure formed by self-assembly may be significantly altered. My thesis focuses on two main objectives :

1. Synthesizing highly incompatible (High χ) block copolymers capable of self-assembling into sub-10 nm nanostructures.
2. Studying how self-assembly and crystallization interact and influence the overall organization of BCPs.

The BCPs developed in this project will combine PVDF, a semi-crystalline fluorinated polymer produced in France, and N-vinylpyrrolidone (nVP) derivatives, recently synthesized in Japan by Prof. KAMIGAITO's team. PVDF's high incompatibility with many polymers makes it an excellent candidate for nanostructure formation. Its semi-crystalline nature also enables the investigation of crystallization effects. The nVP derivatives, obtained from bio-based itaconic acid, have a modifiable ester group allowing control over their glass transition temperature (Tg), ranging from 58 °C (M4) to 130 °C (M1) i.e., below or above the Tc of PVDF. Although they have similar incompatibility with PVDF, their different thermal behaviors create distinct confinement effects, making them ideal for exploring the balance between self-assembly and crystallization.

7. Research implementation and results under the program

Research plan:

To produce these block copolymers (BCPs), two strategies are being considered. The first involves synthesizing the homopolymers PnVP, PM1, and PM4 separately, and then chemically coupling them to PVDF. This fluorinated semi-crystalline polymer had already been produced in France as part of previous research work. The second approach relies on a technique known as sequential polymerization, in which PVDF is used as a starting point, and the monomers NVP, M1, and M4 are directly polymerized onto it. This method enables the controlled formation of the desired blocks. Both strategies aim to produce well-defined BCPs capable of self-assembling into nanostructures, while also allowing the study of how crystallization affects their overall organization.

Description of the research activities:

Block Coupling Strategy:
We synthesized the homopolymers PnVP, PM1, and PM4 with varying chain lengths (N), ranging from 50 to 100 repeating units. These polymers will be sent to France for chemical coupling with PVDF.
Sequential Polymerization Strategy:
We also synthesized block copolymers using PVDF as a macro-CTA, enabling the direct growth of PnVP chains from the PVDF backbone.

Additionally, a large quantity of monomers (nVP, M1 and M4) was prepared to allow further synthesis of this type upon returning to France.

Polymers	***Masses (g)***
$PnVP_{50}$-XA	*7.5*
$PnVP_{75}$-XA	*3.0*
$PM4_{75}$-XA	*1.5*
$PnVP_{25}$-b-$PVDF_{50}$	*1.0*
$PM1_{25}$-b-$PVDF_{50}$	*0.4*

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

This trip to Japan was an extremely enriching experience, both professionally and culturally. I was able to discover a different approach to work than what we are used to in France and enjoy the warm welcome of Professor Kamigaito and his team. Participating in an international conference in Kitakyushu was a highlight, especially discovering the local culinary specialty fugu, complemented by visits to several Japanese cities (Kitakyushu, Hakodate, Tokyo, etc.), which gave me a wonderful glimpse into the country's cultural richness.

9. Adviser’s remarks (if any):

Despite the intense heat in this summer, the research conducted during this summer program was very fruitful thanks to the fellow's enthusiastic experiments and research. The results obtained are expected to contribute greatly to the development of future joint research and to the advancement of new block copolymer technology. In addition, the fellow's excellent personality contributed to the creation of an international environment in the laboratory.

Research Report
JSPS Summer Program 2025
Research Report

1. Name: Milan Hugo （ID No. SP25213）

2. Current affiliation: Université Paris-Saclay

3. Research fields and specialties:

Humanities Social Sciences Mathematical and Physical Sciences
Chemistry Engineering Sciences Biological Sciences
Agricultural Sciences Medical, Dental and Pharmaceutical Sciences
Interdisciplinary and Frontier Sciences

4. Host institution: Suwa Universiy of Science

5. Host researcher: Masahide Ooshima

6. Description of your current research

My research focuses on the reliability of electric drives. To achieve reliability, we aim to create redundancy within the system. Redundancy can be differentiated into two types: passive and active. Passive redundancy is achieved by adding components that are only used in the event of a fault. Active redundancy involves having multiple components that are all used in a healthy state, but the system can still function if one component fails. This type of redundancy is better for creating efficient and resilient systems. To achieve this redundancy, the segmentation principle is used. Segmentation involves using multiple components with low ratings, where the sum of the ratings meets the desired rating. However, we must demonstrate that a fault in one component will not result in the loss of the entire system's functions.

In electric drives, short-circuits in the winding represent 33% to 66% of faults and can lead to thermal stress and fire. Therefore, the main challenge is to understand how to model these types of faults in segmented electric drives to assess their consequences. One type of segmentation is multi-sector segmentation, which was first introduced by Ooshima et al. for bearingless applications. The goal of my research in Japan was to model eddy currents and Lorentz forces in these types of segmentation to assess their impact during faults.

7. Research implementation and results under the program

Title of your research plan:

Impact of Eddy-current on Forces Control in Multi-Sector Surfaced Mounted Permanent Magnet Motors

Description of the research activities:

There are two types of technologies for bearingless machine. The multi sector and the pole number combination. Latest works of Ooshima's lab teams was focus on the pole number combination technologies. However, the two technologies have the same rotor and field in the airgap.

The first steps were to compare the rotor phenomena that should be the same in the two technologies in order to transfer the knowledge from the pole number combination technologies to the multi-sector one. The main common phenomena is the eddy-current. As they only rely on airgap field distribution, we observe no differences between the two technologies and validate this theory through Finite Element Analysis. The next step will be to implement a compensation during healthy and during fault like short-circuit.

In long term perspective, this work could lead to equivalence models between the two technologies. Those models will lead to new design process and performance improvement for bearingless machines.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

This stay was the perfect opportunity to plan my future collaboration with my lab and the two labs that I visited in Nottingham and Suwa.

Additionally, I visited Professor Tetsuya Uchimoto and Professor Benjamin Ducharne at the Elytmax Laboratory in Tohoku University, and we are planning to apply for a standard fellowship at this laboratory for the 2026 fiscal year.

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Cédric Pécou （ID No. SP25214）

2. Current affiliation: Sorbonne Université

3. Research fields and specialties:
Chemistry

4. Host institution: The University of Tokyo

5. Host researcher: Prof. Shin-ichi OHKOSHI

6. Description of your current research

Since the start of my PhD project, entitled “Magnetic Dendrimers,” I have synthesized several families of compounds using a supramolecular "complex-as-ligand" approach. By varying the cores, the branches, and the bridging ligands, we successfully developed more than 20 unique hetero-poly-metallic complexes. Here are some examples of the compounds we obtained:

- 3-branches dendrimers with an oxalate bridging ligand : $CrLn_3Co_6$-ox, $CoLn_3Co_6$-ox, $RuLn_3Co6$-ox, and a chiral Λ/Δ-$IrLn_3Co_6$-ox
- 3-branches dendrimers with an anilate bridging ligands: $CrLn_3Co_6$-dhbq, $CrLn_3Co_6$-Cl_2An
- Dimer compounds with 3 different anilate bridging ligands : $(LnCo_2)_2$dhbq, $(LnCo_2)_2(Cl_2An)$, $(LnCo_2)_2$(ClCN-An)
- 4-branches dendrimers with anilate bridging ligands : $ZrLn_4Co_8$-dhbq
- 4-branches dendrimer with oxalate bridging ligansd : $V_4Ln_4Co_8$-oc

This approach allowed for the systematic variation of precursors resulting in a diverse set of compounds with distinctive structural and magnetic properties. Each compound has been fully characterized through FT-IR spectroscopy and solid-state X-ray diffraction. They are also soluble in common organic solvents, with mass spectra successfully obtained using MALDI spectrometry. Additionally, NMR and UV-vis spectra confirm the stability of these compounds in solution.

7. Research implementation and results under the program

Title of your research plan:

Hetero-trimetallic Dendrimers: surface deposition and imaging of magnetic molecules

Description of the research activities:

Since these molecules have quite a large size (2-3nm) and contain some metals, they could be imaged by Transmission electron microscopy after being deposited onto a small porous grid. This technique allowed us to see images of spherical particles that are of similar size as the dendrimers, and some bigger non spherical particles resulting of the aggregation of the molecules. To confirm the structural integrity of the deposited molecules, the STEM technique is going to be used to perform a chemical mapping of the surface, allowing to see the different elements of the dendrimer.

The dendrimers were also deposited on a highly ordered graphite substrate (deposition of a small drop of a solution containing the dendrimers on the substrate). The surface was imaged using a High-definition Keyence optical microscope, allowing to see the details of the surface at a very high resolution (100nm). While most of the compounds show some bigger aggregated particles, the family of $CrLn_3Co_6$-dhbq dendrimers show the presence of very smooth brown colored films with different color intensities. These homogeneous films could be the sign of a higly ordered structure formed on the surface, this is to be confirmed with STM (scanning tunneling microscopy) measurements to visualize the ordering of the molecule at the nanoscopic scale.

Finally, some physical properties of the dendrimers were investigated ;

- A newly synthetized $V_4Dy_4Co_8$ dendrimer was shown to have Single molecule magnet behavior under an external applied field, which is an interesting property for magnetic information storage at the molecular scale
- Some of the dendrimers showed photoluminescence behavior in the solid state in the near infrared region (NIR) : ZrLn4Co8-dhbq and $(LnCo_2)_2$(ClCN-An) (Ln = Er, Yb). The mechanism of the luminescence has yet to be cleared, but a common hypothesis is the energy transfer from the organic part of the molecule to the lanthanide (Er, Yb), which will emit NIR light upon de-excitation (antenna effect).

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I learned a lot during this stay, especially by using so many different equipements that were available, and the expertise of Ohkoshi's lab members about magnetism helped me a lot.

I also had some very memorable experiences in Japan, like a relaxing day in an onsen next to a cascade. I could also see a lot of summer festivals which featured some beautiful costumes, music and choreographies and a very nice atmosphere overall.

JSPS Summer Program 2025
SP25215 Research Report

1. Name: PLAZA-JOLY Pierre （ID No. SP25215）

2. Current affiliation:

Institut Européen des Membranes, University of Montpellier

3. Research fields and specialties:

Chemistry

4. Host institution:

National Institute of Advanced Science and Technology, AIST, Tsukuba

5. Host researcher: Dr. Akira TAKAHASHI

6. Description of your current research

- Study and development of self-supported inorganic or hybrid adsorbent materials for gas separation with a primary focus on selective adsorption, particularly for ammonia capture.
- Development and investigation of membrane materials for continuous gas separation (different gas stream containing ammonia).
- Investigation and shaping of cyano-based inorganic materials such as Prussian blue analogues (PBAs).

7. Research implementation and results under the program

Title of your research plan:

"Prussian blue analogues shaping strategies for NH3 removal"

Description of the research activities:

My research focuses on the development and characterization of porous alumina-based supports for potential use in ammonia adsorption membranes. I began by fabricating porous alumina disks, using alumina powder as the base material. These supports were then impregnated with various binding agents through different deposition techniques to evaluate their compatibility and effectiveness.

Following the impregnation process, Prussian blue was deposited onto each sample. The objective was to determine which combination of binding agent and deposition method provided the most suitable environment for hosting Prussian blue (which is the active material for ammonia adsorption).

To ensure the integrity and performance of the deposited layers, a series of characterization techniques were employed. These analyses allowed for a detailed assessment of the structural, chemical and morphological properties of the samples, helping to identify the most promising configurations for membrane development.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I really enjoyed Japan and Japanese culture. During my trip, I had the opportunity to visit temple and shrine, enjoy festival, onsen, visiting other cities such as Tokyo, Osaka, Nikko, Yokohama… I also had the opportunity to discover the large variety of japanese food. I strongly recommend this program to everyone; it's a good way to discover and experience a new culture and a new workplace.

9. Adviser's remarks (if any):

I would like to express my gratitude to JSPS for providing this opportunity to engage in new research and collaborate with an outstanding student. Despite the limited time and resources, he took on challenges and created new results. I look forward to continuing our collaboration in the future.

JSPS Summer Program 2025
Research Report

1. Name: Fabyan SOULARD　　（　　ID　　No. SP25216　　）
2. Current affiliation: University of Bordeaux
3. Research fields and specialties: Chemistry
4. Host institution: Institute of Science Tokyo
5. Host researcher: Pr. Tomohisa SAWADA
6. Description of your current research β-sheet protein domains are ubiquitous in nature, carrying out a wide range of functions, acting as key recognition motif in protein-protein interactions and protein aggregation. The design of synthetic systems to simplify and study complicated biological systems is an original approach to better understand the chemical processes and interactions that govern the structure and function of a protein. In this way, foldamers –synthetic oligomers able to fold into stable and well-defined structures– are valuable tools to mimic protein secondary structures. Their structural diversity does not yet equal that of biomolecules, helices are widely represented while sheet-like architectures remain rare. Within this context and with basic design principles now understood, it becomes possible to consider the de novo design of more complex and diverse architectures including multi-stranded artificial structures. The group of Gilles Guichard has recently developed a new class of synthetic molecules programmed to rationally fold into multi-stranded β-sheet structures by formation of intramolecular hydrogen bonds. Non-covalent intramolecular interactions have been rationally exploited to direct the self-organization of organic molecular strands into stable conformations, in a manner that mimics the folding of biomacromolecules.

7. Research implementation and results under the program

Title of your research plan:

Construction of new multi-stranded β-sheet architectures through folding and self-assembly.

Description of the research activities:

During this stay the goal was to study the interaction of molecules known to fold into β-sheet architectures but here, in presence of metal atoms potentially enabling dynamic arrangement into higher order supramolecular assemblies.

The general strategy used was :
-Study the molecules by NMR in solution with various metals and counter ions. The goal of these experiments is to observe any changes in the electronic density of hydrogens in the molecule in presence of metal atoms. It is a quick and reliable way of studying if something is happening.

-Once a metal has been identified to interact with the folding molecules, the next goal is to obtain crystals of the interacting species to be able to solve their spatial structure in solid state.

Throughout the many NMR analysis, we were able to identify some interesting metals giving promising results. Unfortunately, I wasn't able to obtain crystals of these conditions, this process can take up to week/months but nonetheless, I learnt various techniques that I will certainly continue using in my overall PhD project.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I am very glad to have the opportunity to be a fellow of such international cooperation effort. Despite the intense heat during summer, I very much enjoyed going places around Tokyo. The highlight for me was the annual fireworks festival which was amazing (even if very crowded)! I enjoyed most of the food I tried here and I will be back to France with hundreds of good memories !

9. Adviser's remarks (if any):

His stay was a very nice opportunity to start collaboration with France. It was also a good opportunity for Japanese students in the laboratory to interact with a foreign doctoral student. We would like to continue to develop this collaborative work and connections between people. I would like to thank every people involved in this JSPS program.

JSPS Summer Program 2025
Research Report

1. Name: Silvia Neri （ID No. SP25302 ）

2. Current affiliation:

Max Planck Institute for Solid State Research

3. Research fields and specialties:

Sciences

4. Host institution: University of Tokyo

5. Host researcher: Ryo Shimano

6. Description of your current research

The study of low-energy collective excitations is a central topic in condensed-matter physics.
My work focuses on inferring information about superconducting systems, such as the pairing mechanism and other properties of the superconducting condensate, by analyzing the characteristics and features of the collective behavior of their superconducting electrons.

In order to excite these collective modes, the system is perturbed from equilibrium. Many probes are possible; in my work I focus on the response to terahertz (THz) light, used as the probe. In a typical experiment, the superconducting sample is driven by a laser pulse, and the transmitted signal is measured and analyzed to reveal the excited modes. These spectroscopic measurements have been enabled by recent advances in high-field THz sources, which make it possible to observe nonlinear responses in the THz range.

Nevertheless, studying collective modes in superconductors with THz probes, especially in complex systems characterized by multiple order parameters, remains challenging for both theory and experiment, making data interpretation nontrivial.

Accordingly, my PhD research is then mostly focused on the understanding of the spectral signatures in multicomponent superconductors.

7. Research implementation and results under the program

Title of your research plan:

2D coherent spectroscopy of multi-component superconductors.

Description of the research activities:

During my time at the University of Tokyo, I developed code to simulate a two-dimensional coherent spectroscopy (2DCS) experiment on a multiband superconducting system, loosely reflective of MgB_2, and analyzed the resulting numerical data. In such a system, we expect a variety of collective modes—e.g., multiple Higgs modes and the relative-phase (Leggett) mode. The Leggett mode has been observed in MgB_2, whereas a universally accepted experimental observation of the Higgs mode in this material is still lacking. Moreover, how interband coupling affects the multiple Higgs modes remains unclear. To investigate this material, we decided to adopt a 2D coherent spectroscopy setup. 2DCS is a relatively new technique in the realm of quantum materials, that is attracting growing attention because it can disentangle distinct quantum pathways that contribute at the same frequency. In our implementation, the superconducting sample is excited by two phase-coherent light pulses at the same frequency, separated by a controllable time delay; the signal transmitted by the sample is then collected and analyzed. The data are then displayed in, what are usually called, “2D maps”.

Under the guidance of my host supervisor, Prof. Shimano, we explored a range of parameters and identified notable features in the 2D spectra (maps). At the same university, I also discussed the project with Prof. Tsuji, a theorist and expert in collective-mode spectroscopy. With his input, we aim to move beyond the numerical observations and develop a theoretical understanding of the phenomena.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

9. Adviser's remarks (if any):

During her stay in our lab at UTokyo under this summer program, we had intensive discussions on the proposed project of 2D coherent spectroscopy of superconductors. The collaboration was productive. It was so nice that she visited our group and proceed with the project in a focused manner though the period was relatively short. I sincerely appreciate this summer program and JSPS.

JSPS Summer Program 2025
Research Report

1. Name: Charalampos B. KARPOUCHTSIS （ID No. SP25303）
2. Current affiliation: Helmut-Schmidt-University/Univ. of the Federal Armed Forces
3. Research fields and specialties: Social Sciences
4. Host institution: Waseda University
5. Host researcher: Prof. Toyomi ASANO
6. Description of your current research 2025 marks 80 years since the end of World War II, underscoring how memory continues to shape the present. This project investigates how memory politics shape democratic resilience and international security. I use the Japanese–Korean relationship as a key case, analysing how claims to justice and responsibility intersect with strategic cooperation. The Berlin 'Peace Statue' relocates debates on wartime sexual violence to Europe, foregrounding tensions between free expression, gendered violence and diplomacy. Eighty years after the war, these echoes structure policy choices, civic trust and prospects for reconciliation. After arriving at Waseda University, I presented my research design, initially focused on analyzing the Peace Statue erected in Berlin in 2020. The artwork represents the issue of "comfort women", addressing the Japanese-Korean historical conflict and sexualized violence under Japanese imperialism during the war. In light of the workshop at Waseda, I widened the lens to examine the textures of Japanese memory culture. I wanted to understand how the past is staged and communicated in sites of pain, museums, parks and public ritual. I undertook fieldwork in Tokyo, Kyoto, Osaka, Hiroshima, Nagasaki and Okinawa, surveying peace and human-rights museums, memorials and contested landscapes.

7. Research implementation and results under the program

Title of your research plan:

Negotiating Difficult Pasts: Perspectives on WW2 Memory in Japan

Description of the research activities:

At the Hiroshima Peace Memorial Museum, the Nagasaki Atomic Bomb Museum and Peace Park, and the Okinawa Prefectural Peace Memorial Museum, I analysed curatorial choices that translate catastrophe into civic ethics, foregrounding survivor testimony, pacifism and international law. I juxtaposed these with visits to Yasukuni Shrine and the adjoining Yūshūkan museum, whose exhibits advance a revisionist-leaning historiography, recasting culpability, elevating martial sacrifice and normalising imperial warfare within a national narrative. Meanwhile, neighbourhood memorials and human-rights museums in Tokyo, Kyoto, and Nagasaki reveal granular, community-led memory work attentive to gendered violence and colonial entanglements.

To refine the analysis, I presented work-in-progress at Ritsumeikan University (Kyoto), Aoyama Gakuin University and Sophia University, using seminars and roundtables to test claims about narrative competition, reconciliation processes and and democratic resilience. Conversations with scholars, curators and activists helped triangulate competing narratives and their legal, diplomatic and affective registers.

My next task is to synthesise these materials into an article linking debates in Japan to the Berlin statue, situating them within transnational memory activism, democracy, and reconciliation efforts. The analysis will track frictions between national scripts and local memory work, assess how museums mediate responsibility, and consider what kinds of acknowledgement enable meaningful reconciliation.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

My experience in Japan is a highlight in my academic career. Anchored at Waseda, I have encountered an academic community marked by rigour, collegiality and intellectual honesty. Facing painf□l histories demands steadiness and moral clarity; the example set by Japanese colleagues has been quietly galvanising for my own practice.

Furthermore, I had the chance to stay three days with a host family, which made my stay in Japan a unique experience. My time here has been marked by great activities, good conversation, unique tastes of foods and sweets, as well as academic excellence.

JSPS Summer Program 2025
Research Report

1. Name: Voelker, Marvin Paul （ID No. SP25304）

2. Current affiliation:

Technical University of Hamburg

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Tohoku University

5. Host researcher: Prof. Atsushi TAKAHASHI

6. Description of your current research

Interest in Power-to-Gas is increasing in order to reduce global warming and enable seasonal renewable energy storage. A common process is hydrogen electrolysis, where electricity is used to split water into hydrogen and oxygen. The increased carbon dioxide concentration in the atmosphere is caused by the fact that a large proportion of today's energy is generated from fossil fuels. To reduce CO_2 emissions, the captured CO_2 could be used with hydrogen for the CO_2 Methanation to produce methane. This catalytic process is gaining considerable attention in the field of sustainable chemistry and is a promising approach to facilitating carbon recycling and providing a renewable energy source. The knowledge of a robust and trustworthy kinetic model and the reaction mechanism is essential in the chemical industry. The Model is used to make process-specific predictions and to design and optimize reactors and the catalytic performance in order to ensure the most efficient process possible. However, obtaining such a rigorous model is a difficult task. Data of the conversion alone is not sufficient, and multiple different types of experiments are needed. One possibility to address these hurdles is to conduct experiments using a reactor with spatial measurement techniques along the catalytic bed. Concentration and temperature profiles obtained through such methods provide significantly more needed information compared to standard measurements at the reactor inlet and outlet. For example, insights into the dynamic behavior of the catalyst are acquired. Nevertheless, this method still provides no information about the catalytic surface phenomena. Solid catalysts are influenced by the surrounding reactants and process conditions and can thus change their electronic structure, morphology, and reactivity. The catalysts properties can even change in response to local flow, temperature and concentration conditions. Adsorbates can modify their structure and impact the reaction conditions.

My research focuses on the development of an iso-potential DRIFTS setup to measure these changes of the adsorbates. To achieve this, a novel spectroscopic cell, which detects chemisorbed intermediates on the catalyst surface, is coupled with a reactor equipped with spatial-profile measurements. This setup transfers the specific chemical potential at a particular position to the spectroscopic cell, to imitate the same reaction conditions in the catalytic bed. The setup was validated using the oxidation of carbon monoxide catalyzed by γ-Alumina supported Copper catalysts as a model reaction.

7. Research implementation and results under the program

Title of your research plan:

Investigation of low temperature CO_2 Methanation activity of Nickel catalysts in a continuous catalytic fixed-bed reactor

Description of the research activities:

A process setup was developed were CO_2, H_2, and Ar were delivered through mass flow controllers (MFCs) to ensure accurate flow and composition control. A ratio of 1:4 for CO_2 and H_2 and a total volume flow of 100 ml/min was chosen. The mixed gases were introduced into the heated reactor, and reactor pressure was maintained by a back-pressure regulator. The reactor effluent was directed through a heated sampling line, enabling reproducible injections into a Shimadzu GC via a 6-way fixed-volume sampling valve. Calibration of the MFCs with a bubble meter ensured reliable gas delivery, while Ar was used as an internal standard in the GC to quantify product distributions.

Nickel-ceria catalysts with loadings of 12, 10, and 8 percent were prepared by the incipient wetness method using copper nitrate hexahydrate as the precursor. The impregnated catalysts were dried overnight at 120 °C and subsequently calcinated at 600 °C for three hours. After calcination, the catalysts were pressed into pellets, then ground and sieved to obtain particles with diameters in the range of 100 to 350 micrometers. Afterwards, the catalyst was activated in-situ using 10% H_2 in Ar for 90 minutes at 450 °C.

Further, an analyzing method was developed to coordinate the operation of the GC and the reactor in an automated manner, ensuring that gas sampling and chromatographic analysis were synchronized with the reactor operating conditions.

The first experiments at ambient pressure showed promising results for the Ceria-supported Nickel catalysts. Following, I will investigate further different supports loadings and reaction conditions as well as characterize the catalysts in more detail.

Since the results are used for the iso-potential DRIFTS measurements to further investigate adsorbates using more complex reactions, I will continue my research in Japan after the JSPS program ends to acquire more data and find a suitable catalyst.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I am grateful for the opportunity JSPS and Kitakawa lab provided to me. During my time in the program I did a lot of progress in my research and could even enjoy a bit of the Japanese culture on the weekends. For example, spending time with my host family, climbing Fuji-san, visiting Akita for the Kanto Matsuri and going with my laboratory to the Sendai Tanabata fireworks.

9. Adviser’s remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Nora Beier （ID No. SP25305 ）

2. Current affiliation: University of Leipzig, Germany

3. Research fields and specialties:
Mathematical and Physical Sciences / Biological Sciences

4. Host institution: Kyoto University, Japan

5. Host researcher: Prof. Atsushi MOCHIZUKI

6. Description of your current research

My current research investigates how *Escherichia coli* (*E. coli*) survives the harmful effects of reactive oxygen species (ROS) at the metabolic level. These highly reactive molecules can cause severe damage to DNA, proteins, and lipids, and they also disrupt essential metabolic reactions.

The bacterium can survive partly due to an effective enzymatic and regulatory detoxification system. However, this system does not take effect immediately. It is still unclear how *E. coli* maintains metabolic stability before these detox mechanisms are activated.

One possible explanation lies in so-called buffering structures within the complex metabolic network itself. To identify such structures in *E. coli*, we use Structural Sensitivity Analysis (SSA), a mathematical method that analyzes the influence of ROS disturbances on metabolism based solely on the network's topology, which is described by a system of ordinary differential equations (ODEs). SSA focuses on conditions in which the network is in a steady state, meaning metabolite levels remain constant because production and consumption rates are balanced. This approach allows us to pinpoint metabolites and reactions whose changes have the greatest impact on the system's behavior—indicating that they are part of a large buffering structure. Buffering structures are specific sub-networks within the metabolic network in which internal metabolite concentrations and reaction rates remain unchanged when certain reaction rates are perturbed. In this way, they isolate parts of the system from external changes.

My hypothesis is that such buffering structures enable *E. coli* to withstand the damaging effects of ROS at the molecular level, preventing the collapse of its metabolic network. By localizing the impact of disrupted reactions, these structures help preserve the overall balance of metabolism.

7. Research implementation and results under the program

Title of your research plan: Structural Sensitivity Analysis in *E. coli* Metabolism under Reactive Oxygen Species Disturbance

Description of the research activities:

During my research stay at the Mochizuki Lab in Kyoto, I was able to implement the planned project in close collaboration with my host professor and his research group. A central focus of the work was the design and definition of the metabolic network model. This foundational step was crucial, as the quality and structure of the model directly determine the validity of structural sensitivity analyses.

Very large and complex networks often suffer from singularity, meaning the system cannot be solved using ODEs. Further research is required to represent the complete metabolism of an *E. coli* cell as a regular system. Nevertheless, we were able to create larger metabolic networks that capture the most important mechanisms. On these network structures, we applied structural sensitivity analysis to examine how perturbations caused by ROS propagate through the metabolic system.

Our analysis revealed critical metabolic vulnerabilities—reactions in the network where oxidative disturbances have disproportionate effects across the entire system. These findings could be highly relevant for the development of novel therapeutic strategies. By targeting these weak points, it may be possible to disrupt the bacterial stress response and enhance the effectiveness of existing antibiotics.

The stay also involved ongoing scientific exchange with members of the host lab and visiting researchers. These interdisciplinary discussions provided new perspectives and valuable feedback that enriched the project. Additionally, I had the opportunity to attend the ACMB-JSMB 2025 conference in Kyoto, which deepened my insight into the Asian research landscape in my field and facilitated networking with leading experts in related areas.

Overall, the research stay enabled the successful implementation of my project, significantly advanced the conceptual and methodological development of the work, and laid the foundation for possible future collaborations.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I am very grateful to have had this wonderful experience in this beautiful country. Not only did I meet many nice people, I also had the opportunity to experience and learn so many new things. Kyoto is a great city where so much history and culture live harmoniously together with nature and mountains nearby. With the right equipment (umbrella, neck cooler and sweat towel) it is also an amazing place to be on very hot summer days.

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Valerii CHIRKOV （ID No. SP25306）

2. Current affiliation: Department of Biology, Humboldt University of Berlin, Germany

3. Research fields and specialties:
Biological Sciences

4. Host institution: Center for Brain Science, RIKEN

5. Host researcher: Dr. Wataru TOYOKAWA

6. Description of your current research

My research focuses on human collective decision-making, particularly how individuals integrate private experience and socially obtained information during collective foraging and resource tracking. As part of the Cluster of Excellence Science of Intelligence (SCIoI) at Humboldt University Berlin, I am supervised by Prof. Pawel Romanczuk. In collaboration with Dr. Ralf Kurvers (Max Planck Institute for Human Development) and Prof. Heiko Hamann (University of Konstanz), I have examined human ice fishing competitions in Finland. We investigated individual foraging patterns and how people balance and integrate social and private information in a dynamic environment by combining empirical data with computational modeling.

To complement these studies, I have also developed immersive online multiplayer experiments in which groups of participants track dynamic resources under varying social information conditions. These experiments reveal that the availability and reliability of social information strongly affect performance. My broader aim is to formalize these insights into computational models that can explain human behavior and predict conditions that facilitate collective intelligence.

7. Research implementation and results under the program

Title of your research plan:

Flexible Social Information Integration in Collective Search

Description of the research activities:

During my fellowship at RIKEN, I studied how people use information from others to make decisions in uncertain environments. To study this, I focused on the social generalization model, which describes how individuals combine their own experiences with observations of their peers.

First, I reanalyzed existing behavioral data using simulation-based inference. Unlike traditional approaches, which produce only a single "best fit" parameter value, this method estimates full probability distributions over possible parameter values, providing a richer picture of how well different model parameters explain the data. This approach confirmed many of the original study's findings but also revealed discrepancies, showing the value of SBI as a new methodological tool.

I also developed an alternative version of the social generalization model that aligned more closely with the theoretical assumptions. Using computer simulations, I examined the effect of environmental factors on collective performance. I found, for example, that environment size had little effect on the social information generalization process.

Finally, I examined differences between participants by clustering them based on the inferred model parameter values estimated per participant. This revealed two distinct groups: those who relied heavily on social information and those who largely ignored it. Overall, the project contributed methodologically by introducing SBI, theoretically by generating new predictions about when social learning is beneficial, and practically by refining a model that can be used in future research on collective intelligence.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I had an exciting stay in Japan, with the opportunity to participate in the homestay program, explore Tokyo, hike Mt. Fuji, enjoy social gatherings with my colleagues at RIKEN, and even travel to Hokkaido. This summer program was both a deep dive into Japanese culture and an important step in my scientific career. I am grateful to JSPS and Dr. Wataru Toyokawa for making this opportunity possible.

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Tim Ölkers （ID No. SP25307）

2. Current affiliation: Georg-August University

3. Research fields and specialties:
Social Sciences, Agricultural Sciences

4. Host institution: National Graduate Institute for Policy Studies (GRIPS)

5. Host researcher: Kazushi Takahashi

6. Description of your current research

Governments and development partners invest substantial resources in expanding access to agricultural risk mitigation tools, such as index-based insurance, across the globe. While these instruments are designed to protect farmers from the adverse impacts of climate variability, recent evidence from several countries in the Global South highlights persistently low uptake rates. This gap between policy intention and farmer adoption raises important questions about the design, perceived value, and delivery of such products.

This study examines farmers' willingness to pay (WTP) for an innovative bundled insurance product that integrates crop index insurance with two complementary services: personalized farm advisory tailored to local agronomic conditions, and timely, location-specific weather forecasts delivered via SMS. The bundling approach is intended to go beyond simple risk transfer, enhancing farmers' capacity for proactive decision-making throughout the agricultural season. By combining financial protection with actionable, context-relevant information, the product aims to address both the income shocks from adverse weather and the information gaps that constrain adaptive responses among smallholder farmers.

Drawing on primary data collected from smallholder farmers across multiple regions in Mali, we employ a double-bounded contingent valuation method to elicit WTP for the bundled service. This approach allows us to capture not only the average valuation but also the factors that shape heterogeneity in demand, including socio-economic characteristics, prior exposure to insurance, and access to information channels. The findings will inform both policy and product design by identifying whether, and under what conditions, integrated insurance–information packages can overcome adoption barriers, ultimately strengthening resilience and climate risk management in smallholder agricultural systems.

7. Research implementation and results under the program

Title of your research plan:

Bundling Index-Insurance with Information: Assessing Farmers' Willingness to Pay for SMS-Based Risk Mitigation in Mali for bundled products

Description of the research activities:

During my research stay in Tokyo, I focused on the analysis of primary survey data collected from smallholder farmers across several regions in Mali. The dataset captured detailed socio-economic characteristics, farming practices, exposure to weather risks, and prior experience with agricultural insurance and information services. A central objective of my work in Tokyo was to estimate farmers' WTP for an innovative bundled product combining crop index insurance, personalized farm advisory services, and timely weather forecasts delivered via SMS.

The analysis employed a double-bounded contingent valuation method to derive more precise WTP estimates and reduce starting-point bias. I applied econometric modeling to identify the factors influencing adoption potential, including demographic characteristics, risk preferences, prior exposure to digital agricultural tools, and access to extension services. Special attention was given to testing for heterogeneity in demand across regions and gender groups, as well as to exploring the interaction between information access and risk mitigation preferences.

Working in Tokyo provided access to an academic environment that facilitated both methodological refinement and peer feedback. I collaborated with colleagues to review model specifications, improve robustness checks, and incorporate additional variables into the regression framework. This process helped strengthen the validity of the findings and deepen the interpretation of observed patterns in the data.

As part of the research exchange, I presented my work at the GRIPS. The presentation outlined the research motivation, data collection process, methodological approach, and preliminary results. The session attracted an audience of faculty members, researchers, and graduate students, leading to an engaging discussion on the practical and policy implications of bundling index insurance with information services in low-income agricultural contexts.

Overall, the research activities conducted in Tokyo strengthened the analytical depth of the study and provided valuable opportunities for scholarly exchange. The insights gained from both the data analysis and the GRIPS presentation will directly inform the final reporting phase and the formulation of targeted policy recommendations for scaling digitally inclusive agricultural insurance solutions in Mali and beyond.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

My stay in Japan was an enriching experience, both professionally and personally. Living and working in Tokyo allowed me to immerse myself in one of the most dynamic and vibrant cities in the world. Beyond the academic environment, the city itself offered a unique blend of tradition and modernity from centuries-old temples and serene gardens to cutting-edge architecture and bustling urban districts. The culinary experience was truly exceptional. Japanese food exceeded my expectations in both quality and variety, ranging from world-class sushi and sashimi to comforting bowls of ramen and delicate seasonal dishes. I also enjoyed exploring smaller, family-run restaurants and street food stalls, where the hospitality and attention to detail were remarkable. The emphasis on fresh, high-quality ingredients and beautifully presented meals made dining in Japan an experience in itself. Overall, my time in Japan was both intellectually stimulating and culturally rewarding. It provided a valuable opportunity to advance my research while also experiencing the richness of Japanese culture, cuisine, and daily life.

JSPS Summer Program 2025
Research Report

1. Name: Clasen, Annika （ID No. SP25308　）

2. Current affiliation: Heinrich-Heine-University, Düsseldorf, Germany

3. Research fields and specialties:
Humanities　Social Sciences

4. Host institution: The University of Tokyo

5. Host researcher: Professor Yukari IWANAMI

6. Description of your current research

My dissertation investigates the role of norms and values in shaping Japan's foreign policy. I explore why these factors are important, how they are employed, and their influence on actual policy decisions. Although this question is intentionally broad, my dissertation aims to reveal how references to norms such as democracy, human rights, gender equality and the rule of law have informed specific policy choices, and what these references reveal about the underlying narratives within Japan's political discourse. Japan is a particularly compelling case study because of its role in the Second World War, which led to the need to rebuild the country's reputation and establish itself as a reliable and trustworthy partner on the international stage. Consequently, Japan's national identity has been shaped by its pacifist constitution, the pursuit of normality, and efforts to 'catch up' with the West.

To better understand these dynamics, my project at the University of Tokyo focused on comparing Germany, a country with a similar post-war background to Japan's, with Japan. Both were defeated in World War II and adopted pacifist frameworks, building their post-war foreign policies around economic cooperation and multilateralism. In recent years, however, their responses to rising global tensions, particularly in the context of China's growing assertiveness, have diverged. Germany has shown a greater willingness to redefine its international role, partly due to its success in confronting its historical legacy and forging strong partnerships within Europe. Japan, by contrast, continues to face regional tensions rooted in unresolved historical issues, which influence its strategic behaviour and restrict its normative influence in Asia.

By exploring how each country frames its decisions and actions towards China, not only through historical narratives but also through their respective alliances, institutional resources and normative commitments.

Thanks to the resources provided by the University of Tokyo and my participation in various events over the past few months, I was able to gather a wealth of materials and engage in valuable conversations with both researchers and practitioners in the field. In the coming months, my focus will be on analysing this material and integrating it into my project.

7. Research implementation and results under the program

Title of your research plan: Comparison of Germany's and Japan's foreign policy directions amidst growing challenges

Description of the research activities:

During my research stay with JSPS at the University of Tokyo, I collected materials on how Japan has responded to China's growing global influence. Specifically, I attended events with policymakers, conferences and workshops, and visited the National Diet Library to access archival materials on this topic. Through these activities, I acquired contacts for interviews. These interviews provided helpful insights into the institutional constraints and discursive elements that lead to specific policy choices. Furthermore, my time at the University of Tokyo enabled me to develop new relationships with academic professionals at my institute, leading to cooperation and partnership projects and helping me to advance in this area too.

Furthermore, I had the valuable opportunity to collaborate closely with my host professor, which allowed us to further develop and refine our shared research ideas.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

From the outset, JSPS provided us with a wonderful blend of cultural experiences, ranging from wearing kimonos and taking part in tea ceremonies to attending concerts featuring shamisen and koto performances. A personal highlight for me was travelling to the prefectures of Fukushima, Yamagata and Miyagi. Besides enjoying life in Tokyo, this gave me the chance to experience the rural beauty of Japan too. I will always remember the stunning landscapes, the abundance of hot springs, and the delicious local cuisine.

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Theresa BUETTNER （ID No. SP25310）

2. Current affiliation: Freie Universitaet Berlin

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency (JAXA)

5. Host researcher: Assoc. Prof. Tatsuaki OKADA

6. Description of your current research

The interpretation of thermal infrared data gathered around asteroids can provide insights into thermal conditions on the surface, as well as its structural properties and composition. The diurnal temperature variation of an asteroid depends on its material properties, predominantly thermal inertia and surface roughness, which in turn depend on the structure of the material, in particular, grain size or porosity. Thermal inertia and surface roughness can be derived by comparing observational data to temperature predictions of thermophysical models.

In my current research, I am focusing on the numerical modelling of surface temperature cycles of asteroids and their observation by infrared instruments. In particular, I have been working on the thermal modelling of the surface of asteroid (162173) Ryugu, target of the JAXA Hayabusa2 mission. The Hayabusa2 spacecraft was launched in December 2014 and carries several scientific instruments, including a Thermal-Infrared Camera (TIR). TIR measured the thermal emission of Ryugu through a wideband filter with a range of 8 – 12 μm during the 1.5 year long survey of the asteroid. Previously, the surface parameters of Ryugu have been estimated by looking at data gathered by TIR on August 1, 2018, and by MARA (the radiometer on lander MASCOT) on October 3, 2018.

Another aspect of my current work is the coupling of thermal modelling to data assimilation in order to efficiently retrieve model parameters. Data assimilation is an iterative method comparing a model prediction with given uncertainty to an observation with given uncertainty, calculating a correction factor, and using this correction factor to improve the distribution of model input parameters until a stable solution is found. The distribution of input parameters represents the uncertainty of these parameters based on the uncertainty of the observations, e.g., the uncertainty of thermal inertia based on the uncertainty of the temperature measurement done.

7. Research implementation and results under the program

Title of your research plan:

Modelling and Interpretation of Observations by Infrared Mapper TIR

Description of the research activities:

During my time at ISAS with the JSPS Summer Program 2025, I focused on expanding the previous work described above by examining and evaluating data from additional observation dates. In order to be able to compare the data from different dates, there were three main tasks:

The available databases use two different shape models of Ryugu, both consisting of approx. 200 000 facets, which are all oriented and shaped differently to represent the surface of Ryugu as precisely as possible. The observations by TIR are mapped onto these shape models to acquire a diurnal temperature curve for each facet. I first reviewed the differences between the two shape models and examined their local and global influence on the estimation of the thermophysical parameters.

Subsequently, I examined the impact of including the seasonal wave into the thermophysical models. The seasonal wave describes temperature variations associated with the asteroid's orbital year, penetrating deeper into the subsurface layers, instead of the daily surface temperature variations caused by the asteroid's rotation around itself. In previous estimations of the thermophysical parameters of Ryugu, the seasonal wave was not taken into account.

Lastly, I compared the observations and results from August 1, 2018 with the data from other dates. For this, I mainly used data from October 3-4, 2018, which was gathered by TIR after the deployment of the MASCOT lander.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I was able to experience many unique things during my stay in Japan with the JSPS Summer Program, which can most likely not be recreated in any other setting. It was amazing to connect with other researchers from all over the world, both in my host institution and during activities with the other JSPS fellows. The working group at my institute made me feel very welcome, and I was able to visit the Chiba Institute of Technology in context of my work here. I especially enjoyed the nature and the homestay with my host family.

9. Adviser's remarks (if any):

Theresa performed an excellent job in such a short period of time for updating the estimate of thermal inertia and surface roughness mapping of asteroid Ryugu, including the seasonal effect. It is also useful to compare the results with the data from different dates (different solar distances and solar phase angles), which should constrain the results. Temperature dependency of thermal inertia (especially for specific heat) should be also considered in the future. I am happy to know that Theresa has an interest in this topic and she is willing to continue this research after she is back in Germany. It is ok for keeping in touch for further discussions.

JSPS Summer Program 2025
Research Report

1. Name: Moritz René Pretzsch （ID No. SP25311）

2. Current affiliation: University of Kassel (Germany)

3. Research fields and specialties:

Humanities **Philosophy (Metaphysics)** Social Sciences Mathematical and Physical Sciences

Chemistry Engineering Sciences Biological Sciences

Agricultural Sciences Medical, Dental and Pharmaceutical Sciences

Interdisciplinary and Frontier Sciences

4. Host institution: Waseda University (Tokyo)

5. Host researcher: Professor Ryo Ito

6. Description of your current research

I am currently working on the following research project in philosophy: 'The Grammar of Reason in Wittgenstein's Thought - Rationality and Criticism of Rationality with Excursions to Hamann, Goethe, Nietzsche, Kierkegaard, Heidegger and Foucault.' I am working on this project at the Universities of Kassel and Munich (Germany) and at the University of Bergen (Norway). As part of this project, I am examining the question of the conception and structure of reason, the tension between conviction and persuasion, and the concepts of thinking style, intuition, will, emotion, passion and madness. Fundamentally, I am interested in how we must think about the concept of reason today and how we can respond to the crisis-ridden times we are currently experiencing.

7. Research implementation and results under the program

Title of your research plan:

As part of my PhD project at the University of Kassel, I am researching the concept of reason in Ludwig Wittgenstein's thinking. The guiding question is to what extent sceptical and affirmative tendencies towards reason can be found in Wittgenstein's thinking. In addition, the study focuses on the extent to which Wittgenstein's logical argumentation was influenced by his colleagues Bertrand Russell and Gottlob Frege. The research gaps I would like to fill here include an evaluation of the relevance and a more detailed examination of important concepts in Wittgenstein's thinking that are closely related to the concept of reason: for example, the concept and status of intuition in the philosophy of mathematics, of the will, and the distinction between discursive and intuitive thinking in Wittgenstein's work. The aim is to examine the relationship between these concepts and the concept of reason in Wittgenstein's work and to what extent Wittgenstein is sceptical and critical of a purely rational approach to the world. The research work of Professor Ryo Ito on early analytical philosophy, the philosophy of logic and the philosophy of mathematics in the thinking of Russell and Wittgenstein is particularly groundbreaking and extremely helpful in this regard. Professional exchange and supervision are more than useful and helpful for my research work. However, my current research on Wittgenstein and the concept of reason in his thinking also deals with Wittgenstein's critique of manifestations of instrumental reason as found in modernity. For example, his critical examination of progress as the dominant form of civilisation in modernity and the scientistic and technicist spirit. The extent to which we can currently benefit from Wittgenstein's critical thinking about reason is an important component of my PhD research project.

Description of the research activities:

I was able to have numerous intensive discussions with my host about my project. These were very enriching and helpful. Waseda University provided me with an excellent place to work on my research project! I would love to come back! I would like to take this opportunity to once again express my sincere gratitude to JSPS for awarding me this scholarship!

I was also able to successfully participate in lectures at Kyoto University at the ‘Kyoto Workshop on Language, Value, and Reason: Themes from Wittgenstein and Kant’ on 5 and 6 August. I gave a lecture on ‘The Grammar of Reason – Rationality and Scepticism of Rationality in Wittgenstein's Thought’. This led to further very enriching discussions. I was also able to participate in the workshop ‘Waseda Workshop on the History of Western and Eastern Philosophies’ on 19 August with a lecture on ‘Propaganda for a style of thinking – An investigation of Wittgenstein's concept of style of thinking’, which opened up very enriching discussions for me.

I would like to take this opportunity to once again express my sincere thanks to JSPS and, above all, Professor Shunichi Takagi (Kyoto University) for the invitation and the exchange.

My sincere thanks go to Professor Ryo Ito (Waseda University) for providing me with every conceivable support and assistance and for always being there for me as my host. Thank you very much for the invitation!

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

At this point, all that remains is for me to once again express my sincere gratitude to JSPS and, by extension, to the Japanese government. I would also like to extend my warmest thanks to Professor Ryo Ito for his trust and all his efforts and assistance!

I would very much like to return to Japan, this wonderful country.

9. Adviser's remarks (if any):

I am pleased to report that Moritz René Pretzsch actively engaged with academic activities, participating in seminars and workshops held at Waseda University and Kyoto University and presenting his work at some of those workshops. (R. Ito)

JSPS Summer Program 2025
Research Report

1. Name: Matthias Hartmann （ID No. SP25312）

2. Current affiliation: Universität Münster

3. Research fields and specialties:
Chemistry

4. Host institution: Osaka Metropolitan University

5. Host researcher: Prof. Akitoshi Hayashi

6. Description of your current research

My current research during my Ph.D. focuses on the development of new solid-state electrolytes and batteries for beyond lithium-based systems, like sodium-based ones.
This includes the optimization for synthesis of inorganic compounds as well as their characterization by diffraction, spectroscopy methods and the investigation of their transport properties by electrochemical methods. The combined data set will in turn be used to formulate a relationship between the determined crystal structure and the ionic conductivity. The latter is a key metric for the evaluation of solid electrolytes.
In terms of solid-state batteries, my research focuses on sodium-based systems. This includes the screening and selection of suitable materials. These are typically already reported materials that show a promising electrochemical stability, a high ionic conductivity, or both. The cells are electrochemically characterized by the means of alternating charge and discharge cycles as well as by impedance spectroscopy to determine the aging behavior of the cell. Gradual increases of the charge and discharge rates are further used to determine how much of the capacity can still be accessed under the employment of higher currents.

7. Research implementation and results under the program

Title of your research plan:

Development of Na-based solid-state batteries with oxyhalide solid electrolytes

Description of the research activities:

The research was focused on the development of a sodium based solid state battery with a novel solid electrolyte. This compound is part of the recently more discussed oxyhalides and it shows a promising stability towards high potentials as well as a high ionic conductivity. Both properties are important for a solid electrolyte. The batteries were assembled and investigated in their charge and discharge behavior. Several batteries were repeatedly charged and discharged, some at higher and some at lower currents. An additional cell was built, where the current increased between cycles in order to determine how the cell behaves under different currents. After a set amount of cycles, the cells were stopped, opened and investigated.
These analyses included electron scanning microscopy, X-ray diffraction as well as different spectroscopy methods. The goal was to identify why the capacity of the battery degraded gradually. A main focus was towards the positive electrode, as it contained several compounds, including the solid electrolyte, which has not been investigated before in a solid-state battery.
Overall, the conducted experiments allow preliminary conclusions to why the cell degraded during cycling and which compound represents the bottleneck in the cell performance. Even though the cell degraded over time, its performance is promising and the analyses after cell disassembly did not show significant amounts of cell degradation. Further tests will be conducted to identify the degradation mechanism and to determine what material properties need to be adjusted.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

During my stay, I was able to gather lots of cultural experiences. Firstly, the overall friendliness of people in Japan was a great experience. From the stay I saw how traditions can be followed while also implementing new technologies, which showcase the technical development in Japan. The contrast between tradition and technology is fascinating and something I will dearly miss. Having been able to visit a lot of festivals / festivities also was a great experience and a contrast to the traditions I know in Germany.
The overall stay here was a great experience, professionally and also personally.

9. Adviser’s remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Andrea Leipe （ID No. SP25313）

2. Current affiliation: Leipzig University,
Rudolf-Boehm-Institute of Pharmacology and Toxicology

3. Research fields and specialties:
Medical, Dental and Pharmaceutical Sciences

4. Host institution: Laboratory of Physiology and Anatomy,
School of Pharmacy, Nihon University

5. Host researcher: Genki Kimura

6. Description of your current research

TRPV2 is an unselective, Ca^{2+} permeable ion channel found ubiquitously in cells of the human body, with particularly high amounts in immune cells. However, its physiological role remains largely elusive. To investigate TRPV2´s functions, our group has identified and validated the TRPV2 inhibitor IV2-1 and the TRPV2 activator AV2-1. Both exhibit favorable properties for the application in experiments with living cells *in vitro.* After full characterization, they can now be used to elucidate TRPV2 function in experiments. In *in vitro* measurements using mouse mast cells, human peripheral blood derived macrophages and NK cells, AV2-1 reliably activated TRPV2, an effect that could be blocked by IV2-1.

Consequently, we now possess powerful tools to modulate TRPV2 in immune cells to investigate the ion channel´s function. Studies from other groups and our research suggest that TRPV2 could play an important role in the immune system. For mouse bone marrow derived macrophages, decreased migration and phagocytosis have been reported when TRPV2 is inhibited or genetically ablated (Link et al., 2010; Raudszus et al., 2023). Mast cells have been reported to express TRPV2 and to degranulate upon mechanical TRPV2 activation (Plum et al., 2020; Stokes et al., 2004; D. Zhang et al., 2012). Our research demonstrates clear TRPV2 activation in mast cells via AV2-1, as shown by single-cell Ca^{2+} imaging. Subsequently, this effect leads to degranulation and migration, effects that are absent when TRPV2 is blocked.

Altogether, these findings support a likely involvement of TRPV2 in immune responses. Given that asthma and chronic obstructive pulmonary disease (COPD) are inflammatory diseases with underlying immune components, TRPV2 may be involved in their development and/or progression. TRPV2 expression in the lung has been demonstrated (Masubuchi et al., 2019; Yang et al., 2006; Fantozzi et al., 2003). However, studies on the involvement of TRPV2 in inflammatory lung diseases are scarce. One study among children diagnosed with asthma found a strong correlation between an increased expression of TRPV2 in peripheral lymphocytes and their asthmatic condition (Cai et al., 2013). Furthermore, San-ao decoction, a Chinese traditional medicine for the treatment of asthma and cough, reduced TRPV2 expression in the lung (Zhang et al., 2020). Regarding COPD, one study discovered impaired TRPV2 expression and phagocytic function in alveolar macrophages from mice exposed to cigarette smoke (Masubuchi et al., 2019). To date, there are no data available about the involvement of TRPV2 in asthma-COPD overlap syndrome (ACO).

As the prevalence of asthma, COPD, and ACO is increasing worldwide, affecting millions of patients, and as these diseases still cannot be sufficiently treated or cured, there is an urgent need to identify new therapeutic targets in lung inflammatory diseases. Our research and literature suggest that TRPV2 is a promising candidate for drug development. To gain deeper insights into the role of TRPV2 in asthma, COPD, and ACO, we employed the ACO model established by Kimura et al., in which papain and tobacco smoke are used to induce ACO-like symptoms in mice (Kimura et al., 2024). Using this model, we investigated TRPV2 expression, function and effects in alveolar macrophages and NK cells isolated from these disease models.

7. Research implementation and results under the program

Title of your research plan:

Could TRPV2 be a new target for Asthma and COPD treatment?

Description of the research activities:

Different cell populations and distinct types of immune cells were isolated from healthy control mice as well as from mice with asthma, COPD and asthma-COPD-overlap (ACO) symptoms. These immune cells were analyzed and compared regarding their expression of TRPV2. Interestingly, we observed a trend towards lower TRPV2 expression in cells derived from bronchoalveolar lavage across all inflammatory lung models. These differences were also evident in functional Ca^{2+} imaging measurements and in preliminary data from phagocytosis assays. In these assays, which assess the bacterial clearance capacity of specialized immune cells, addition of the activator AV2-1 promoted phagocytosis. This effect was blocked upon addition of the inhibitor IV2-1.

NK cells isolated from lung or spleen from asthma and ACO model mice exhibited slightly higher TRPV2 expression and function compared to control mice. Even more distinctly, NK cells from COPD mice showed lower expression compared to control mice and exhibited nearly no response to the activator AV2-1 in functional measurements.

The observed trends did not reach statistical significance due to high interindividual variability and the limited sample size of n=3 per model. This approach was chosen to minimize animal usage and due to time constraints. Overall, the promising results of this project provide the basis for future collaborations with a special focus on establishing TRPV2 as a novel therapeutic target in COPD.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

During my research stay, I enjoyed Japanese hospitality in its full extension. I was very fortunate to even have a welcome party with the students of our laboratory, where we made Okonomiyaki and had a lot of fun. Additionally, I had the opportunity to attend a scientific conference organized by my laboratory. The PhD students of a neighboring lab introduced me to Izakaya culture. I explored the culture, nature and food of Tokyo and nearby cities. For example, I visited shrines and temples, a jazz bar, a baseball game at Tokyo Dome and different traditional festivals. Overall, my stay in Japan was very rich and diverse, I made professional and personal connections with many very kind and highly skilled people and I have learned many things in research and culture that I could not have learned anywhere else in the world. I am incredibly grateful to my professors and all the people who made this stay possible and such a wonderful experience and I hope to maintain the invaluable relationships that I made in Japan.

9. Adviser's remarks (if any):

Although limited sample availability from mice posed a considerable challenge, the knowledge and skills of the team were fully utilized in collaboration to obtain measurable data. Notably, the behavior of TRPV2 in NK cells derived from COPD model mice provides highly interesting insights, potentially explaining the smoking-induced decline in immune function.
Overall, this experience has been extremely stimulating and valuable for us as well.

JSPS Summer Program 2025

Research Report

1. Name: Mareike Antonia Lotze （ID No. SP25314 ）

2. Current affiliation: University of South-Eastern Norway

3. Research fields and specialties:
Social Sciences

4. Host institution: APU Ritsumeikan University Beppu

5. Host researcher: Prof. Thomas JONES

6. Description of your current research

My research combines nature-based tourism with community development studies, aiming to develop a sustainable trajectory for social well-being as well as wildlife and habitat conservation.

In Norway and Iceland, wildlife tourism has emerged as an alternative source of income for local communities, leading to a shift from subsistence lifestyles that once focused on exploiting wildlife, towards a more synergistic system that promotes the conservation of endangered species while securing livelihoods for locals. Although this development has sparked a motivation to protect certain species, it has not been without conflicts and challenges, particularly at the managerial level within communities. The interests of conservationists and tourism operators often diverge. Issues such as access rights to wildlife viewing sites and the appropriate level of human-animal interaction—ensuring minimal disturbance to natural behavior—continue to generate tension.

On a broader scale, societal development in the sparsely populated Scandinavian regions is being affected by issues like workforce shortages in remote areas and increasing urbanization, issues Japan is severely affected by as well. These factors pose challenges to societal well-being and the successful operation of the tourism sector in rural areas. With regions dependent on nature-based and wildlife tourism, there is a pressing need for innovative solutions to revitalize these areas, making them attractive places for young people and families to live.

To address the complex and interconnected issues facing these regions, I apply the TRANSFORM framework by Wiek and Lang (2016), which provides guidance for analyzing key determining factors and envisioning possible future scenarios to design a favorable path forward. My current research focuses on the small town of Húsavik in Northern Iceland. With a history of whaling, Húsavik has successfully transitioned into a whale-watching hotspot, renowned for excellent humpback whale sightings. Although this shift has effectively ended whale hunting and created a promising future for the town, ongoing disagreements highlight the need for more sophisticated scenario planning to ensure truly holistic and sustainable development.

The desire to deepen my understanding of wildlife tourism as a culturally conditioned practice has motivated me to participate in the JSPS Summer Program.

7. Research implementation and results under the program

Title of your research plan:

Towards Sustainable Wildlife Tourism in South-West Japan: Integrating Interdisciplinary and Multi-cultural Perspectives

Description of the research activities:

During my stay at Ritsumeikan University in Beppu I had the chance to meet other researchers in the field of nature and wildlife tourism and engage in fruitful discussions on current practices and challenges in their respective case studies, ranging from rabbit islands to dolphinariums. My host researcher Prof. Jones was of invaluable help with expanding my network. Additionally, the exchange with other international students has broadened my knowledge on Asian wildlife tourism beyond the scope of Japan.

We executed wildlife tourism field trips to various sites, including Japanese macaque monkeys at Takasakiyama and Yakushima, Shika deer in Miyajima and Yakushima and loggerhead/green sea turtles in Yakushima. We discussed and analyzed the wildlife tourism practices according to aspects of the site and human-animal interaction, also considering history and purpose, captivity, feed provisioning, petting, as well as the view of locals and tourists on the wildlife either as a pest or attraction. In this exchange, the cultural differences of Japanese vs. Western (European, US) wildlife tourism were highlighted, pointing towards an emphasis in Japanese culture of the convenience in wildlife experiences whereas Western thinking mainly pursue a higher effort mentality.

We conducted qualitative interviews in Yakushima with various stakeholders, among them local guides from the sea turtle tourism organization, conservationists from Umigamekan association, visiting tourists and Yakusugi museum employees. Drawing on field trip observation and interviews we studied the role of sea turtle tourism in depth and currently work on a comparative paper, as similar research has been conducted in Central America (Mexico, Costa Rica).

Lastly, I see many similarities between the development and challenges in the town Húsavik on Iceland and Yakushima. Hence, upon return I will engage in the visioning process following the TRANSFORM framework to create scenarios of Yakushima's trajectory, which we plan to present and discuss with the mentioned stakeholders of Yakushima wildlife tourism in future fieldwork.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

During my time in Japan I had the chance to participate in calligraphy classes, stay in a buddhist temple, learn Origami and experience various festival, including the Hakata Gion in Fukuoka. I also appreciated the time with the host family and the international exchange with professors and students from Japan and across the world. Overall, I can highly recommend the JSPS summer program.

9. Adviser's remarks (if any)

JSPS Summer Program 2025

Research Report

1. Name: Yongli MOU （ID No. SP25315）
2. Current affiliation: RWTH Aachen University
3. Research fields and specialties: Mathematical and Physical Sciences
4. Host institution: National Institute of Informatics
5. Host researcher: Prof. Shin’ichi Satoh
6. Description of your current research Vision-language models aim to bridge the gap between visual inputs and natural language, enabling tasks such as image captioning and visual question answering. However, these models often suffer from hallucination, generating outputs that are unfaithful to the visual input. Hallucination arises due to over-reliance on learned patterns from training data, misalignment between textual and visual modalities, or limitations in attention layers responsible for guiding the model’s focus. In this project, we analyze the hallucination in state-of-the-art VLMs.

7. Research implementation and results under the program

Title of your research plan:

On the analysis of hallucination in vision language models

Description of the research activities:

1. Research Questions

This study focuses on two key questions:

1. Confidence and Hallucination: When the model hallucinates, is it aware of its own uncertainty? In other words, is the model's confidence (measured by output entropy) higher or lower when hallucination occurs?
2. Modal Imbalance and Attention Dynamics: Given that multimodal inputs are often imbalanced (e.g., for simple questions around 2000–3500 tokens, with more than 2000 tokens from the image modality), how does the attention distribution between image and text tokens evolve during token generation? Is there a pattern of modality dominance or neglect associated with hallucination?

2. Methodology

1. Measuring Model Confidence: For each generated token, we compute the entropy of the next-token prediction probability distribution over the vocabulary. Lower entropy indicates higher confidence. We compare the average entropy between hallucination and non-hallucination outputs.
2. Analysing Attention Distribution: We extract the attention weights across image and text tokens during generation, which allows us to visualize how the model's focus shifts across modalities. Specifically, we examine whether attention to image tokens decreases when hallucination occurs.
3. Visualization Tool: To support analysis, we implemented a web-based visualization interface. It provides interactive displays of token-level entropy trends, cross-modal attention heatmaps, and image patch mappings corresponding to image tokens. The mapping between image tokens and spatial patch positions is also implemented, enabling fine-grained interpretability.

3. Preliminary Findings

Initial experiments suggest that hallucinated responses often exhibit a lower confidence (high entropy), implying that models may be aware, to some extent, of the uncertainty associated with their incorrect outputs.

4. Contribution

This research provides a quantitative framework for assessing confidence in VLM hallucination, an attention-based interpretation of modality imbalance and a visual analytic tool for researchers to explore VLM internal behaviors interactively.

5. Future Work

We aim to extend the analysis to more models and datasets, to explore interventions (e.g., reweighting or calibration) to mitigate hallucination, and to incorporate human evaluation for a deeper understanding of perceptual vs. factual hallucination.

Remark

Code is available: https://github.com/MouYongli/DeepHallu

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I truly enjoyed my time in Japan (foods, sightseeing, people and culture) and hope to have another opportunity to visit Japan in the future.

9. Adviser’s remarks (if any):

Mr. Mou's research topic on analysing hallucination of VLMs is very interesting. The discussion made during his stay was very productive.

JSPS Summer Program 2025
Research Report

1. Name: Girish Kakkepalya Hanumantharaju （ID No. SP25316）

2. Current affiliation: University of Augsburg, Germany

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Meiji University, Ikuta campus

5. Host researcher: Prof. Yutaka Noguchi

6. Description of your current research

Perovskite nanocrystals (PNCs) have gained significant interest in the research community for light-emitting applications due to their exceptional optical properties. Factors such as charge-carrier balance and type of ligand passivation on the nanocrystal surface play a crucial role in determining the electrical and optical stability of PNCs and the overall device efficiency. Additionally, vapor deposited polar organic thin films, typically the electron transport layers (ETLs), show preferential alignment of their permanent dipole moment (PDM), leading to a macroscopic polarization of the film (Fig.1(a)). This results in something called giant surface potential (GSP), which leads to charge accumulation at the thin film interfaces and can significantly influence the charge carrier dynamics in perovskite nanocrystal LEDs (Fig.1(b)). This effect is quite well reported in organic LEDs, where the charge accumulation would confine the emission zone and act as an exciton quencher, leading to faster device degradation. However, studies on the effect of GSP on perovskite nanocrystal LEDs are scarce.

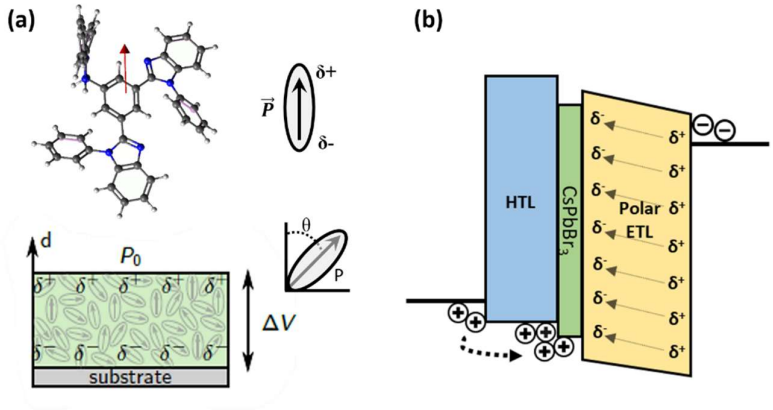


Figure 1. (a) Macroscopic polarization of vapor deposited organic thin film due to the net orientation of the molecules PDM. (b) Charge accumulation in perovskite nanocrystal LED due to GSP of ETL.

Addressing this, my current research focuses on understanding the charge accumulation behaviour due to GSP and the corresponding exciton quenching in perovskite nanocrystal LEDs. One suitable technique to understand both the charge dynamics and the exciton behaviour in the device is through the displacement current measurement (DCM) technique combined with simultaneous observation of the photoluminescence (PL) intensity. This technique, developed by Prof. Noguchi's group, is analogous to the conventional capacitance-voltage measurement but is a faster technique for investigating the effect of GSP in perovskite nanocrystal devices.

7. Research implementation and results under the program

Title: Influence of GSP on the charge carrier and exciton dynamics in perovskite nanocrystal LEDs.

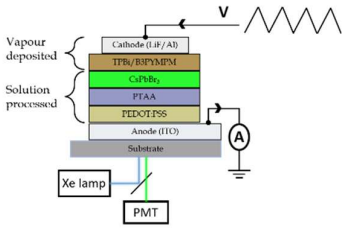


Figure 2. Perovskite LED structure with DCM-PL setup used for this study.

Description of the research activities:

Perovskite nanocrystal LEDs were fabricated at Noguchi Laboratory, Meiji University. Displacement current measurements were performed while simultaneously monitoring the PL intensity. The results, presented below (Fig.3), indicate that the incorporation of TPBi ETL having GSP reduces the PL quenching in perovskite LEDs. These observations are consistent with previous supporting measurements conducted at Augsburg. Unlike in OLEDs, where GSP-induced charge accumulation typically increases PL quenching, the presence of GSP in perovskite LEDs appears to mitigate non-radiative recombination, thereby enhancing their optical performance. This suggests that GSP could be a beneficial design strategy for improving the efficiency and longevity of perovskite-based LEDs.

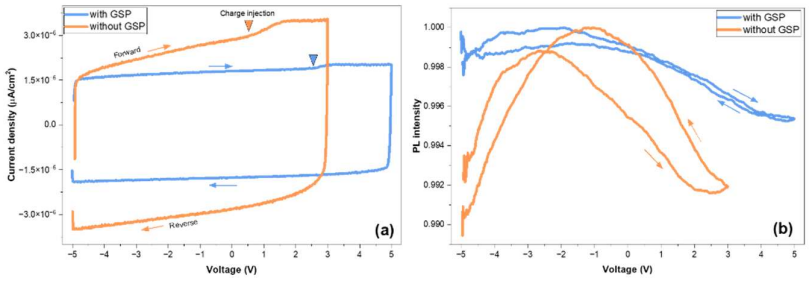


Figure 3. (a) DCM & (b) PL intensity plots of perovskite LEDs with two ETLs.

8. Please add your comments, including any cultural experience during your stay in Japan:

Although this was my second visit to Japan, the country's rich tradition always has something new to offer. This time, I witnessed Tokyo's Lantern Floating Festival—a breathtaking scene of glowing lanterns drifting across the water, carrying wishes and memories, surrounded by soft music, quiet prayers, and the warm glow of community.

9. Advisor's remarks (if any):

During his stay in our laboratory, he worked diligently and actively engaged with the students in my group. Although his research did not always progress as smoothly as expected, he pursued it with his utmost effort. I greatly appreciate having the opportunity to host his visit, which brought positive influence to our group and will further strengthen our international collaborations.

JSPS Summer Program 2025
Research Report

1. Name: Minh Trinh （ID No. SP25317）

2. Current affiliation: RWTH Aachen University

3. Research fields and specialties:
Engineering Sciences

4. Host institution: Nagoya Institute of Technology

5. Host researcher: Professor Kenta Seki

6. Description of your current research

My research focuses on developing a comprehensive and intuitive framework for friction identification in CNC (Computer Numerical Control) robot joints. I aim to streamline the identification process while capturing key influences on friction dynamics, such as velocity, load, temperature, and axis-specific effects. To achieve this, I implement advanced data-driven approaches, including neural networks and grey-box models, to improve prediction accuracy while ensuring physical interpretability and generalizability across different robot axes. I also integrate incremental learning into the framework so that friction models can adapt to new operational data over time, maintaining robustness and reducing the need for manual recalibration. In addition, I develop a digital shadow that enables automated friction identification and supports continuous monitoring, contextualization, and refinement of both data-driven and conventional models. Through these contributions, my work advances the understanding and management of friction in CNC robot joints, ultimately improving the precision, reliability, and adaptability of robotic systems for demanding applications such as aerospace manufacturing.

7. Research implementation and results under the program

Title of your research plan: Neural Network-enhanced Smith Predictor for Friction and Time Delay Compensation in an Asteroid Flyby Observation Testbed

Description of the research activities:
Building on my broader interest in data-driven modeling and friction identification, I focused a related line of research on enhancing the classical Smith Predictor for time delay compensation. Specifically, I integrated neural network-based friction models with the aim of improving control performance in an asteroid flyby observation testbed within a project of the Japan Aerospace Exploration Agency (JAXA). My work began with an in-depth theoretical and Simulink-based analysis of the Smith Predictor alongside classical friction models – including Coulomb Viscous, Stribeck, LuGre, and temperature-dependent models. Drawing on this foundation, I developed a deep learning framework using MATLAB's Deep Learning Toolbox, leveraging tools such as Regression Learner, Neural Net Time Series, Neural Net Fitting, and Deep Network Designer (incorporating Long Short-Term Memory and Transformer networks) to predict nonlinear system dynamics. This process involved extensive data preprocessing, neural network training, hyperparameter optimization, and systematic comparison of different modeling strategies, including hybrid approaches that combined analytical and data-driven methods. To ensure adaptability in dynamic environments, I incorporated incremental learning methods, enabling the neural networks to adapt to changes in system behavior while preserving learned knowledge. I also implemented interpretability techniques to clarify the reasoning behind the machine learning predictions. Once trained and validated, these models were integrated into the Smith Predictor in Simulink and deployed on the asteroid flyby testbed.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

During my stay in Japan, I had the opportunity to immerse myself deeply in both academic exchange and cultural life. Through exchanges with universities such as Gifu University, Nagaoka University of Technology, Keio University, and Yokohama National University, as well as industry visits to Sumitomo Heavy Industries and Okuma, I gained valuable insights into Japan's advanced research and industrial practices. Beyond academics, I experienced everyday Japanese life through a homestay program, enjoying many memorable trips with my host family. I participated in uniquely Japanese cultural events, including the Nagoya Grand Sumo Tournament, a lively baseball game at Vantelin Dome, and a music festival at Saitama Super Arena. Dancing in a Yukata at Gujo Odori, enjoying dazzling summer fireworks, and sharing evenings of nomikai and karaoke with my research lab and professor gave me a genuine sense of community. I also engaged in travel and exploration, from the Osaka Expo to hiking through the Nikko UNESCO World Heritage site and road trips through Japan's picturesque countryside. Altogether, these experiences allowed me to connect with Japanese culture on multiple levels, blending tradition, modernity, and personal exchange into an unforgettable chapter of my life.

JSPS Summer Program 2025
Research Report

1. Name: Ivanna Kupryianchyk-Schultz （ID No. SP25318 ）

2. Current affiliation: Charité – Universitätsmedizin Berlin

3. Research fields and specialties:
Biological Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof. Yasuhiro Murakawa

6. Description of your current research

In my current PhD research at MDC/Charité, I focus on understanding the role of SYNGAP1 isoforms (splice variants) in neurodevelopment. SYNGAP1 is a critical gene for synaptic function, and mutations in this gene are linked to neurodevelopmental disorders such as intellectual disability and autism spectrum disorders. SYNGAP1 is known to have many different isoforms, but their functions are not yet well characterized. I aim to comprehensively profile SYNGAP1 isoform diversity and expression in both control samples and samples carrying introduced patient mutations. By directly comparing these conditions, I aim to reveal how specific isoforms contribute to neuropathology and to illuminate the regulatory mechanisms driving SYNGAP1 splicing. Such insights will deepen our understanding of how these mutations impact neuronal function and may pinpoint new targets for therapeutic intervention. To address the limitations of animal models, I use human cerebral organoids derived from pluripotent stem cells, which closely mimic human brain architecture and development.

7. Research implementation and results under the program

Title of your research plan: Descriptive organoid isoform study using full-length and CAGE sequencing

Description of the research activities:

I learned and performed **full-length RNA sequencing protocol** in the laboratory, which allowed me to capture complete transcript structures. In addition, I applied **computational analysis** to process and interpret the sequencing data.

I also learned about **CAGE sequencing (Cap Analysis Gene Expression)**, a method that identifies transcription start sites and promoter activity. Combining both long-read sequencing and CAGE data will provide a more detailed view of isoform diversity and gene regulation in organoids.

Through these activities, I gained practical experience in experimental techniques as well as bioinformatics analysis. The results gave me a first overview of how different isoforms are expressed in developing brain-like tissue, which will be valuable for future research on gene regulation in the nervous system.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

The **JSPS Summer Program** was an unforgettable experience, both professionally and culturally. I had the opportunity to learn new experimental and computational methods that will be valuable for my PhD project, while also gaining insight into the Japanese research environment. Being able to work on both laboratory techniques and bioinformatics analysis gave me a deeper understanding of current trends in genetics and increased my confidence in my own skills.

Outside of the lab, I enjoyed exploring Kyoto and nearby cities. Kyoto's unique combination of culture and nature—with its many temples, shrines, and beautiful parks—made a lasting impression on me, and the city will always hold a special place in my heart. I also highly recommend the homestay program and Japanese language classes, which brought me even closer to Japanese culture. I sincerely hope to return to Kyoto one day.

9. Adviser's remarks (if any):

Ivanna successfully mastered our originally developed CT-seq method from colleagues in my lab in Japan and achieved important results in both experimental and computational analyses. By actively learning and acquiring new techniques, she not only enhanced her own skills but also made significant contributions to advancing collaborative research between Japan and Germany. Furthermore, she engaged actively with Japanese culture, and it is expected that this experience will enable her to contribute to strengthening bilateral exchange and relations in the future.

JSPS Summer Program 2025
Research Report

1. Name: Joshua Noah SCHULTE （ID No. SP25319）

2. Current affiliation: Ruprecht Karl University of Heidelberg

3. Research fields and specialties:
Biological Sciences

4. Host institution: The Cancer Institute of JFCR

5. Host researcher: Prof. Ryohei KATAYAMA

6. Description of your current research

Breast cancer is the most common cancer disease among women globally. My current research focuses on a subtype of breast cancer: estrogen-receptor positive breast cancer. For this type of cancer, the initial treatment involving chemotherapy and hormone therapy often produces good results. However, a late recurrence after 5 to 10 years of surgery is specific to this cancer type, leading to a highly metastatic tumour with a high mortality rate. These late recurrent tumours exhibit high expression of a specific group of long non-coding RNAs, which form a cloud around the *ESR1* gene (which codes for the estrogen receptor) in the nucleus and thereby enhance its expression, leading to tumour growth and enhanced survival. These cloud-forming RNAs are called ELEANORs (*ESR1* locus enhancing and activating noncoding RNAs) and mediate a balance between *ESR1*-mediated cell growth-enhancing signaling and *FOXO3*-mediated cell death/apoptotic signaling. Fukuoka et al. showed that ELEANOR-positive breast cancer patients exhibited an increased recurrence rate after 5 years (*Cancer Sci*, 2022). My research focuses on how the tumour cells are capable of surviving the hormone therapy and continuing to grow after a long period of being in a dormant state. The working theory is that there is a potential trigger which is capable of transforming dormant breast cancer cells, which cannot be targeted by current medicines, into an active state with high proliferative and metastatic potential. Among the other potential triggers reported in the literature, such as neutrophil extracellular traps or obesity, chronic stress is a possible candidate, as demonstrated in the review of Silva et al (*J Cell Physiol*., 2022). To conduct the research, cells were transformed in vitro into a long-term estrogen-deprived (LTED) state to mimic the effects of hormone therapy. ELEANOR expression has been verified using reverse transcription quantitative PCR (RT-qPCR) and fluorescence in situ hybridisation (FISH), providing both quantitative and visual verification.

7. Research implementation and results under the program

Title of your research plan:

Investigation of molecular target therapy resistance in non-small-cell lung cancer

Description of the research activities:

Lung cancer is globally common and the leading cause of cancer deaths, with non-small-cell lung cancer (NSCLC) comprising approximately 85% of all new cases. *ALK* mutations occur in 3–5% of cases. Treatment of ALK+/ROS+ patients with tyrosine kinase inhibitors (TKI) demonstrated clinical efficacy. However, emergence of resistance in long-term treatments represents a significant challenge (Kondo et al. *JCI Insight* 2023).

Three genes of interest (GOI) were assigned to me, which showed enhanced resistance to the TKIs Alectinib and Lorlatinib in the CRISPR-a screening of ALK+ NSCLC cell lines. While the other two GOIs had already been stably overexpressed in cell lines, I created an overexpression strain of the third GOI by using a lentiviral plasmid that codes for a specific guide RNA (sgRNA), which should lead to its overexpression. First, the plasmid was transformed into a functional lentivirus, which was then amplified using HEK293FT cells. After the lentivirus was extracted, target cells that were already expressing the dCAS9-VP64 protein were infected with the sgRNA lentivirus. This lentivirus also encoded resistance to puromycin, which was used as a selection marker to retain only the successfully infected cells. Two different strains were used for each GOI, with different sgRNAs to overexpress the GOI. Additionally, there was a cell line containing only control sgRNAs that did not overexpress any gene. First, RNA was extracted and reverse transcribed into cDNA, and overexpression was verified using RT-qPCR. After successful verification of the GOI overexpression, the cells were plated in a 96-well plate and treated with a serially diluted Alectinib and Lorlatinib to test their sensitivity to these drugs. Another experiment, in addition to the Cell-Titer Glow assay to verify resistance, was the colony formation assay. Control or GOI overexpressed cells were plated in quadruplicate and treated with various concentrations of Alectinib and Lorlatinib for 9 days. After drug treatment, the drug tolerant persister cells were fixed and stained with crystal violet to visualise survived cells. If cell lines with specific GOI overexpression passed both of these verifications, the resistance mechanism was explored using differences in protein levels and modifications such as phosphorylation, in a Western blot experiment with antibodies against the GOI itself and other important downstream targets, such as AKT or ERK.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

During my time on the JSPS summer program, the highlight of my cultural experience was visiting the shogun shrine in 日光市. After attending Prof. Screech's excellent lecture at SOKENDAI in Hayama, I gained an understanding of the impact of the Shogun and 日光市 during the Edo period. Furthermore, climbing 富士山 with another JSPS scholar was quite an impressive experience.

9. Adviser’s remarks (if any):

Mr. Joshua Noah SCHULTE performed a number of in vitro experiments to examine whether the candidate genes identified by our previous CRISPR-a screening are related to an increase in anti-cancer drug-tolerant persister cells. He carefully conducted the experiments and clearly demonstrated that at least one of the candidate genes is related to the drug-persister phenotype in ALK-rearranged cancer. Due to the short research period, it was difficult to determine how the GOI induces the drug persister phenotype. He carefully planned the experiments and considered the results obtained. He had a positive influence on our lab members, especially the Master's and PhD students of similar age. I believe he enjoyed Japanese culture during his short time here. It would be great if we could collaborate with him in the future.

JSPS Summer Program 2025
Research Report

1. Name: Felix Stirm （ID No. SP25320 ）

2. Current affiliation:

International Psychoanalytic University Berlin

3. Research fields and specialties:

Social Sciences

4. Host institution: Rikkyo University Tokyo

5. Host researcher: Prof. Ishikawa, Jun

6. Description of your current research

Shared leadership, meaning the enactment of leadership behaviour by more than one, formally appointed individual within groups or teams has been shown to have a significant positive impact on team performance (Carson, Tesluk, Marrone 2007; Ishikawa 2016). Closely related to the concept of shared leadership is that of emergent leadership, meaning the phenomenon that within groups (both with and without formally appointed leaders) networks of influence arise (which do not necessarily coincide with the formal leadership structure of the group). By definition, a high degree of shared leadership within a team is equivalent to saying that multiple individuals have emerged as influential.

A large body of knowledge has been gathered on high-level antecedents and outcomes of both shared and emergent leadership, including the influence of a formal leaders' leadership style (Ishikawa 2013), internal team environment (Carson, Tesluk, Marrone 2007), task complexity/uncertainty (Ishikawa 2013; Wang, Waldman & Zhang 2014), individual team member personality and intelligence (Taggar, Hacket & Saha 1999; Emery, Calvard & Pierce 2013), and individual motivation-to-lead (Oh 2012; Luria & Berson 2013; Chan & Drasgow 2001), but satisfying explanations of in-the-moment dynamics and the individual cognitive processes behind emergent leadership behaviour are missing. I argue that while this is mostly due to the difficulty of accessing and measuring these intra-psychic process, a general lack of consideration of the emergent nature of the phenomena in question also plays a role.

In my research, I aim to develop a framework that might help elucidate the in-the-situation dynamic that spurs leadership behaviour. At the same time I intend to contribute to the mission of "putting emergence back in leadership emergence" (Acton et. Al 2019) by exploring the relationship between lower-level speech acts and the abstract higher-level constructs that make up group life, including leadership.

A series of semi-structured interviews on emergent leadership will provide material to empirically explore the framework and tests its usefulness for explaining subjective leadership and group experience. By recruiting interviewees of various nationalities (Europe, North America, Africa and Japan), biases in the form of skewed Implicit Leadership Theories are to be partially avoided, slightly increasing the very limited generalizability of the insights.

7. Research implementation and results under the program

Title of your research plan:

Narrative Exploration of Emergent Leadership as a Key to Understanding Subjective Group Experience

Description of the research activities:

- Conducted a series of 16 in-depth narrative interviews with a sample of about 50% international interviewees residing in Japan and 50% Japanese professionals on the topic of emergent leadership which will serve as the empirical basis for a new framework for the understanding of here-and-now emergent leadership dynamics
- Results were enriched by a 2h focus group discussion with undergraduate students from Rikkyo University which was also thoroughly analyzed using qualitative methods
- Participation in the 71th general conference on group dynamics held 21-22nd August 2025 in Hirosaki, Aomori

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

- Extensive exchange with leadership doctoral course students under supervision of Prof. Ishikawa
- Attendance of various networking events including of the Facilitators' Association of Japan (FAJ), international chambers of commerce in Japan, Creative Bureaucracy Festival Japan, EY Wavespace Japan

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Sercan Sever （ID No. SP25321）

2. Current affiliation: University of Tübingen

3. Research fields and specialties: Humanities

4. Host institution: Tokyo College, The University of Tokyo

5. Host researcher: Assoc. Prof. Arisa Ema

6. Description of your current research

Technologies can't be understood as simple tools whose application leads directly to the desired outcome. Technologies alter overall structures and have far-reaching consequences. I am interested in reflecting on the use of technologies and their impact. Currently, I am examining Artificial Intelligence (AI) in the context of language and literature classes in high schools. AI is increasingly permeating various sectors of society, leading to profound transformations. The field of school education also faces significant challenges as a result. Understanding and analyzing these changes are challenging tasks, given that technology is always deeply intertwined with social contexts. Assessing the opportunities and risks associated with AI is even more challenging, yet it remains essential. My aim is to understand whether, how, and why AI is used in teaching, what potentials and risks are involved, and what knowledge is required to act responsibly.

7. Research implementation and results under the program

Title of your research plan:

Negotiating Knowledge and Ignorance. A Comparative Study of AI in Language and Literature Classes

Description of the research activities:

Japan's 'Leading DX School' initiative led by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) promotes the optimization and innovation of school operations and teaching through advanced technology, especially generative AI, and encourages schools to publicly share their findings. During the summer of 2025, my fieldwork in several prefectures – enabled by the Lab of my adviser and supported by Japanese colleagues and local institutions – allowed me to observe open-class sessions, collect video and audio data, and conduct an interview with a teacher. My initial findings from Japanese classes in high schools show that AI is used for multiple educational purposes:

- *Argumentation training:* Students engaged AI in structured debates on topics of their choice, developing reasoning skills.
- *Language reflection:* Students and AI collaboratively explored why certain sentences convey positive or negative connotations.
- *Haiku composition and evaluation:* AI assisted students in writing, optimizing, and assessing traditional poems, supporting creativity and self-expression.

The collected data directly supports my work to develop more transparent, culturally informed approaches to technological governance in education. During the next phase I want to analyze the data and conduct a cross-cultural comparison with observations from Germany, focusing on if/how AI integration varies by cultural contexts.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

My research stay provided several opportunities to deepen my understanding of Japan's academic and cultural landscape. At the highly international and interdisciplinary Tokyo College, regular seminars were held on a wide range of topics from various disciplines. I was able to attend some of these sessions and take part in the subsequent tea ceremonies, which offered a culturally rich setting to connect more personally with colleagues. A highlight was attending the DFG Lecture by Leibniz Prize laureate Prof. Hartmut Rosa at Ritsumeikan University in Kyoto, where he presented his new *Critical Theory of Modernity*. During the lively Q&A session, I was able to pose a question informed by my field observations, which led to an insightful response by Prof. Rosa. The perspectives gained from this exchange are now feeding directly into an article I am preparing. Another particularly inspiring experience was attending the Falling Walls Lab at Tohoku University in Sendai. This international forum challenges young researchers to present their projects in concise, three-minute talks, and is supported by institutions such as the German Academic Exchange Service (DAAD) and the German Center for Research and Innovation (DWIH). The event offered a glimpse into cutting-edge research in Japan and served as an outstanding platform for networking within the German–Japanese scientific community.

9. Adviser's remarks (if any):

Mr. Sercan Sever conducted his research with sincerity, initiative, and professionalism. During his two-month stay, he visited several schools, including one we attended together, to observe the use of AI in Japanese classrooms. These visits provided valuable insights not only for his study but also for my own understanding of AI in educational settings. His proactive approach, respectful attitudes, and appreciation for the support of various institutions and individuals were notable. I believe these qualities will serve him well as he continues to develop as a researcher. I hope his experiences in Japan will positively influence his future academic work.

JSPS Summer Program 2025
Research Report

1. Name: Jessica NGUYEN (ID No. SP25401)

2. Current affiliation: University of Toronto

3. Research fields and specialties:
Biological Sciences

4. Host institution: Tokyo University of Agriculture and Technology

5. Host researcher: Prof. Ryuji KAWANO

6. Description of your current research

Lyme disease is a tick-borne infection caused by *Borrelia burgdorferi* in North America and by *Borrelia afzelii* or *Borrelia garinii* in Europe and Asia. It is transmitted by black-legged ticks, which can also be carriers for other pathogens such as *Babesia microti* and Powassan virus[1,2]. Although early treatment with antibiotics is effective, diagnosis in the early stage is challenging and delayed treatment may result in serious, long-term health issues. This is becoming an emerging public health concern as climate change contributes to the global rise in Lyme disease incidences[1,2].

Current diagnostic methods rely on serological testing, which require centralized laboratories and trained scientists—limiting timely access, particularly in remote or rural regions[1-3]. This emphasizes the need for accessible, point-of-care (POC) diagnostics that enable rapid, on-site testing and early treatment[3].

In response, we are developing a multiplexed POC test based on our lab's CRISPR-Cas12a detection platform[4], RAPID (RNA/DNA Affinity Precision Innovative Diagnostics). After Cas12a detects Lyme, it is activated and can then cut DNA hairpins off our quantum dot (Qdot) nanoparticle reporters, producing a bright visual output. To ensure sensitive and clinically relevant detection, we integrate the DNA amplification method called loop-mediated isothermal amplification (LAMP)[5] upstream of RAPID. All reactions will occur within tubes in a 3D-printed, portable diagnostic device[6], enabling decentralized testing without complex equipment.

1. CDC Centers for Disease Control and Prevention. Lyme Disease. (2022).
2. Government of Canada. Lyme disease: For health professionals. (2022).
3. Peeling, Rosanna W et al. Diagnostics for COVID-19: moving from pandemic response to control. Lancet (London, England) vol. 399,10326 (2022): 757-768.
4. Chen, Janice S et al. CRISPR-Cas12a target binding unleashes indiscriminate single- stranded DNase activity. Science (New York, N.Y.) vol. 360,6387 (2018): 436-439.
5. Notomi, T et al. Loop-mediated isothermal amplification of DNA." Nucleic acids research vol. 28,12 (2000): E63.
6. Jung, Jaeyoung K et al. Cell-free biosensors for rapid detection of water contaminants. Nature biotechnology vol. 38,12 (2020): 1451-1459

7. Research implementation and results under the program

Title of your research plan:

A Point-of-Care Test for Tick-borne Diseases

Description of the research activities:

Although our LAMP + RAPID system demonstrates high sensitivity and specificity, it currently operates as a two-step workflow: LAMP reaction is performed first in one tube, followed by a manual transfer into a second tube containing the RAPID CRISPR components. This transfer step increases the risk of cross-contamination and reduces the practicality of field deployment.

To address this, we collaborated with Prof. Kawano's lab to develop a single-tube, one step workflow where we do not require the manual transfer step. Our approach involves encapsulating the CRISPR components within liposomes (spherical vesicles) produced using microfluidic chips and placing them in one tube containing LAMP components. To combine them, we would explore strategies that can break the liposomes at the appropriate time, releasing the CRISPR components to interact with LAMP.

Over the summer, I worked with a PhD student to produce and characterize liposomes. I learnt how to use the confocal and inverted fluorescence microscope for imaging, and how to measure osmolality to ensure their structural stability. We also evaluated liposome stability under different conditions and encapsulated CRISPR components inside them. Our future steps include combining this with LAMP and Qdot reporters. This integration would enhance the platform's suitability for field use.

Overall, this experience not only expanded my skill set into a new area but also provided strong opportunities for future joint publications and ongoing collaboration between our labs.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I am thankful for this summer program in providing me an opportunity to explore and learn more about Japanese delicious food, kind culture, and gorgeous landscape. I was really fortunate to travel and visit many prefectures in the Kansai, Kanto, Chūgoku and Chūbu region.

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Jeremy COHEN （ID No. SP25402）

2. Current affiliation: University of Waterloo, Canada

3. Research fields and specialties:
Biological Sciences

4. Host institution: Tohoku University

5. Host researcher: Prof. Yoshifumi SAIJO, Dr. Takuro ISHII

6. Description of your current research

My PhD research has focused on understanding how the venous system regulates blood flow, particularly in response to changes in body position and muscle activity. While much is known about how arteries adapt with age, veins are less studied despite playing a critical role in returning blood to the heart and supporting cardiac output. Using a tilt-table setup, I investigated how shifts in posture alter venous return and volume stress. This approach allowed me to carefully manipulate preload and study how the system adapts under controlled conditions.

To capture the complexities of venous blood flow, I applied vector flow imaging (VFI), an advanced ultrasound technique that provides angle-independent velocity maps and reveals flow organization, turbulence, and vortical patterns around venous valves. By comparing younger and older adults, I showed how venous compliance, muscle pump efficiency, and flow organization differ with age and cardiovascular stress.

Together, these studies provide a new perspective on venous physiology and its role in cardiovascular regulation. The technical expertise I developed in tilt-table protocols and VFI imaging builds a strong platform for studying integrative cardiovascular control and has direct relevance for understanding orthostatic intolerance, aging physiology, and exercise hemodynamics.

7. Research implementation and results under the program

Title of your research plan:

Cardiac vortex flow determined by EchoDynamography during and following cardiac preload manipulation through posture and exercise

Description of the research activities:

Our study set out to explore how the heart manages blood flow under different physiological conditions, focusing on the swirling vortex patterns that form inside the left ventricle. These vortices are thought to help the heart conserve energy and move blood more efficiently, but until recently they have been very difficult to study in detail. We used echodynamography (EDG), a new imaging approach that applies advanced processing to standard echocardiography, allowing us to reconstruct two-dimensional maps of blood flow inside the heart.

We recruited 10 healthy young adults to undergo tilt table testing, shifting their body position between head-down, flat, and head-up, both at rest and after a bout of 20min stair-climbing exercise. These changes altered venous return to the heart, providing controlled shifts in cardiac preload. With EDG, we were able to capture how vortices formed, moved, and changed in size and organization under these conditions.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

During my stay in Japan I had the opportunity to experience Japanese culture through, art, architecture and food. Highlights included visiting castles and museums in the surrounding Tohoku and Kanto regions. Additionally, I really enjoyed my lab hosting a takoyaki party where we made takoyaki from scratch directly in the lab.

I will cherish the connections I made with Japanese colleagues fostered during this time.

9. Adviser's remarks (if any):

As a JSPS international research fellow, Mr. Jeremy Cohen has worked with great enthusiasm on applying EDG, a novel quantitative ultrasound flow visualization technique, to investigate how the exercise-induced changes in cardiac loading affect intra-cardiac hemodynamics.

During his stay, he established an experimental setup and conducted echocardiographic measurements combined with physiological assessments before and after exercise tasks. He also developed proficiency in our ultrasound data processing framework to generate flow vector maps within the cardiac chambers.

Jeremy's excellent work during this visit, along with the unique perspective he brought to our laboratory, will broaden the applicability of EDG technique in physiological science and foster future multidisciplinary collaborations between Canada and Japan.

JSPS Summer Program 2025
Research Report

1. Name: Elizabeth Mai-Ling HUA （ID No. SP25403）

2. Current affiliation: McGill University

3. Research fields and specialties:
Biological Sciences

4. Host institution: Waseda University

5. Host researcher: Professor Toshio OHSHIMA

6. Description of your current research

Current research project: Sustained treatment with Fusicoccin A and Epothilone B promotes CNS axon regeneration

Current supervisor: Professor Alyson Elise FOURNIER

Abstract:

In the central nervous system (CNS), information communication is mediated by neurons and their axons, like electrical wiring. When these wires are broken, information can no longer be transmitted efficiently throughout the CNS. Inability to spontaneously regrow and repair these wires results from the formation of a growth inhibitory scar region and failure to induce an intrinsic growth program. The scar region plays an important role in filling cavities that form at an injury site; however, the fibrotic core presents a physical, cellular, and biochemical barrier to regeneration and expresses numerous growth inhibitory extracellular matrix molecules.

To contribute to the development of therapeutics for treating CNS injury, our lab explores various avenues for promoting axon regeneration, including finding new molecular targets and small molecules that have a regenerative effect. Fusicoccin is a small molecule as well as a 14-3-3 targeted drug. 14-3-3 adaptor proteins can regulate intracellular signalling pathways and interact with their target protein to modify its activity and intracellular location. Protein-protein interactions are an important focus for drug discovery since they allow for pathways to be modified rather than specific targets. Our lab has shown that the addition of Fusicoccin A stimulates neurite outgrowth and axon regeneration in vitro and in vivo by stabilizing 14-3-3 PPIs. Another drug, Epothilone B, has also been shown to promote regeneration and reduce fibrotic scarring when applied systemically. We collaborated with the Shoichet Lab to encapsulate our two drugs into nanoparticles that can be slowly released from a hydrogel and then applied the hydrogel to our optic nerve crush model for sustained drug release after CNS injury. Overall, our project aims to target intrinsic and extrinsic growth inhibitory components of axonal injury to promote regeneration and recovery.

7. Research implementation and results under the program

Title of your research plan: Validating chemical candidates to promote axon regeneration following CNS injury

Description of the research activities: The Ohshima Lab has identified several candidate chemicals that inhibit Collapsin response mediator protein 2 (CRMP2) phosphorylation and has tested their effect on axon regeneration in a zebrafish spinal cord injury (SCI) model. My goal was to determine if the results of the most promising chemical candidate could be recapitulated in the mammalian CNS using a mouse optic nerve crush model. During the fellowship, I trained Ohshima lab members on various techniques, including optic nerve crush, intravitreal injections, and retinal tissue processing. I also received training on dorsal hemi-section in mice and stab wound injury in embryonic zebrafish (models of SCI). Finally, I received many opportunities to attend lectures and seminars and participate in interesting discussions relevant to my research.

Rationale: Neurons in the mature mammalian CNS do not regenerate spontaneously after injury. CRMP2 is part of a family of CRMP molecules that mediates Sema3A signalling during CNS development. CRMP2 stabilizes microtubules and promotes their regeneration by binding to tubulin dimers, but this function is inactivated when CRMP2 is phosphorylated. CRMP2 phosphorylation is upregulated following injury, acting as an additional barrier to regeneration. Inhibiting CRMP2 phosphorylation may help promote regeneration following CNS injury.

Aim: Overall, the goal of this project was to determine if the regenerative effects of a CRMP2 phosphorylation inhibitor identified in a zebrafish SCI screen translates to mammals using mouse optic nerve crush. Inhibiting CRMP2 phosphorylation could be an effective strategy to reduce barriers to CNS regeneration.

Results: The chemical candidate that promoted the most significant regeneration in the zebrafish SCI screen promotes significant regeneration following optic nerve crush in mice.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

Living and working in Japan provided invaluable experiences of both the culture and lifestyle. Outside of lab, I was able to attend several festivals, celebrate holidays, visit various temples and shrines, wear a yukata in Kawagoe, and light fireworks in the park with my colleagues and friends.

9. Adviser’s remarks (if any):

Elizabeth Mai-Ling Hua achieved research outcome in this limited time. She focused on her experiments in Ohshima Lab. In addition, she interacted with lab members in their research field by providing her experimental skills.

JSPS Summer Program 2025
Research Report

1. Name: Kim Beaulieu （ID No. SP25404）

2. Current affiliation: University of British Columbia

3. Research fields and specialties:
Social Sciences

4. Host institution: Osaka University

5. Host researcher: Prof. Wakako Maekawa

6. Description of your current research

In 2023, the Malian government requested that the United Nations (UN) peacekeepers leave Mali after 10 years in the country, citing a failure to adequately address the country's security challenges. When speaking to the press, El Ghassim Wane, who was the Head of the mission in Mali (MINUSMA) at the time, said that: "[...] The point I'm making, and I believe it's a point that everyone agrees on, is that peacekeeping is based on the principle of consent from the host country and absent that consent, of course, operations are nearly impossible" (Al Jazeera 2023). His remark highlights the importance of the principle of consent and makes clear that, without reliable consent from the host state, peacekeeping operations are bound to experience significant difficulties, if not outright failure.

Yet, what happens when that consent breaks down, as it did in Mali? We can easily identify the moment consent is withdrawn (i.e., when a government publicly calls for a mission's departure) but what leads to that point? What causes the breakdown of the relationship between the host state and the UN, so that the host state decides to withdraw its consent to a mission? Considering that such breakdowns do not occur overnight, it is likely that the quality of consent began to deteriorate months or even years before reaching the outcome of withdrawal. How does the UN operate in missions where consent might exists in name but not in practice? What leverage or practices does the UN have to manage host state consent? My research seeks to answer these questions through detailed case studies and the creation of a dataset on host state consent.

7. Research implementation and results under the program

Title of your research plan: The Politics of Host State Consent in United Nations Peacekeeping Operations

Description of the research activities:

During my time in Japan, I drafted a detailed research proposal for my project. The 30 pages document will serve as the foundation for my PhD research. It includes information on the puzzle/research questions, the definition of my key concept (host state consent) as well as an outcome matrix, the main six independent variables that I will be considering in my research and a literature review to support these, a preliminary framework of UN-host state relationship expressed through game theory, a preliminary data collection plan for all variables and an overview of my universe of cases. I also collected data regarding my dependent variable for the United Nations Mission in South Sudan. This is the first step toward building a new and original dataset on host state consent.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I had an amazing time discovering the wonders of Japan while working on my research. I visited a few important cultural sites such as the Ise-jingū shrines and onsen towns such as Kinosaki-onsen.

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Justin White （ID No. SP25405）

2. Current affiliation:

University of British Columbia

3. Research fields and specialties:

Biological Sciences

4. Host institution: Tokyo Metropolitan University

5. Host researcher: Dr. Kouji Hirota

6. Description of your current research

Our cells use special proteins called Y-family polymerases to copy DNA even when it's damaged. While this helps cells survive stress, it can also make cancer cells resistant to chemotherapy drugs that work by damaging DNA. Humans have four types: REV1, POLH, POLI, and POLK. We know REV1 has unique roles, but it's less clear if POLH, POLI, and POLK have distinct jobs or just back each other up. To find out, we used gene editing (CRISPR) to create cells missing each of these four proteins one by one. We then studied how these cells responded to DNA damage, both normally and when treated with a low dose of the chemotherapy drug cisplatin. This allowed us to map the specific interactions and dependencies related to each protein. Our goal is to pinpoint unique vulnerabilities associated with each Y-family member. Understanding these specific roles could reveal which cancer types might be effectively treated with new drugs designed to block these particular polymerases. This could help overcome chemoresistance and make cancer treatments more successful. In Dr. Hirota’s lab, I sought to determine the mechanism by which these cells lacking a TLS polymerase experience toxicity and subsequent death.

7. Research implementation and results under the program

Title of your research plan:

Uncovering genetic interactions of the translesion synthesis pathway: targeting DNA repair mechanisms as a therapeutic strategy in cancer

Description of the research activities:

While working in Dr. Hirota's lab, the primary goal was to validate the findings from my work in Canada. With any remaining time, a secondary goal was to determine the potential mechanisms for the observed cellular toxicity. To this end, I successfully generated over 30 new cell lines in two different model systems: the human lymphoblast TK6, and the chicken DT40. These cell line libraries included multiple knock out clones of the TLS polymerases POLH, POLK, and POLI in both a "wild-type" and inducible STAG2 knockout background. STAG2 was selected as a target as it plays important roles in genome stability and DNA repair and is also frequently mutated in a variety of cancer subtypes.

After creating the knockout cell lines, they were then investigated for growth defects and toxicity upon induced knockout of STAG2. In both models, none of TLS polymerase knockouts alone appeared to cause changes in cell growth, which was expected, especially in the absence of external replication stress (e.g. drug treatment). Surprisingly, knockout of STAG2 caused no difference in growth for the TLS polymerase knockouts compared to the control in the TK6 system. However, double knockout of POLK and STAG2 in DT40 cells caused a drastic decrease in viability. A possible explanation for this difference is the p53 status of the cell lines, with TK6 and DT40 being p53-positive and p53-negative, respectively. Indeed, the original CRISPR screens were conducted in a p53-negative system, providing further evidence for this p53-dependent synthetic lethal relationship of POLK and STAG2. To fully understand the mechanism behind the observed toxicity, the new cell lines will be shipped to Canada for further analysis.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I was lucky enough to experience a wide range of Japanese culture during the JSPS Summer Program. This included participating in a Homestay experience, local summer festivals, sporting events (volleyball and baseball), and hiking Mt. Fuji. I was also able to visit other areas on the weekends such as Kyoto, Nara, Hakone, Izu, Nikko, and Okinawa. Overall, the program was an excellent way to foster scientific collaboration while also fully immersing into a new environment.

9. Adviser's remarks (if any):

SP25406 Research Report

1. Name: Allister Poulos （ID No. SP25406）

2. Current affiliation: Queen's University

3. Research fields and specialties:
Engineering Sciences

4. Host institution: University of Tokyo

5. Host researcher: Prof. Shinsuke MURAKAMI

6. Description of your current research

The current research aims to understand how the electrification of passenger transportation will change the environmental impacts of the transportation sector. Specifically, we focus on modelling the environmental impacts of recycling electric vehicle batteries in the Canadian context. To do so, we quantify the mass of critical materials such as lithium, nickel, and cobalt demanded by the Canadian market as passenger vehicle electrification unfolds from now until 2050. With this estimation of the mass of critical materials we then model the service life of electric vehicle batteries to estimate the mass of materials available for recycling once the batteries have reached the end of their useful life in the vehicle fleet. By estimating the mass of critical materials available for recycling at different times in the future, we can predict the environmental impacts of recycling those batteries. We consider different environmental impacts and different recycling technologies to present detailed estimates of future electric vehicle battery recycling impacts in Canada for decision makers to consider when evaluating policy options and business opportunities. However, recycling is not the only option for reducing the environmental impacts of electric vehicle batteries. For this reason, I travelled to the Murakami Lab at the University of Tokyo to learn how to model an electric vehicle battery ecosystem where batteries are repaired, remanufactured, and reused, before recycling.

7. Research implementation and results under the program

Title of your research plan:

Design and Evaluation of a Canadian Electric Vehicle Battery Ecosystem

Description of the research activities:

Prior to recycling, electric vehicle batteries can be repaired for reuse in a second vehicle or be remanufactured for reuse in other applications, such as grid electricity storage. Reusing batteries before recycling reduces economy-wide environmental impacts as fewer critical materials need to be extracted from nature to meet the demands of our society. Given the foreseeable landslide of retired electric vehicle batteries in the coming years, it is critical to model how batteries might be repaired, remanufactured, and reused before being recycled. The model initiated at the University of Tokyo will assess the value of these circular economy options as well as the life cycle environmental impacts of this electric vehicle battery 'ecosystem' to provide insight into how a circular economy might affect

Canadian society.

During my time in the Murakami Lab at the University of Tokyo, I evaluated different modelling techniques to solve the problem of the electric vehicle battery ecosystem. At first, Agent Based Modelling seemed a promising technique, but through the support of my lab mates, we discovered that System Dynamics would be the more appropriate method to model this problem. Using System Dynamics, I have created a framework for modelling the value and the impacts of this ecosystem, and I have collected relevant data to parameterize the model. The framework is as such: The quantity of electric vehicle batteries sold in Canada is integrated into the system dynamics model. This model directs the flow of retired batteries from repair to remanufacture, to reuse, and to recycling, as well as all other logical combinations of these four options (e.g., directly to recycling after being retired). Different ratios of flows from one second life use to another are assessed to determine what combinations create what quantity of environmental impacts across the entire system. The value (costs as well as potential profits) of each circular economy option under each combination of flows is assessed to understand where there are business opportunities as well as where governmental intervention could support an electric vehicle battery ecosystem.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

My time researching at the University of Tokyo and exploring Japan has been memorable and has altered me for the better. Through the homestay program, I experienced Japanese culture in a way that gave me profound respect for the Japanese way of life and how it differs from my western experience. My travels from major cities to the many mountains of Japan have opened my mind to experiences that I've not known before and am grateful to have now. I am deeply thankful to the Japan Society for the Promotion of Science for this opportunity. This summer program not only facilitates cutting-edge research and collaboration but also enriches the lives of those willing to engage with the unfamiliar and uncomfortable.

JSPS Summer Program 2025
Research Report

1. Name: Kaito Hara-Lee （ID No. SP25407）

2. Current affiliation: Queen's University

3. Research fields and specialties:
Engineering Sciences

4. Host institution: University of Tokyo

5. Host researcher: Prof. Etsuko Kobayashi

6. Description of your current research

My research focuses on developing a robotic imaging system to improve breast-conserving surgery by ensuring complete tumour removal. Positive margins—when cancer cells remain at the edge of excised tissue—occur in up to 40% of cases and significantly increase the risk of recurrence. To address this, I am integrating optical imaging with robotic technology to inspect the tumour bed intraoperatively. Using a low-cost 6-DOF robotic arm, I am implementing an algorithm to determine an optimal scan path over a 3D point cloud of the tumour bed, captured with a depth camera. This approach minimizes unnecessary robot motion while enabling systematic optical scanning with a probe attached to the robot. In my initial work, I simulated the system in MATLAB to validate the algorithm, and I am now extending this to a physical setup by integrating the robot, depth camera, and optical probe within the open-source 3D Slicer platform using SlicerROS2. By comparing my optimized scanning strategy against conventional methods, such as raster scanning, I aim to reduce scan time and improve the detection of residual cancer cells. Ultimately, this research seeks to enhance surgical precision, reduce recurrence rates, and provide a framework for rapid clinical translation in breast-conserving surgery and other oncological procedures where complete tumour resection is critical.

7. Research implementation and results under the program

Title of your research plan: Tissue Deformation Analysis for Robotic Automation in Endoscopic Surgery

Description of the research activities:

During my research stay at the Biomedical Precision Engineering Lab at the University of Tokyo, I worked on enhancing their current surgical measurement system, which can visualize organ deformation during endoscopic procedures. The existing setup used a monocular endoscope, and I helped transition it to a stereoscopic endoscope to allow 3D visualization. To support this, I designed, and 3D printed custom holders to rigidly mount the stereo endoscope, as well as marker clusters to track the camera's position optically. My primary focus was on integrating surgical tool tracking into the same camera space, which I achieved by developing a calibration pipeline that aligned the optically tracked forceps tip with the stereo endoscope's view. Together, these developments allow the interaction between tissue surface and surgical tools to be measured and visualized in real time, laying the groundwork for future advances in surgical support systems.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I had a fantastic experience working in an academic environment in Japan. I was part of a multicultural lab, and everyone was extremely welcoming. In addition, I had the opportunity to travel around Japan and visit cities like Osaka, Kyoto, Hiroshima, and Nasu. Every town I visited, I gained a better appreciation of Japanese culture and gained a deeper understanding of how beautiful the country is. I made new friends in my research lab and within the JSPS program, for which I am grateful. I hope to keep all these excellent connections I've made during my fellowship.

9. Adviser's remarks (if any):

To quantify endoscopic surgical operations, Mr. Hara-Lee integrated 3D endoscopic imaging with a surgical instrument position measurement system. Despite the short period of involvement, he actively engaged in the project and achieved remarkable results. He also maintained excellent communication with the laboratory members and made a significant contribution to the internationalization of the students in the laboratory.

JSPS Summer Program 2025
Research Report

1. Name: Jerry Huang （ID No. SP25408）

2. Current affiliation: Université de Montréal

3. Research fields and specialties:
Interdisciplinary and Frontier Sciences

4. Host institution: University of Tokyo

5. Host researcher: Dr. Zihui Irene Li

6. Description of your current research

My research looks at how to ensure statistical guarantees for deep learning models in terms of the predictions they make and how to ensure that they are reliable. Oftentimes, we often will only look at the final output a model makes, such as its prediction, without attempting to understand the underlying statistical distributions that they make. This obfuscates a large part of the model's use, as it is often not the case that the models are completely confident/certain in their predictions. The process of trying to ensure that the model's accuracy (i.e. how often it predicts something correctly) is well reflected in the underlying statistical distributions they produce is called **uncertainty calibration**. My research attempts to better understand how we can ensure proper model calibration under a variety of empirical constraints, such as under distribution shifts, as well as in more complex tasks, such as sequence prediction tasks. More recently, my research has delved into understanding how these apply to more common deep learning models, such as generative models.

7. Research implementation and results under the program

Title of your research plan:

Understanding Multilingual LLM Uncertainty Calibration In Low-Resource Language Settings

Description of the research activities:

Over the course of this program, I began a project that attempted to look at uncertainty calibration in large language models in a particular setting, namely how uncertainty and confidence in multilingual LLMs can vary based on the data on which it is trained.

The project started as simply finding the right set of models and datasets to use for testing a number of hypotheses, primarily to ensure proper control of many varying factors. The next step required controlling the training process of these models manually, such that we had to train a number of models from scratch on controlled datasets to ensure fairness of comparison.

Finally, we completed our analysis and testing using these controlled models, which we used to validate a number of hypotheses such as how confidence and accuracy in models individually change depending on the statistical distribution of the test data relative to the training data. This enabled us to propose a straightforward solution, which we have validated as well through controlled training as well.

These results are currently being prepared for a manuscript that is expected to be submitted to a suitable venue in the near future.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I participated in the homestay program and thoroughly enjoyed my time interacting and connecting with a Japanese family. Though it was short, it was a very great time to learn the culture and better accustom myself to the manners and society here.

I also visited a number of shrines and festivals, which was a very immersive way to experience part of the traditions here as well.

Finally, I had a great time visiting a number of different cities outside of Tokyo during my stay which was an effective way of broadening my impressions about Japan through seeing new things.

9. Adviser’s remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Samuel Ruttiman （ID No. SP25409）

2. Current affiliation: University of Alberta

3. Research fields and specialties: Mathematical and Physical Sciences

4. Host institution: University of Osaka

5. Host researcher: Jun Yamasaki

6. Description of your current research

Electron Microscopy is a powerful tool that can be employed in the study of materials systems. In a transmission electron microscope (TEM) high energy electrons are used to probe samples, and can resolve features at atomic length scales (far beyond what can be achieved in an optical microscope). While various experimental methods can be employed in a TEM to acquire information about the crystallographic and electronic structure of a material, conventional TEM is incapable of mapping many of the dynamical processes that occur at the atomic scale. My research at the University of Alberta is centered on developing an ultrafast transmission electron microscope (UTEM), that utilizes femtosecond laser pulses coupled into a TEM to allow such dynamics to be probed. While such an instrument has be around for well over a decade, there are many ongoing efforts to enhance the temporal resolution. One such method that I am investigating further leverages ultrafast laser pulses to generate intense terahertz (THz) frequency electromagnetic pulses that can be used to favorably manipulate electrons before the probe the sample of interest.

7. Research implementation and results under the program

Title of your research plan:
Momentum Resolved Electron Energy Loss Spectroscopy of Transition Metal Dichalcogenides

Description of the research activities:

During my stay at the university of Osaka I studied samples of tantalum diselenide ($TaSe_2$) in a TEM. First the quality of the samples was checked, most importantly we looked for signs of "satellite peaks" in the diffraction pattern. These peaks confirm that the $TaSe_2$ exhibits a charge density wave, which is the particular phase of the material we were interested in for this study. The main part of this experiment was to then investigate the electronic structure of the samples using a technique called electron energy loss spectroscopy (EELS). In this configuration the probing electrons are separated by the amount of energy they lose during their interaction with the sample. I acquired data across both the low-loss and core-loss energy regimes, with each regime corresponding to different electronic features of the material. To further refine the measurements a momentum filtering slit was inserted to gain insight into how electronic properties change with spatial direction (a property known as anisotropy). Before I could fully analyze the data there was several steps of preprocessing required to remove noise and artifacts that arise from imperfections of the probing electrons and camera used to detect them. This step required implementation of algorithms in python which the data would be run through prior to analysis. Once this was done the analysis was performed to extract numerical values for the properties of interest, which was done by fitting the data to different physical models. The results obtain are not yet definitive, however there are signs of electronic anisotropy present that warrant further investigation. The samples used in this experiment (along with several new ones) will be shipped back to Canada where I will study them further

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

My stay in Japan has been a wonderful experience. I had the opportunity to explore many amazing cultural locations and parks in addition to enjoying the incredible food and weather. I would like to thank Professor Yamasaki and Professor Nakajima and everyone else at the University of Osaka's Ultra High Voltage Electron Microscopy center for being so welcoming and helping me conduct my research. I look forward to revisiting Japan in the future!

9. Adviser's remarks (if any)

SP25410
Research Report

1. Name: Virginia CHIU （ID No. SP25410 ）

2. Current affiliation: Ontario Tech University

3. Research fields and specialties:
Chemistry, Biology

4. Host institution: Kyushu Institute Of Technology

5. Host researcher: Shinobu, SATO

6. Description of your current research

G-quadruplex (G4) are a type of DNA or RNA that can fold into different types of structures, where four guanine bases are held together by Hoogsteen hydrogen bonds. The type of structure that forms plays a key role in genomic events that can affect telomerase activity. Unregulated, telomerase can cause tumour formation, and in some cases, cancer.

By targeting G4s, it is possible to prevent tumour formation. While there has been the development of G4-binding ligands to chemically modulate G4 formation, to the best of our knowledge, no one has attempted to modulate G4 structure directly from within the structure itself. Azobenzenes have photoswitchable properties that disrupt molecule structure have been used in other types of RNA drugs (ex. short interfering RNAs) to control drug activity, turning it on or off after exposure to certain wavelengths, based on the chemical substituents on the azobenzene structure, changing from *cis* to *trans* form.

My research at the Kyushu Institute of Technology focused on characterizing and testing the photoswitchable abilities of several G4 quadruplex designs that comprised of 1-3 azobenzene chemical modifications in different loop positions.

7. Research implementation and results under the program

Title of your research plan:

Characterization of photoswitchable DNA quadruplexes (G4) with azobenzene

Description of the research activities:

During my research, I made sure the single stranded DNA made the special G4 structure by annealing in either sodium chloride buffer to form an anti-parallel G4, or in potassium chloride buffer to form a parallel G4. I confirmed G4 structure formation by checking the secondary structure of each DNA design via circular dichroism spectra. Single stranded DNA, parallel G4, and antiparallel G4 each have their own distinct CD spectra shapes, making it clear to see whether structure changes have occurred. I then subjected all samples to 2 hours of UV light and 2 hours of visible light, checking their CD spectra after each respective light treatment. CD results showed that azobenzene did not impede G4 formation and in some designs, could change DNA structure dependent on the specific type of light treatment.

Additionally, I characterized the DNA designs via gel electrophoresis, checking both sodium chloride and potassium chloride versions of samples. Gel electrophoresis allowed for me to observe the size differences of fragments and purity of each sample.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I attended 2 conferences related to my field of research. I enjoyed getting to wear yukata at the Tanabata festival. I also did homestay with a family in Dazaifu and got to experience local life and go into the mountains to see the pottery village and some shrines. I greatly enjoyed sight-seeing, going to onsen and trying the local cuisines.

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Alexei KAZAKOV （ID No. SP25411）

2. Current affiliation: University of Ottawa

3. Research fields and specialties:
Humanities

4. Host institution: Kobe University

5. Host researcher: Prof. Asami NAKAMURA

6. Description of your current research

The burgeoning field of “nostalgia studies” is profoundly influenced by an important distinction drawn by Svetlana Boym (2001) between “restorative” and “reflective” nostalgia, the former attempting to rebuild the past in the present, the latter reflecting melancholically on the loss itself. In the subsequent literature, this heuristic distinction has often taken the form of a hard dichotomy used to situate every expression of nostalgia into two mutually exclusive camps, typically in order to denounce “bad” nostalgias (e.g. far-right ultranationalist politics) as being “restorative”. On such a reading, the writers Yukio Mishima and Kazuo Ishiguro appear as paradigmatic cases of “restorative” and “reflective” nostalgia, respectively; but a closer analysis reveals that the reality is far more complex. In examining the nature of the nostalgic longing expressed in both authors—both in terms of their relation to their respective ideas of Japan and in terms of a more general, transcendental longing for an Absolute—we can see that each expression of nostalgia contains both reflective and restorative elements. We hope that a deeper exploration of this notion will contribute to a more nuanced treatment of Boym’s distinction and a revision of Mishima and Ishiguro’s respective receptions in the subsequent literature.

7. Research implementation and results under the program

Title of your research plan:

Contesting the Restorative/Reflective Nostalgia Dichotomy with Yukio Mishima and Kazuo Ishiguro

Description of the research activities:

The summer was spent, for the most part, doing a literature review on the research topic (reading lots of Mishima, Ishiguro, and secondary literature on them). Frequent collaborative discussions were conducted with the host supervisor to develop the ideas that would find their way into the paper. Towards the end of the research trip, an outline of the paper was created, and drafting is now underway. We hope to have an initial draft of the paper completed by the end of September.

We also organized meetings with notable scholars of Ishiguro and Mishima which led to a number of fruitful discussions. I am planning to return to Japan in the future to collaborate with some of these scholars on further research regarding especially Yukio Mishima.

I also gave a public lecture at Kobe University on a separate topic, but still related to nostalgia. Some of the ideas from this public lecture found their way into the argumentative thread of the paper.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

This is a wonderful program and I am very grateful to have been given the opportunity to participate in it. I am very much looking forward to returning to Japan in the future!

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Lilla Eperjesi (ID No. SP25412)

2. Current affiliation: University of Waterloo

3. Research fields and specialties:
Humanities Social Science

4. Host institution: International University of Japan

5. Host researcher: Dr. Masayuki Tadokoro

6. Description of your current research

My project is rooted in Feminist Security Studies (FSS) and places gender at the core of the analysis in order to uncover the linkages between masculinity, nationalism, militarism and security in the existing policies and practices of Japan's national security institutions. The project examines the gendered policies that sustain discriminatory practices of Japan's national security institutions and assesses the potential of policies designed to promote diversity and inclusiveness to counter those discriminatory practices. As a graduate student at the University of Waterloo, my research focuses on examining Japan's domestic and international security policies through the National Security Strategy, the National Defense Strategy, the National Buildup Program and the National Action Plans. During my time at the International University of Japan, I conducted interviews with experts in the field of national security and gender studies to assess the cross-institutional implementation of policies and practices and to identify spaces for developing more effective national security policies that achieve substantial change.

7. Research implementation and results under the program

Title of your research plan:

Gender and Security in Japan: Examining the Integration of the Women, Peace, and Security Agenda in National Security and Foreign Policy

Description of the research activities:

During my research in Japan, I conducted twelve key-informant interviews with experts in military relations and gender studies in Japan. Interviewees included professors at various universities, members of the Ministry of Defense, the National Defense Academy, and the National Institute for Defense Studies. The interviews covered topics related to gender and security, national policies geared towards diversity and inclusiveness, policy implementation and institutional culture. The interviews were recorded using a recording device, transcribed using OtterAI, and coded using Nvivo. The findings of the research are currently being written up as they will contribute to my thesis work in Canada. Participants will have an opportunity to review their quotes and comments prior to the submission of the thesis.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

By conducting in-person interviews, I had the chance to travel within the country to meet my interviewees and in addition explore the beautiful nature, culture and food of Japan. The past 2.5 months have provided cultural experiences in many ways. The most notable ones were being able to explore Japanese art, temples, and castles as well as exploring the rich cuisine of Japan and sampling traditional sweets from different prefectures across the country.

9. Adviser’s remarks (if any):

N/A

JSPS Summer Program 2025
Research Report

1. Name: Jenny Lee (ID No. SP25413)

2. Current affiliation: Queen's University

3. Research fields and specialties:
Engineering Sciences

4. Host institution: University of Tokyo

5. Host researcher: Dr. Gentiane Venture

6. Description of your current research

Robotic technology is leaving enclosed industrial spaces and research labs and entering human-occupied environments. Given current trends of technological growth, commercial and residential robots may become commonplace, placing greater importance on societal perception of robotics and artificial intelligence. Unfortunately, the socio-cultural impact of robotics on human populations is not well understood, limiting the safety and effectiveness of their deployment. My current research looks at the impact of human-robot interaction on human gait and their perception of the robots. This research looks at the different aspects of a robot that could impact one's gait when walking along side them such as morphology, behaviour and walking strategies. The research employs out-of-lab experiments with wearable inertial sensors (Xsens, the Netherlands) and a metabolic measurement unit (COSMED, Italy) to measure gait kinematics and energetic expenditure, respectively. Questionnaires and semi-structured interviews will also be used to assess participants' perspectives on walking with a companion robot. By studying the influence that robots have on humans, it will enhance our understanding of people's perception of robotic companions, which is critical when designing robots that can successfully integrate into everyday environments.

7. Research implementation and results under the program

Title of your research plan: Walk With Me- Emotional and Physiological Impact of Robot Companions

Description of the research activities:

The robot Pepper was programed to be able teleoperated to walk alongside humans and have simple conversations with them. For the study, a primary study was done first where two participants walked up and down a hallway. This was done three times, once alone, once with a human companion and once with the robot companion Pepper. After completing the 3 walking the participants participated in a interview about their experience. Using those interviews a questionnaire was created to be used for the primary study. During the primary study participants walked for around 5 minutes and after five minutes do a laundry folding task involving folding 5 shirts, 5 pants and 5 pairs of socks. Participants repeat this procedure 3 times. Once alone, once with a human companion, and once with the robot. After each trial participants answer the questionnaire to evaluate their experiences. Participants also wear a motion capture suit and Fitbit to measure their gait and heartrate. The study is still on going and analysis will be done once all the data is collected.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I did the homestay program for a weekend during my stay in Japan. The host family and I went to a sweets shop and learned how to make nerikiri and kingyoku. The homestay was my favourite part of the program!

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Jessica Nachman （ID No. SP25414 ）

2. Current affiliation: York University

3. Research fields and specialties:
Social Sciences

4. Host institution: Osaka University

5. Host researcher: Prof. Chiaki Okada

6. Description of your current research

The purpose of this research is to highlight how sport is taken up by contemporary social movements in Canada and Japan. In an era marked by escalating global crises—including genocide, forced displacement, and deepening social inequality—sport is a powerful tool for political intervention. For example, sport boycotts were part of the international movement to pressure South Africa into ending its racial segregation policies. This project highlights the urgency of using sport to address the genocide in Gaza.

Since October 2023, the Israeli army has killed over 800 Palestinian athletes and sports officials in Gaza and the West Bank. Nearly all sports facilities, infrastructure, and stadiums were significantly or completely destroyed. Remaining sport stadia are used as shelter for thousands of displaced Palestinians. On August 6, 2025, former Palestinian national team footballer Suleiman al-Obeid was killed while waiting for humanitarian aid. The genocide in Gaza thus poses an urgent humanitarian crisis under which international sport bodies have a responsibility to address. For example, FIFA, UEFA, and the IOC have all condemned Russia's invasion of Ukraine and have taken actions to support Ukrainian athletes. Yet, these same sport bodies have been disturbingly silent in addressing the invasion of Gaza and Israel's ongoing occupation of Palestinian land.

7. Research implementation and results under the program

Title of your research plan:

Sport and Social Movements for Gaza

Description of the research activities:

I have conducted literature reviews on mobility justice and decolonial theories to better understand the Israeli occupation of Palestine. Mobility justice acknowledges mobility– as well as the right to stay in place – as a form of capital; a resource that is unevenly accessed, and yet access to this resource significantly affects human flourishing and access to opportunities (Cook & Butz, 2018). Meanwhile, decolonial theory reveals how settler colonial states such as Canada, Israel, the U.S., Australia and New Zealand aim to secure "ongoing state access to the land and resources that contradictorily provide the material and spiritual sustenance of Indigenous societies on the one hand, and the foundation of colonial state-formation, settlement, and capitalist development on the other" (Coulthard, 2014, p. 7). As Wolfe (2006) succinctly put it, settler colonialism is not an event from history, but rather an ongoing structure of invasion onto Indigenous land.

While in Japan, I examined recent protests related to sport and anti-genocide demands. For example, in 2018, Israeli defense and security technology companies sponsored a trade show in Kawaski. The trade show was meant to advertise security technology for the 2020 Tokyo Olympic Games. Japanese activists protested outside of the trade show, condemning Japan's strengthening military ties with Israel. Further, protestors condemned the way that Israel tests its military products on Palestinians, to be sold internationally (Loewenstein, 2023). The anti-genocide activism in Japan is evidence of transnational decolonial resistance (Tabar and Desai, 2017). Indeed, mega-sport events as an international display, poses a unique opportunity for contributing to the movement against genocide.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

During Obon week, my guest house invited me to participate in the neighbourhood community festival. There were many music performances and they hosted Obondori (the dance). I was also invited to cook meals and eat together with community members.

JSPS Summer Program 2025
Research Report

1. Name: Liam B. Surry （ID No. SP25415 ）

2. Current affiliation: McMaster University

3. Research fields and specialties:
Chemistry

4. Host institution: Keio University

5. Host researcher: Prof. Masahiro Sugimoto

6. Description of your current research

Poor diet quality and tobacco smoke exposure are two modifiable risk factors linked to an alarming increase in chronic diseases globally. Accurate assessment of dietary or smoke exposures is challenging in epidemiological studies that rely on self-reports, as they are prone to bias. Capillary electrophoresis-mass spectrometry (CE-MS) is a high-efficiency separation technique optimal for resolving complex mixtures of ionic metabolites in volume-limited samples. Sample throughput can be greatly increased when using multisegmented injection (MSI)-CE-MS that takes advantage of a serial sample injection format. However, data preprocessing remains a major bottleneck in MSI-CE-MS due to the large migration time variability for metabolites. Currently, my research is focusing on developing a new software tool for automated data preprocessing of MSI-CE-MS data. This software tool, named PeakMeister, is written in the R statistical environment and allows for automated data preprocessing of authenticated metabolites by MSI-CE-MS. We are expanding our software for rapid and reliable data preprocessing of biomarkers associated with diet quality and other lifestyle exposures. This gives us a tool to rapidly enable more accurate exposure risk assessment relevant to human health.

7. Research implementation and results under the program

Title of your research plan: Automated Metabolomics Software Tool for Nutritional Assessment of Diet Quality in Urine

Description of the research activities:

A key takeaway from this summer's research, and research in general, is that nothing ever goes exactly as planned. This required learning to adapt quickly, troubleshoot setbacks (including replacing entire instrument components), and find creative solutions when experiments did not behave as expected. Each day brought a new challenge to be overcome, but also an opportunity to develop valuable skills.

This study examined four populations: heavy smokers (≥1 pack/day), individuals with second-hand smoke exposure, and two groups of non-smokers. Two instrumental setups were employed to characterize metabolic profiles: a time-of-flight (TOF) mass spectrometer (low sensitivity, positive/negative mode) and an Orbitrap mass spectrometer (high sensitivity, positive mode). Although analysis is ongoing, distinct metabolomic profiles were observed between heavy smokers and non-smokers. Furthermore, the Orbitrap enabled the detection of nicotine metabolites in second-hand smoke-exposed individuals that were not detectable with the TOF, providing a tool for identifying trace environmental exposures. This provides the foundation for determining metabolomic profiles that can differentiate individuals with second-hand smoke exposure from non-smoking individuals and heavy smokers. Work is still underway to compile the complete metabolome to gain a comprehensive view of smoker and non-smoker metabolic signatures, specifically regarding dietary patterns.

Each instrument configuration originated from a different vendor and therefore used unique proprietary data file formats. Our software, PeakMeister, successfully analyzed both formats after conversion to a common open-source standard, ensuring accuracy and reliability. Inter- and intra-day precision were evaluated by assessing PeakMeister's performance on a single sample analyzed 36 times across multiple days in positive and negative ionization modes. A decline in accuracy was observed toward the end of the experiment, most likely due to capillary degradation, which caused unpredictable shifts. Additionally, Orbitrap analysis in single-injection mode showed large variations in migration times for analytes; however, PeakMeister maintained high detection accuracy even under these conditions. These results highlight PeakMeister's potential for application across multiple CE-MS systems beyond MSI mode, allowing CE-MS analysis to not be limited to a single vendor platform.

8. Please add your comments, including any cultural experiences during your stay in Japan (if any):

Truly, this was an unforgettable cultural experience. I feel exceedingly privileged to be granted the opportunity to travel to Japan for research. I was located in a more rural part of Japan (Tsuruoka, Yamagata prefecture), which was a very different experience from my time in the big cities. All of the locals were incredibly nice. For such a small city, there was a surprising number of things to do or places to explore if one knew where to look. Notable experiences include: hiking a 1200 year old ancient pilgrimage route (the rokujurigoe kaido), visiting the Sokushinbutsu, or the buddha mummies in Yamagata prefecture, exploring the countryside with my homestay family, discovering the cities underground live music scene, seeing the wildlife (including wild monkeys, a racoon dog, and a wild boar), biking around the countryside, exploring the mountains and surrounding coastline, and getting to experience Hokkaido. 10/10 would visit again.

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Sean F. Palter （ID No. SP25416）

2. Current affiliation: University of Toronto

3. Research fields and specialties:
Biological Sciences

4. Host institution: Tohoku University

5. Host researcher: Dr. Mitsuo Umetsu

6. Description of your current research

My current research involves creating reporters that quantify amino acid concentrations. This is done by using translation - the process in which proteins are built from their amino acid building blocks. By limiting the target amino acid, protein production is stopped when the target runs out. Using proteins with inherently quantifiable properties like fluorescence or enzymatic activity, we can quantify the amount of target amino acid in a solution.

Future work involves creating an effective platform to allow for portable and point-of-care quantification. This can be useful for farmers trying to determine plant growth, for field doctors who may use amino acids as a metric and more possibilities. Current focus is on using lateral flow assays or electrochemical means.

Other future work involves creating multiplexing capabilities. Using short peptides which do not use all amino acids and using binding molecules could allow for multiplexing. Early experiments demonstrate this working with two proteins that each have 19 amino acids (i.e. one unique amino acid per protein), allowing multiplexing of those two amino acids. Finding combinations that enable more amino acid multiplexing is currently challenging.

Using techniques developed during this summer program, I can screen for a large variety of short peptides that may enable my future work.

7. Research implementation and results under the program

Title of your research plan:

Receptors as therapeutic proteins using machine learning.

Description of the research activities:

I started with the four stages of protein library expression. First, I had to create a library. Using a DNA amplification technique, overlapping PCR, designed to create random mutations, I was able to generate variants of the target protein. Next, I incorporated the many different DNA variants into a plasmid to produce the different mutant proteins. I added the plasmid into cells, cultured the cells and extracted the target proteins. I used enzyme-linked immunosorbent assay (ELISA) to test the binding capacity of the generated mutants. With this completed, the successful proteins were sequenced to identify the mutations. Now knowing the sequences, machine learning was performed to identify the best possible sequence.

I was taught another method for variant generation known as phage display. Utilizing phages, viruses that only target bacteria, a generated library can be inserted into these phages, which will propagate in bacteria. Using this can allow for a much larger screening of protein variants.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I participated in the homestay program. It was an amazing experience being part of a Japanese family for a weekend. In addition, I saw the Tanabata Festival in Sendai, one of Tohoku's great festivals. On weekends, I climbed Mt. Fuji, travelled to Hokkaido, Aomori, around Miyagi prefecture, and on Obon week, travelled to Hiroshima, Kobe, Nara, Osaka, Kyoto and Tokyo.

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Eric DeMarbre （ID No. SP25417）

2. Current affiliation:

Carleton University

3. Research fields and specialties:

Other: Information Technology – Human-Computer Interaction

4. Host institution: Nara Institute of Science and Technology

5. Host researcher: Prof. Kiyoshi Kiyokawa

6. Description of your current research

My current research is in Human-Computer Interaction (HCI) in Extended Reality (XR) systems, which includes Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR). I have two research focuses. One is evaluating performance in near field user interfaces in XR like poke, touch, and grab interactions, within arm's reach of a user. Some of my current research suggests these interactions may not behave in the same way as distance interactions, like ray casting, or small-scale touch interfaces, like on mobile platforms.

The other focus is on the relationship between realism in XR on user performance and the concept of presence, which is the subconscious feeling of being there in virtual environment). In XR HCI research we often manipulate realism to elicit an effect on performance and presence, but these changes are rarely quantified. The topic of my Master's Thesis was an attempt to use the Elo rating systems, which is a mathematical rating system previously used for chess players, to provide a numerical value to the realism and graphical quality virtual objects in an MR system, where virtual information was overlayed on a real-world scene. I ran a 2-alternative-forced-choice (2AFC) experiment where the system would present participants with two similar MR VEs with the graphical conditions of placement plausibility, shadows, texture quality, and polygon count, either in an on/high or an off/low position. Participants chose which VE they found to have the highest graphical quality. I applied the Elo ranking system used for chess matches to these results and analyzed the scores, which I named the quality ranking (QR). The QR scores showed that the element with the least impact was polygon count, and the plausibility of placement had the highest impact. In addition, the mean difference in QR score for each set of combinations was consistent, suggesting that a ranking system could quantify graphical quality in the same system. With this evidence, I wanted to determine if I could find a correlation between a user's performance and subjective feeling or presence based on changes to QR score. In a follow up study, I chose four combinations of graphical quality suggested by study 2 and used those VEs to run a within-subjects experiment on user performance and presence. Participants performed target selection tasks and completed standard presence surveys in each VE. I compared the time of target selection, accuracy, error count, and scores from the presence surveys. The results suggest some correlation between the QR score for both presence and performance. There may be a threshold where graphical changes do not affect a user's ability to complete tasks.

My proposed research project with my host institution is to extend this concept to avatars in XR, which replace a user's body since they are unable to see it in fully immersive VR.

7. Research implementation and results under the program

Evaluating the Impact of Graphical Ranked Avatars on Embodiment in Extended Reality Systems

Over the two months of the research fellowship, I designed a user study to evaluate the importance of elements of realism that users perceive in avatars. I developed the software using the Unity 3D engine for the Meta Quest 3 virtual reality headset. With assistance from Professor Kiyokawa and other researchers at the NAIST CARE Lab, we defined a user study in which a sufficiently detailed avatar could have specific and impactful graphical qualities toggled to produce different levels of realism. We chose: Shadows (cast, received, and none), Polygon Count (high/low), Rendering Style (realistic/stylized), Normal Mapping (on/off), and Specular Highlights (on/off). This results in a 3 x 2 x 2 x 2 x 2 experimental design with 48 distinct avatar configurations providing 1128 unique matchups. The system presents a matchup at random to the participant in a 2-Alternative Forced Choice paradigm: evaluating which avatar from the pair they believe is more realistic, then voting for that avatar. The system records these results, and new matchups are selected. Results will be subjected to a mathematical ranking system like Elo, Glicko-2 and Q Score to generate a numerical value for realism. These values will be analyzed to identify which elements impact realism and be what factors. They will also be evaluated against the participant's sense of embodiment and the Proteus Effect (when a person begins to behave like the avatar) in future experiments.

I tested this software along with a pilot study run with fellow researchers to refine the experimental process and identify some preliminary results. Initial subjective results suggest that specular highlights and a combination of normal mapping with received shadows are the most impactful conditions to realism, which polygon count and cast shadows were the least important or noticed.

We will continue the research by completing a full user study at both the host institution and my home institution.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I have had a number of amazing cultural experiences exploring Nara, Osaka, Tokyo, and Osaka on my free time and weekends. Even in the working environments I've had unique Such as several organized trips to an Izakaya after a day at the lab with both the Japanese and International members. Finally, because I took some time to attend the 2025 World Expo hosted in Osaka, I got to experience many other cultures and meet people from around the world. Truly a unique international experience.

9. Adviser's remarks (if any):

【SP25XXX】

JSPS Summer Program 2025
Research Report

1. Name: Justin Desrochers （ID No. SP25418 ）

2. Current affiliation: Université de Sherbrooke

3. Research fields and specialties:

Humanities Social Sciences **Mathematical and Physical Sciences**

Chemistry Engineering Sciences Biological Sciences

Agricultural Sciences Medical, Dental and Pharmaceutical Sciences

Interdisciplinary and Frontier Sciences

4. Host institution: Hiraoka Lab - Kyoto University Institute of Advanced Study

5. Host researcher: Hiraoka Yasuaki

6. Description of your current research

Persistent Homology (PH) studies the shape of a data set by viewing it as points in a geometric space. We construct a vector space V(S, D), which describes the homological features at each scale S and density D. Examples of such features include loops, spirals, and clusters in Euclidean data. As the parameters S and D change, different features of the data appear and disappear. PH focuses on features that persist for a long time, as these describe the true shape of the data. The function V is called a module, an object studied by representation theorists.

We study persistence modules using invariants—functions that associate a module with a list of easy-to-understand spread modules. Each invariant describes certain information about the topological features. The fundamental challenge in representation theory is that there is no single invariant that completely describes every persistence module. Many different invariants exist in the literature, and currently, there is no method to decide which invariants are useful for a given data analysis problem. Our project seeks to understand the relationships between two invariants and to develop efficient algorithms.

The first invariant is the compressed multiplicity developed by the Hiraoka Lab. This invariant compresses a persistence module into a smaller one. It then examines which features are born and die in the smaller module and associates each feature with a spread module.

The second invariant is called a spread approximation, which approximates each module by a sequence of spread modules. This invariant has attracted much interest in PH, including research by Asashiba, Brüstle, and myself. For modules with few density changes, a known relationship exists between compressed multiplicity and spread approximations. We hope to eventually extend this relationship to arbitrary modules.

7. Research implementation and results under the program

Title of your research plan:

Computation and Relationships between invariants for Topological Data Analysis

Description of the research activities:

This project focused on developing computational methods for spread approximation of persistence modules and understanding its relationship to compressed multiplicity. Our investigation revealed further evidence that such a relationship exists, though a complete proof remains an open problem. I plan to explore this problem during a future project.

I engaged in frequent discussions with researchers in the Hiraoka Lab and collaborated closely with Enhao Liu on this project. Initially, we tried using the Auslander–Reiten quiver for computing spread approximation. However, this direction led to significant challenges, and we have decided to set it aside in favour of other ideas. Through discussions with Jan Jendrysiak, we formulated an algorithm for spread approximation. However, this algorithm is not yet practical for data analysis applications. Liu and I have strategies for improvement and hope to pursue these ideas in future work.

Throughout the summer, I engaged with the research community in Japan. I attended several presentations on topological data analysis (TDA) at the Hiraoka Lab and made two visits to Kobe University for discussions with the TDA group there. In addition, I attended the TDA PARTI symposium at OIST, where I presented my work alongside leading experts in the field. This event, along with a mini-course on TDA and machine learning, inspired new research ideas. I also learned about innovative computational tools for visualizing multiparameter persistence modules.

Beyond these activities, I deepened my theoretical foundation by studying tools from homological algebra, such as spectral sequences and the Salamander Lemma, which are essential techniques for this research. I also participated in several online lectures during the TDA and representation theory thematic program.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I really enjoyed experiencing Japanese culture and heritage this summer. I hiked at Fushimi Inari twice, and the temples in and around Kyoto were breathtaking.

I was inspired by the beautiful countryside, rivers, and mountains throughout Japan. I had the chance to attend Gion Matsuri and Gozan Okuribi. I met many kind people and made friends both in my lab and among other participants in the summer program. I will treasure the friendships and memories I made here forever.

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: **Grace MUKUNZI** （ID No. SP25501）

2. Current affiliation: **Lund University**

3. Research fields and specialties:
Engineering Sciences

4. Host institution: **The University of Tokyo**

5. Host researcher: **Professor Hironori KATO**

6. Description of your current research

Railways play a pivotal role in reducing greenhouse gas (GHG) emissions and curbing the ongoing rise in global temperatures. However, as ridership and traffic volumes increase, they are presented with a challenge of upholding reliability and punctuality – factors on which the attractiveness of any mode of transport relies.

With an increase in traffic volumes comes a shrinkage of existing railway capacity, which makes operations more sensitive to disruption from unexpected events on the network. Such events may include asset failures, operational errors, fires, or natural disasters, and extreme weather events such as floods, heat waves, among others. Moreover, the severity and frequency of these unexpected events are increasing due to climate change.

My PhD research then studies the relationship between incidents/unexpected events and delays/punctuality to derive insights and methods for accounting for this stochasticity during timetable design, network design, and operations planning in order to achieve a more reliable service. My current research focuses on turnouts (switches and crossings), a special type of track along the railway where plain tracks merge into, diverge from, or cross each other, fostering network flexibility, increased capacity, and safety. Despite their pivotal role in railway networks, they are notorious for disrupting train traffic. My research seeks to determine and explain trends and patterns in S&C failures.

7. Research implementation and results under the program

Title of your research plan:

A comparative study of turnouts (switches and crossings) and their impact on train delays in Japan and Sweden.

Description of the research activities:

The study adopted a *mixed methods approach* to assess the extent to which turnout failures disrupt railway operations in Japan and elicit explanatory reasons for differences in the disruption effect between Japan and Sweden. *Descriptive statistical analyses* of historical incident report data, obtained from stakeholders and those published by Japan's Ministry of Land, Infrastructure, Transport, and Tourism. For Sweden, data from LUPP – a database containing delay attributions was used. *Semi-structured interviews* were conducted with railway practitioners in Japan. A total of 11 participants were interviewed, including representatives from a research institute, academia, private railway operators, railway construction companies, and a JR company. The study also involved a continuous review of both peer-reviewed articles and grey literature.

Below are the main insights from the study

- Sweden experiences up to 50% more major disruptions (incidents causing cancellations and train delays of 30 minutes or more). External causes of disruption dominate for Japan, while internal causes of disruption dominate for the Swedish railway network. Based on data from 2010-2020.
- Approx. 160 major S&C disruptions per year in Japan compared to 371 per year in Sweden. Based on data from 2013-2015.
- A recurrent theme to explain comparatively lower major disruptions from S&Cs on the JRN is the use of *fewer switches and simpler switch layouts*. High spatial density and limited space for station areas make it infeasible to have larger and more complex track layouts. Smaller and less complex interchange stations, and in some cases, physical separation of otherwise connected stations, as a consequence of railway privatisation and the institutional set-up. More than one separate line serving the same O-D pairs, especially in urban areas, creates redundancy, allowing for 'suspension of service' on an affected line as opposed to rerouting - a disruption management strategy reliant on more complex track layouts & an increased number of switches. Trade-off between maintenance cost associated with many switches and network flexibility.
- Technological differences identified include the use of the 12-Next generation S&C in Hokkaido, 30% rail operators use condition monitoring systems, use of the anti-friction tongue rail, snow mitigation through air jets & water sprinklers

Other research activities within the JSPS period.

- Weekly International Project Laboratory seminars to discuss progress of PhD, master's, and undergraduate research ideas/projects.
- DISUMA (Design of Innovative Sustainable Urban Mobility in Asia) graduate academy – a 3-day event in which we trialed a workshop method for developing future transport scenarios. This included a guided academic tour of Tokyo city. Participation in CASPT and Transit Data Conference, 2025

8. Please add your comments, including any cultural experiences during your stay in Japan (if any):

The program has been extremely enriching, ranging from the academic and research rigor at UTokyo's IPL to the rich and diverse culture in Japan. I visited several temples and shrines both in Osaka, Kyoto and Tokyo. I hiked Takao Mountain. I visited a tea house for a traditional tea ceremony & dined at several traditional Japanese restaurants. I participated in JSPS' homestay program and attended a children's piano recital. I also undertook JSPS' Japanese language classes, among other pleasant and fun experiences.

9. Adviser's remarks (if any):

Ms. Mukunzi demonstrated great dedication to her research despite facing numerous challenges. One of the most significant obstacles was the stark contrast between the Swedish and Japanese railway systems. However, through interviews with local professionals in Japan, she developed a strong understanding of the distinctive characteristics of Japan's railway system. I am confident that she will be able to accurately interpret these practices and extract valuable insights for her PhD study.

JSPS Summer Program 2025
Research Report

1. Name: Aida Paivandy （ID No. SP25502）

2. Current affiliation: Uppsala University

3. Research fields and specialties:
Biological Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof. Osamu Takeuchi

6. Description of your current research

My current research focuses on finding new ways to reduce harmful inflammation caused by respiratory viruses such as influenza and SARS-CoV-2. These viruses activate immune sensors in our cells, leading to the production of strong inflammatory signals that can worsen disease. Our recent work shows that targeting specific cell compartment called endolysosmes can successfully reduce this inflammation.

7. Research implementation and results under the program

Title of your research plan:

Targeting Inflammatory Responses to Respiratory Viruses through RNA Regulation

Description of the research activities:

I aimed to investigate the roles of two regulatory proteins, Regnase-1 and N4BP1, as well as the role of pH modulation through inhibition of acidification in cellular compartments called endolysosomes, in controlling inflammation triggered by respiratory viral infection. These regulatory proteins normally act to limit inflammation by degrading virus-induced inflammatory mRNAs within cells. To address this, I examined whether Regnase-1, N4BP1, and pH modulation can influence virus-induced inflammation using both human airway cells and mouse immune cells. Specifically, mouse macrophages or human airway epithelial cells were stimulated with viral RNA mimics or infected with live influenza virus, followed by assessment of inflammatory responses.

Our preliminary results show that loss of Regnase-1 or N4BP1 (in cells deficient in these proteins) does not significantly affect the production of inflammatory mediators such as IL-6 and TNF-α in macrophages stimulated with synthetic double-stranded RNA [poly(I:C)]. In contrast, pretreatment of these immune cells with pH-modulating compounds markedly suppressed poly(I:C)-induced inflammatory mediator production. Similar experiments were conducted in human airway cells, and the results are currently under analysis. In addition, we have initiated studies to evaluate the role of Regnase-1 and N4BP1 in immune cells during live influenza virus infection, with results pending analysis.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I am very grateful to JSPS and all the organizers for providing this unique scientific and cultural experience. It was truly enriching to learn about Japanese culture and history, while also having the chance to enjoy the country's beautiful nature. This program has been an unforgettable part of my career and personal journey. My only wish is that even more cultural activities could be included in the program to further deepen the experience.

9. Adviser's remarks (if any):
None.

JSPS Summer Program 2025
Research Report

1. Name: Sahand SALARY （ID No. SP25504）

2. Current affiliation: Karolinska Institute

3. Research fields and specialties:
Biological Sciences

4. Host institution: The University of Tokyo

5. Host researcher: Prof. Donald Cameron

6. Description of your current research

Topoisomerases (TOP) are a class of enzymes that relieve mechanical stress put on DNA by introducing and re-ligating single- or double-strand breaks. Several chemotherapeutic agents exist that target TOP activity, and while effective, these drugs are associated with many serious side effects. These include diarrhea, hair loss, anemia, and increased susceptibility to infection, as well as more severe complications such as cardiac toxicity and secondary malignancies. Novel treatments targeting TOP with fewer and less severe side effects would be of clinical benefit. Recent studies suggest that TOP interacts not only with DNA but also with proteins such as MYC, an oncoprotein frequently dysregulated in cancer. Deeper insight into this mechanism may lead to the development of new therapies.

MYC is believed to act as a global activator of transcription and overexpression will in turn increase transcriptional output. Recently, MYC has also been shown to increase the diffusion rate of TOP in vitro by reducing TOP complex size and limiting self-interactions, thereby enhancing its activity. This has the potential for novel oncogenic treatments targeting the diffusion rate of TOP. However, before this interaction can be leveraged for therapeutic development, more efficient screening approaches are needed. Measuring the diffusion rate today is laborious, costly, and low throughput. Therefore, this study aims to develop a method for high throughput diffusion rate measurements as it would greatly accelerate research in this field of study.

7. Research implementation and results under the program

Title of your research plan:

Designing a high-throughput screen for measuring protein diffusion

Description of the research activities:

I have cultured and managed Halo-TOP2A HCT116 cells, stained them using Nile Red dye and successfully imaged them using confocal microscopes available at the University of Tokyo. Additionally, I edited imaging software that will be used to analyze images taken with the confocal microscope.

Furthermore, we utilized 293F mammalian cell lines for expression of YFP-tagged N-MYC, DDX-20, EBNA2, and TOP2A proteins. Subsequently we prepared a buffer screen to optimize protein solubility prior to protein purification by size exclusion chromatography as this would maximize protein yield and stability.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I have mainly spent my time in Tokyo and even though I have lived here for two months, I still feel like there is so much I have not seen. Apart from adventures down tucked away streets or going to small art exhibits hidden away in the corners of the city, I have developed a newfound love for matcha.

I have had a lovely time together with the other JSPS fellows. Thank you very much to JSPS, Sokendai, my nominating authority STINT and anyone else involved for this wonderful experience!

9. Adviser's remarks (if any):

Sahand has been an excellent student as well as a cheerful and kind presence in the lab. Considering he was only learning to pipette for the first time two months ago, he has demonstrated incredible growth to the point where he can perform experiments independently. We have both greatly benefited from this JSPS scholarship and we hope to work together again in the future.

JSPS Summer Program 2025
Research Report

1. Name: Yunting Xie （ID No. SP25505 ）

2. Current affiliation: Department of Business Studies, Uppsala Univerisity

3. Research fields and specialties: Social Sciences

4. Host institution: Graduate School of Business Administration, Kobe University

5. Host researcher: Prof. Shigehiro Nishimura

6. Description of your current research

I am a doctoral student in the Uppsala Patent History Research Group at the Department of Business Studies, Uppsala University. My doctoral project, “From invention to innovation: Novelty, impact and value of patents in 20th century Sweden”, focuses on using digital methods in researching Swedish patent history at the first half of twentieth century with a global perspective.

The study begins by reconstructing the historical context of patenting and exploring how patent texts were created. The first phase of the project consists two studies: a computational analysis on patent texts similarity and a historical investigation of international patenting activities between Sweden and Japan. These studies help to identify key actors in text production and patent management in Sweden and beyond in the first half of twentieth century, which paves the way of more sophisticated analysis for the interplay of text and value in historical context.

7. Research implementation and results under the program

Title of your research plan:

Building Japan-Sweden Patent Families: Patent Agents, Multinational Enterprises and Trading Companies (1900–1945)

Description of the research activities:
During my research visit at Kobe University, I investigated the formation of Japan–Sweden patent families before WWII together with my host, Prof. Nishimura. In particular, I focused on the case of AB Ljungström, an innovative Swedish company that patented extensively in Japan, and Gadelius K.K., a pioneering machinery trader and manufacturer active between Sweden and Japan. The research was carried out through archival work, field visits, and regular research meetings.

Our initial findings suggest that licensing was a crucial channel for Sweden–Japan technology diffusion, and that both independent patent agents and trading companies played essential roles in introducing Swedish inventions to Japan. Following my stay in Kobe, we plan to continue exploring corporate archives in both Japan and Sweden, with the aim of providing an in-depth analysis of the intermediaries and mechanisms of international patenting in long-distance contexts where connections between actors were limited.

In addition, thanks to the research support allowance provided by JSPS, I had valuable opportunities to travel and meet scholars as well as patent agencies in the Kansai region and beyond. These encounters helped me to gain familiarity with Japanese patenting practices and contributed to a deeper understanding of business history and the history of innovation in Japan.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

My time in Japan has been truly memorable. Thanks to the support of my host, colleagues, and the administrative staffs at the institution, I was welcomed into a friendly working environment and had access to an excellent library. Beyond the campus, I especially valued the homestay experience arranged by JSPS and the Homestay in Japan project. It was a great pleasure to meet the Nakai family and spend a weekend at their home. During the homestay, I enjoyed authentic Japanese food and culture, and we shared many laughs together.

9. Adviser’s remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Nicol LATSIA （ID No. SP25506）

2. Current affiliation: Luleå University of Technology

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: University of Tokyo

5. Host researcher: Prof. Hideaki Miyamoto

6. Description of your current research

My current project examines the effects of diurnal and/or annual temperature variations on meteorites, acting as asteroid analogues. Using a climatic chamber, we are subjecting the meteorites into many thermal cycles of repetitive heating and cooling to understand how fracturing initiates and propagates through our samples. This gives us an understanding on the production of regolith, the loose unconsolidated material composed of small rocks and particles, on the surfaces of small planetary bodies. This is research is also relevant for future space missions, such as JAXA's Martian Moons eXploration (MMX) mission, which will target one of Mars' moons; Phobos. For this reason, my work extends beyond the study of meteorites to also include the University of Tokyo Phobos Simulant (UTPS).

7. Research implementation and results under the program

Title of your research plan: Investigation of the thermal properties of University of Tokyo Phobos Simulant (UTPS)

The initial plan of this research visit was to observe and develop the University of Tokyo Phobos Simulant (UTPS). This simulant serves as analogue material to examine the surface of one of Mars' moons; Phobos. The scope of the project expanded to the investigation of the thermal properties of the UTPS. Using the facilities at the Miyamoto Laboratory, we set up a solar simulator to simulate space conditions similar to those on Phobos. In particular, we have subjected the simulant to repeated thermal cycling to simulate the temperature variations the surface undergoes during a Martian day-night cycle.

This experiment allows us to calculate the thermal expansion coefficient of the UTPS. Such measurements are essential for understanding how Phobos-like materials respond to repeated heating and cooling, which over time can lead to thermal fatigue. Thermal fatigue can be the cause of microcracks, fragmentation, and eventually, surface alteration. These results are particularly relevant in the context of the upcoming JAXA's Martian Moons eXploration (MMX) mission, which aims to land on Phobos and return samples to Earth.

At this stage we have obtained only preliminary test results, as the time restrictions only allowed for working on the simulant, and optimizing the experimental setup.

Description of the research activities:

During this research visit, the study of the UTPS was initiated. A solar simulator was installed and configured at the Miyamoto Laboratory and then tested using temperature monitoring equipment. Initial measurements on the physical alterations in the UTPS sample were performed. It was deemed necessary that more specialized equipment would be necessary for acquiring results with higher accuracy. A dilatometer, an instrument used to measure the change in length when a sample is subjected to thermal variations, will be ordered for future experiments.

Beyond laboratory activities, I attended group meetings and gave a seminar related to my work and research plans at the University of Tokyo.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

The entire research project has been an incredibly rewarding experience, both scientifically and personally. It has been a great opportunity to work with the team at the Miyamoto Laboratory, whose expertise has been invaluable throughout the project. Our work will continue after the end of the JSPS Summer Programme.

Beyond the laboratory, my experience in Japan has been equally memorable. From the delicious cuisine and cultural heritage to the kindness and hospitality of the people, every day has been amazing. My favourite day was the four-peaks hike from Mt. Jinba to Mt. Takao, where we were able to enjoy the view of Mt. Fuji, have some shaved-ice cream and udon noodles.

I have had the pleasure of meeting incredible people during this stay both in and outside the lab, and whom I hope to stay connected with for life. Thank you JSPS for this incredible opportunity! I am truly grateful!

JSPS Summer Program 2025
Research Report

1. Name: Ghadir Razaz (ID No. SP25507)

2. Current affiliation: Mid Sweden University

3. Research fields and specialties:
Engineering Sciences

4. Host institution: Meiji University

5. Host researcher: Associate. Prof. Hajime Wagata

6. Description of your current research

In my current research, three aluminum electrodes from various classes of alloys with opposite surface and oxide film properties, 99.99% Al (ref material), 2XXX, and 5XXX alloys respectively are studied for negative electrode in aluminum batteries. The plating/stripping tests of each aluminum alloy have been performed using [EMImCl]: AlCl3 ionic liquid electrolyte at various current densities. It can be observed that the lowest over potential is seen for cells constructed with 5XXX alloy, while the highest observed from cell made of 2XXX alloy. Difference in plating/stripping behavior is supposed to be partly attributed to aluminum oxide film properties. Thus, it is great of interest to alter the oxide film morphology of aluminum electrode surface and analysis its ‘impact on plating/stripping in aluminum batteries.

7. Research implementation and results under the program

Title of your research plan:

Reforming Aluminum Oxide Film using Low Temperature Flux Methode

Description of the research activities:

During my research time at Meiji University in Japan, it is tried to change he morphology of aluminum oxide film of aluminum electrode using low temperature flux technique. The low temperature flux is carried out through various steps in following. The plasma treatment of aluminum surface, spin coating of flux on aluminum surface, and heat treatment of coated aluminum surface for 4 hours at different temperatures. Various flux chemistries such as Na_2NO_3, K_2CO_3, Na_2CO_3 have been used during low temperature flux technique. The most interesting results are obtained from Na_2CO_3 flux. The scanning electron microscopy analysis revealed that the triangle-shaped crystallites oxide is formed with low temperature flux method using Na2CO3 flux. It is also seen that the porous nano structure with plate-like crystallites formed using K2CO3 flux. Next, the fabricated Al electrodes with triangle-shaped crystallites oxide will be tested and evaluated from battery performance perspective at my home university in Sweden.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I had a very pleasant time in Japan, unique research and life experience. I have also learned new research activities in Japan.

9. Adviser’s remarks (if any):

JSPS Summer Program 2025
(SP25509) Research Report

1. Name: David Silverlid （ID No. SP25509 ）

2. Current affiliation: Örebro University

3. Research fields and specialties:
Humanities (International Law)

4. Host institution: Kyoto University Graduate School of Law

5. Host researcher: Professor Shotaro Hamamoto

6. Description of your current research

In the international law of enforcement jurisdiction, there is one basic rule. States may not exercise enforcement jurisdiction in the territories of other states absent their consent. However, in today's digital age, cross-border access to electronic evidence is required in more than half of all criminal investigations. This development has emerged with the rise of cloud computing, and law enforcement agencies now find themselves in dire need of accessing data remotely stored in cloud-based servers abroad. Adding further complexity to this development, the mechanisms that enable cross-border criminal cooperation between states that already exist, chiefly mutual legal assistance (MLA) treaties, are widely regarded as dysfunctional in the digital context, since requested data may be manipulated or destroyed while slow and cumbersome MLA processes take upwards to a year or longer to resolve. As a consequence, states now look to externally held data to aid their law enforcement efforts and act unilaterally in cyberspace to obtain it.

Are such unilateral enforcement practices not prohibited by the basic rule on enforcement jurisdiction? The answer, it seems, may not be deducible from the law of enforcement jurisdiction alone. Instead, attempts to justify unilateral enforcement practices in cyberspace rely, at least in part, on notions borrowed from the law of prescriptive jurisdiction. That area of law takes a far more flexible approach to extraterritorial practices, and that approach is now seeping into the law of enforcement jurisdiction in the cyberspace context. A normative shift is underway, and the once so sturdy wall separating enforcement jurisdiction from prescriptive jurisdiction appears to be collapsing. This normative shift is the focus of my doctoral research project *Across Time and Cyberspace: How Digitalization is Changing the International Law on Enforcement Jurisdiction.*

7. Research implementation and results under the program

Title of your research plan: *Across Time and Cyberspace: How Digitalization is Changing the International Law on Enforcement Jurisdiction*

Description of the research activities:

In Japan, I have focused on documenting relevant state practice on enforcement jurisdiction in cyberspace from the Japanese perspective. In so doing, I have accessed valuable materials, including case-law and literature, thus adding substantial value to my analysis of how various states around the world are addressing the issue of access to electronically stored evidence. I have also presented my research on three occasions, at the weekly seminar of the Kyoto International Law Study Group, the Kyoto-NCCU Joint Seminar in International Law, and the Suenobu Foundation 2025 Symposium on the Future of Law About Emerging Technologies and Emergencies in a Global Context at Kobe University. On all three occasions I received valuable feedback on my current research from renowned Japanese scholars in this field, some of whom also shared additional research materials with me that are relevant for my project. Additionally, during my time in Japan I have progressed with the writing of the dissertation too, finalizing a full chapter.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

My summer in Japan has truly been wonderful, with rich cultural experiences ranging from traditional dinners, festivals, and temples in Kyoto to exploring the busy streets of Tokyo, hoping from one izakaya to the next. What I will miss the most is the friendliness of the Japanese people and, of course, all of the fantastic food that I have had the opportunity to experience.

9. Adviser's remarks (if any):

Professor Shotaro Hamamoto has been an excellent adviser – welcoming and generous while providing rigorous feedback on the research. I could not have asked for a better adviser during my stay in Japan.

JSPS Summer Program 2025
Research Report

1. Name: Julia Martinez （ID No. SP25510）

2. Current affiliation: Department of Cardiology, Clinical Sciences, Lund University

3. Research fields and specialties:

Medical, Dental and Pharmaceutical Sciences

4. Host institution: Department of Cardiovascular Medicine, Osaka University Graduate School of Medicine

5. Host researcher: Prof. Shuichiro HIGO

6. Description of your current research

Heart failure is a condition characterized by failure of the heart to pump around enough blood to meet the body's needs and can be caused by various cardiomyopathies. The survival rate is 50% 5 years post diagnosis even with optimized treatment. Therefore, further research is needed to investigate disease mechanisms and to develop novel treatments.

Titin is a sarcomeric protein important for the elasticity of the heart muscle and plays an important function in contractility. Splicing abnormalities in Titin have been linked to cardiomyopathy and heart failure, however research into the exact pathogenic mechanisms and how its different variants contribute to heart dysfunction is unclear. My research aims to investigate variants of Titin in heart failure.

RNA sequencing and qPCR data from the SwedeHeartSeq cohort, which includes 100 heart failure hearts and 7 unused donor hearts free from heart failure, revealed significant upregulation of the short Titin variant Novex-3. There is a lack of research into Novex-3. Its localization, function and association with heart disease is undiscovered. My research currently focuses on investigating Novex-3 in the healthy and failing heart. So far, it has been discovered that Novex-3 is located to the Z-band of the sarcomere, which has a role in providing mechanical stability to the sarcomere and surrounding structures. Additionally, Novex-3 seems to have a role in regulating nuclear morphology, which is important for heart function.

This research is still underway, and further experiments need to be conducted to unravel the role of Novex-3 in the healthy and failing heart.

7. Research implementation and results under the program

【SP25510】

Title of your research plan:

Characterizing the Small Titin Variant Novex-3 in Cardiomyocytes from a Dilated Cardiomyopathy Patient with Heart Failure

Description of the research activities:

Dilated Cardiomyopathy (DCM) can cause heart failure. The short Titin variant Novex-3 has previously been seen to be upregulated in DCM. Therefore, using a DCM patient-derived cell model from Shuichiro Higo's laboratory, I investigated the short Titin variant Novex-3 in terms of gene and protein expression, localization and its relationship to the patient model, by comparison with a control cell model representing healthy conditions.

Our previous data revealed upregulation of Novex-3 gene expression in DCM patients. qPCR was used to analyze this aspect. The patient model had lower Novex-3 gene expression compared to the control, not correlating with our previous patient data. This outcome may reflect a patient-specific effect or could be attributed to differences in cell maturity compared to direct patient samples. Immunofluorescence was used to analyze protein expression and localization of Novex-3 and nuclear morphology in the patient model compared to the control. Immunofluorescence revealed localization of Novex-3 to the Z-band, correlating well to previous results in another cell model. The localization to the Z-band indicates a role in mechanical stabilization of the sarcomere and surrounding structures in the heart cell. Further, Novex-3 had a minimal increase of protein expression in the patient model. This contradicts the qPCR results; however, alterations in mechanisms regulating protein levels may account for this discrepancy. In previous findings, Novex-3 had a role in regulating nuclear morphology which is important for heart function. The patient model had changes in nuclear morphology correlating to nuclear dysfunction. To investigate a connection between Novex-3 and nuclear dysfunction, Novex-3 was silenced in the patient model. Novex-3 was successfully silenced on gene level but not on protein level. This protocol needs to be optimized to be able to investigate the relation between Novex-3 and this DCM type.

In conclusion, the data obtained from this project point toward Novex-3 having a role in this DCM patient model and confirms its localization to the sarcomere. To further elucidate the connection between Novex-3 and DCM, additional experiments are required and will be conducted in Sweden.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

9. Adviser’s remarks (if any):

During this JSPS summer program, Julia enthusiastically pursued basic research using human cardiomyocytes differentiated from our patient-derived iPS cells based on her own research theme. Julia communicated well with our laboratory members and learned Japanese cultures. I hope these experiences will be helpful for her future endeavors.

JSPS Summer Program 2025
Research Report

1. Name: Anna Lang （ID No. SP25511）

2. Current affiliation: Linköping University

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Tokyo University

5. Host researcher: Professor Takao Someya

6. Description of your current research

My current research revolves around making flexible organic photovoltaics (OPVs) on wood-based substrates, such as cellulose nanofiber sheets (CNF). CNFs are derived from wood by mechanical processing and subsequent defibrillation. They are bio-degradable, bio-renewable and lightweight.

OPVs consist of multiple layers: top and bottom electrode, hole transport layer (HTL) and electron transport layer (ETL), and active layer (figure 1). At least one electrode needs to be transparent. The most commonly used transparent electrode is Indium Tin Oxide (ITO). However, ITO is brittle, therefore it is not suitable for flexible substrates, and it is necessary to find alternatives.

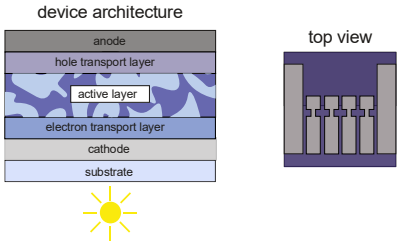


Figure 1: The device architecture of an organic solar cell. A solar cells consists of multiple layers which are deposited on a substrate. In order to permit light harvesting, at least one electrode needs to be transparent.

For this project, I have developed a method to replace ITO by evaporating a thin layer of silver to create a semitransparent bottom electrode.

When creating a proof of principle on glass, the ITO-free devices show similar V_{OC} to ITO-based solar cells, with a reduction in the J_{SC} due to the semi-transparent nature of the silver bottom electrode.

When implementing the same method on flexible substrates, the efficiency decreases drastically, mainly due to an uneven coating of the substrates and buckling from handling.

Since the Someya-Yamagishi lab focuses on flexible substrates, I wanted to learn about their device making and processing techniques.

7. Research implementation and results under the program

Title of your research plan:

Wood-based materials for Optoelectronics

Description of the research activities:

In Japan, I have conducted research in Prof. Takao Someya's group. My main goal was to learn about the handling of flexible substrate and the device making process established in the Someya lab.

To facilitate the device making process, the substrates are adhered to glass. Glass substrates were first cut to size using a glass cutter. Then, the substrates were cleaned and PDMS was applied on the surface. The PDMS is then cured according to the manufacturer guidelines. This allows for the deposition and subsequent removal of flexible substrates without damaging them.

Since I work with wood-based substrates, Yokota-sensei kindly provided me with CNF sheets by Oji holdings corporation. These sheets are made from modified nanocellulose fibers. The CNF sheets show excellent transparency but are limited in solvent resistivity. To increase the solvent resistivity, I have coated the CNF sheets with resin. Following the industry standard for the curing process, the resin causes the paper to buckle. Therefore, I investigated different deposition speeds, which changes the layer thickness, annealing temperatures and exposure times. As a next step, ITO was deposited onto the substrates. The goal is to fabricate devices with an ITO bottom electrode to be used as a reference, since ITO is the industry standard for OPVs.

Another goal was to investigate S-PEDOT as an alternative to PEDOT:PSS, both as a HTL as well as a semi-transparent bottom electrode. S-PEDOT is more conductive than PEDOT:PSS and dissolvable in ethanol and water, whereas PEDOT:PSS is a dispersion.

To deposit the S-PEDOT via spin coating, I tested the following conditions:

- spin coating speed: this modifies the layer thickness. Additionally, it ensures that the substrate is coated evenly.
- annealing conditions: the solvent needs to be removed without warping ethe substrates.
- dilution of stock solution and intermixing with alternative solvents to increase hydrophobicity.

With these changes, I successfully created an even coating of S-PEDOT on CNF substrates to function as an HTL. In order to make devices, further experiments need to be conducted.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

During my stay, I visited Nikko, Nara, Kamakura and Enoshima Island, enjoyed the views of mount Fuji and participated in a traditional tea ceremony. During Obon week, I traveled to Aomori and Sendai.

JSPS Summer Program 2025
Research Report

1. Name: Victor PURNOMO （ID No. SP25512 ）

2. Current affiliation: Chalmers University of Technology (Gothenburg, Sweden)

3. Research fields and specialties:
Engineering Sciences

4. Host institution: The University of Tokyo

5. Host researcher: Associate Professor Muhammad AZIZ

6. Description of your current research

The direct reduction of iron oxide presents an attractive alternative to the energy-intensive blast furnace process, which continues to play a central role in iron and steel industry around the globe. In addition to its application in ironmaking, direct reduction also offers potential as a means of energy storage, whereby the chemical energy invested during reduction can be recovered through oxidation, yielding heat and power generation. On top of that, unlike conventional blast furnace operations, which inherently emit high carbon emissions, direct reduction can be rendered carbon-free when hydrogen derived from water electrolysis is used as the reducing agent.

Among the various reactor configurations considered for direct reduction, fluidized beds are particularly suitable for iron powder processing, as there is no need for pelletizing. However, the main hinder to broader commercialization of fluidized bed reactors remains the risk of particle sticking or agglomeration—a challenge that has led to the discontinuation of several commercial-scale operations.

My current research is focused on experimentally evaluating the feasibility of conducting hydrogen-based direct reduction in a fluidized bed at low temperatures. Previous studies suggest that both reducing operating temperatures and using hydrogen as a reductant may mitigate or even eliminate the sticking issue. Preliminary results from lab-scale experiments suggest that this approach may be viable, although further investigation is required to determine its thermodynamic and economic viability.

To address such a question, I am conducting a comprehensive thermo-economic analysis of hydrogen-based direct reduction in fluidized beds for energy storage applications under the supervision of Associate Professor Muhammad AZIZ at the University of Tokyo, one of the known experts in the field. The scope and results attained under the two-month stay under JSPS Summer Program 2025 are presented in the next section.

7. Research implementation and results under the program

Title of your research plan:

Thermo-economic analysis of direct reduction using hydrogen in fluidized beds at a low temperature with a means of energy storage.

Description of the research activities:

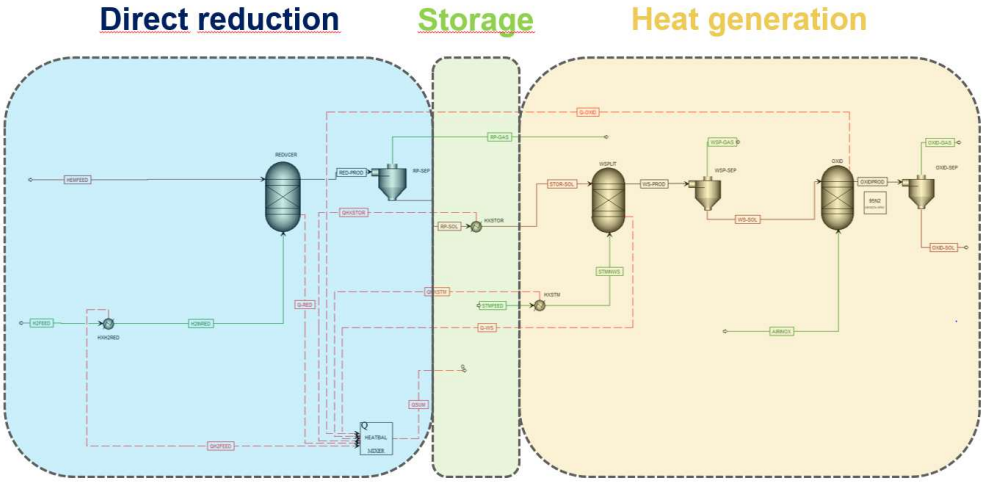
The work has been conducted using Aspen Plus V14 as the main tool for simulating the direct reduction in fluidized beds with means of energy storage. The idea here is to perform a direct reduction when the cost of electricity obtained from renewable sources, such as wind and hydropower, is low, and to recover the stored energy by oxidizing the reduced iron for heat and power when energy is costly or scarce. This is particularly suitable for Sweden, the reference country, due to its high share of renewable energy for producing electricity, as well as established district heating network and fluidized bed facilities in the country.

The chosen temperature for direct reduction was 550 °C, which is significantly lower than typical commercial temperatures, in an attempt to prevent sticking. The simulation mainly incorporates the following sections (please refer to the figure):

i) Direct reduction, taking mainly in the reducer.

ii) Iron storage.

iii) Heat generation, which involves steam reforming and oxidation.



During the simulation, the design renders that all reactors should be autothermal. However, this resulted in a huge amount of heat required, making further optimization necessary. Some feasible ideas include incorporating hydrogen combustion and adjusting the extent of reduction. This work will continue under collaboration between the groups at Chalmers and UTokyo.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I especially enjoyed the JSPS Homestay Program! The host family was welcoming and willing to share with me various aspects of Japanese culture and society.

9. Adviser's remarks (if any):

Not applicable

JSPS Summer Program 2025
Research Report

1. Name: Maria Florutau ID No. SP25513

2. Current affiliation: Uppsala University

3. Research fields and specialties:
Humanities

4. Host institution: University of Kyoto

5. Host researcher: Prof. Genji Yasuhira

6. Description of your current research

Globalising the Rise of Scientific Institutions: Learned Societies in Batavia and the Bengal, 1770-1830

This project challenges the traditional European-centered narrative of Enlightenment science by examining two pioneering colonial learned societies in Asia: the Batavian Society in Jakarta (1778) and the Asiatic Society in Kolkata (1784). Founded by Dutch and British East India Company members respectively, these institutions were instrumental in institutionalizing scientific knowledge and establishing global research networks during the Enlightenment period.

Moving beyond the focus on famous individual scientists, this comparative study explores how these societies functioned as active agents of knowledge production, extraction, and transfer between Asia and Europe. The Batavian Society concentrated on practical knowledge—agriculture, manufacturing, and engineering—to support Dutch colonial interests during a period of decline. In contrast, the ascending British used the Asiatic Society to pursue scholarly research in linguistics, anthropology, and religion, developing soft power through intellectual pursuits like William Jones's groundbreaking work on Indo-European languages.

Both societies shared a fascination with Japan, leveraging their unique trading positions to gather knowledge through figures like Carl Thunberg, Isaac Titsingh, and Philipp Franz von Siebold. Their research contributed significantly to European understanding of Asian civilizations while simultaneously serving imperial and mercantile interests.

This research reframes Enlightenment academies as participants in truly global intellectual history, demonstrating how colonial institutions shaped modern scientific practices. By revealing the complex, multidirectional flows of knowledge between colonies and metropoles, the project contributes to understanding how eighteenth-century institutional models continue to influence contemporary global science and research collaboration.

7. Research implementation and results under the program

Title of your research plan:

Between Batavia and Dejima: Isaac Titsingh's Role in European-Japanese Scientific Networks during the Tokugawa Period

Description of the research activities:

During my JSPS summer fellowship at Kyoto University under Prof. Genji Yasuhira's supervision, I conducted focused research on Isaac Titsingh's role within the Batavian Society's knowledge networks, examining how Dutch colonial learned societies institutionalized scientific knowledge about Japan during the Enlightenment. Through archival analysis of the Batavian Society documents from the National Archives of Indonesia, I traced Titsingh's membership trajectory from April 1779 to 1785, revealing a dual structure within the society between active Batavia-based members who processed and centralized information, and traveling members like Titsingh who served as knowledge collectors in colonial outposts.

My research uncovered specific botanical instructions issued to Titsingh by botanist Van Wurmb in 1779, directing him to observe and classify plants according to Linnaean taxonomy during his Japanese travels. Despite pressure from society founder Radermacher to publish regularly, Titsingh contributed six articles to the Proceedings between 1781-1784, covering topics from soy sauce and sake recipes to imperial chronologies and meteorological observations. These contributions, while relatively modest in volume compared to other members, proved foundational for later Japanese studies and established both Titsingh's reputation as a Japanologist and the Batavian Society's position as a center for Japanese knowledge in the Dutch colonial world.

I had the opportunity to observe and develop a working hypothesis that contextualise the Dutch collecting of Japanese knowledge within a wide colonial milieu. Whereas research of other colonial interactions, such as Dutch-Javanese or Dutch-Indian knowledge transfer involved the partial or total erasure of the local interlocutors, the political and diplomatic context in which Titsingh collected information relied on intermediaries and informants that had agency and the protection of the Japanese-Dutch diplomatic and trade relationship. I will expand this hypothesis in an article based on my research this summer.

Additionally, I organized the workshop "Beyond Dejima: Dutch and Swedish Perspectives on Japan during the Enlightenment" with speakers from Nichibunken and Uppsala University, and conducted field research in Nagasaki at the Dejima Restoration Project, Nagasaki Museum of History and Culture, and Siebold Memorial House to gather comparative material on later Dutch-Japanese scientific exchanges.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

My stay in Japan has been one of the most enriching and academically insightful experiences of my career. The fellowship provided complete freedom to work with my archival sources, unencumbered by teaching or administrative responsibilities, while also creating space for deeper reflection on broader theoretical questions and creative thinking. The incredible support from my host and department enabled me to co-organize a workshop, invite international experts, and engage with colleagues from Japanese academia. The opportunity to visit Dejima and explore Nagasaki more extensively allowed me to develop my ideas more profoundly than would have been possible through purely archival analysis and secondary reading in Uppsala.

The immersive research environment proved invaluable for connecting historical sources with their geographical and cultural contexts. Rather than simply analyzing documents in isolation, I could examine the physical spaces where these knowledge exchanges occurred and engage with Japanese perspectives on early modern European-Japanese relations. This multifaceted approach—combining archival work, academic collaboration, and site-based research—has fundamentally enriched my understanding of how colonial learned societies functioned as knowledge networks across cultural boundaries.

Being based in Kyoto and Japan also involved other cultural experiences, which although not directly related to the research, helped me understand the history and culture of Japan more, especially the Edo period. This included weekend visits to Sapporo and Naha, Nara, Uji and Wazuka, Nagoya, Osaka, Kayabuki no Sato and walking sections of the Kumano Kodo, as well as the Nakasendo trail between Magome and Tsumago.

9. Adviser’s remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Wing Ki Chan （ID No. SP25514 ）

2. Current affiliation: University of Gothenburg

3. Research fields and specialties:
Medical, Dental and Pharmaceutical Sciences

4. Host institution: International Institute for Integrative Sleep Medicine, University of Tsukuba

5. Host researcher: Professor Takeshi SAKURAI

6. Description of your current research

Our team's research focuses on autism, which is a common neurodevelopmental disorder with a global prevalence of approximately 1 in 100. Autism is more common in males than females (3:1) and is characterised by social and communication challenges, as well as the presence of repetitive and restricted interests and behaviours. Despite the high prevalence of autism, its underlying pathophysiological mechanisms remain unclear, and no effective treatment has been established.

Autism arises from an interaction between genetic and environmental factors. Existing research has demonstrated an increased risk of subsequent neurological and developmental impairments following perinatal inflammation. *Staphylococcus epidermidis* (SE), a gram-positive bacterium commonly found on the skin and mucosal membrane, is one of the most prevalent hospital-acquired pathogens among preterm infants, accounting for up to 50% of late-onset sepsis. *SE* has been found to primarily activate Toll-Like receptor 2 (TLR2), a type of transmembrane receptor which recognises pathogens and triggers a subsequent inflammatory response as part of the innate immune system.

Our team has previously demonstrated that the induction of self-clearing systemic postnatal SE infection increased the vulnerability of the neonatal mouse brain to hypoxic-ischaemic induced neuropathology, specifically in male mice, highlighting the association between infection, inflammation and neonatal brain vulnerability. Our team has also shown that postnatal *SE* infection induced microglia activation in the immature hippocampus, demonstrating inflammasome-driven neuroinflammation and suggesting a potential unrecognised role of *SE* in neurodevelopmental disorders in preterm infants, which warrants future investigation. Based on the existing findings, my current research primarily focuses on investigating the long-term effects of postnatal SE infection on neurodevelopment, particularly focusing on autistic-like behaviours in mice. Through investigating the mechanisms underlying the development of autism, including the possible role of the TLR2 pathway, our research may contribute to the identification of possible biomarkers and the development of effective treatment strategies for autism.

7. Research implementation and results under the program

Title of your research plan:

Effects of Optogenetic and Chemogenetic Stimulation of Serotonergic Neurons on Neurological Development and Behaviour Following Early-Life Systemic TLR2 Activation

Description of the research activities:

To investigate whether the activation of serotonergic neurons influences the neurodevelopmental and behavioural effects of postnatal *Staphylococcus epidermidis* infection in relation to autism, both chemogenetic and optogenetic approaches were employed and tested. The preliminary protocols are as follows: transgenic chemogenetic (*ePet-Cre*+/−; *hM3Dq-DREADD* f/f) and optogenetic (*ePet-Cre*+/-; *LSL-Opn4* f/f) mice were administered 5mg/kg of either Pam3CSK4 (P3C), a TLR2 agonist mimicking the immune response to postnatal SE infection, or sterile saline on postnatal day (PND) 5, by a single intraperitoneal (I.P.) injection. This time point corresponds to a developmental stage of preterm brain development. For optogenetic manipulation, the mice were exposed to blue light (470 nm; for OPN4 activation) or red light (500nm; as a control condition) with a cage-bottom LED system at the same time daily during the light phase from PND 6 to 10. For chemogenetics, clozapine N-oxide (CNO) 0.5mg/kg (for activating serotonergic neurons) or sterile saline (as a control) was administered once daily during the light phase between PND 6 and 10. 48 hours later, on PND 12, mice were subjected to a negative geotaxis test for motor function before being sacrificed for tissue collection (tail, brain, plasma) for genotyping and further analysis in Sweden.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

The time that I have spent at the Sakurai/ Hirano Lab at the International Institute for Integrative Sleep Medicine (IIIS) at the University of Tsukuba has been extremely fruitful and memorable. I have been warmly welcomed and treated kindly as a valued member of the team by my sensei, Professor Takeshi Sakurai and Dr. Yoan Cherasse, as well as everyone in the laboratory. It has been an eye-opening and deeply positive experience to be able to not only observe but also be part of a multicultural scientific working environment in Japan. In the lab, I have been introduced to the optogenetic and chemogenetic techniques employed in sleep research and had the precious opportunities to learn and perform stereotaxic surgery on mice for virus injection and optic fibre implantation for optogenetic manipulation, which had been particularly challenging and fascinating. I have enjoyed making connections with my colleagues, as well as friendships and memories which I believe will be long-lasting. I am deeply grateful for the opportunity provided by JSPS, and I am looking forward to future collaborative opportunities with the IIIS and other Japanese laboratories.

9. Adviser's remarks (if any):

JSPS Summer Program 2025
Research Report

1. Name: Maya-Setan DIAKITÉ （ID No. SP25515 ）

2. Current affiliation: Swedish University of Agricultural Sciences (SLU)

3. Research fields and specialties: Engineering Sciences

4. Host institution: Tokyo University, Department of Global Agricultural Sciences

5. Host researcher: Dr. Yoko KUROKOCHI

6. Description of your current research

During this summer program, I worked on two types of rice husk: *Japonica Kochihikari* and a test sample of unknown origin, which was used as a preliminary trial before conducting experiments on *Kochihikari*. The study examined the effect of hydrothermal treatment, performed in an autoclave at 160 °C and 180 °C, on the ability of the treated particles to act as a binder between particles after crushing. We also investigated the impact of a post-treatment washing step, intended to remove free extractives such as polyphenols and sugars, on this binding capacity.

After producing our materials under different conditions including washing, no washing, and control samples (untreated, water-immersed, hydrothermally treated at 160 °C, and hydrothermally treated at 180 °C), we manufactured particleboard panels from each condition. These panels were then evaluated for their mechanical properties, including internal bonding strength and modulus of elasticity, to assess the influence of the treatment parameters on performance.

7. Research implementation and results under the program

Title of your research plan:

Valorisation of Japanese Agricultural By-products into Bio-based Building Materials for a Circular Bioeconomy.

Description of the research activities:

In this study, we investigated the effect of hydrothermal treatment, performed in an autoclave at 160 °C and 180 °C, on the ability of rice husk particles to act as a binder between particles after crushing. We also examined the impact of a rinsing step carried out after hydrothermal treatment, intended to remove free extractives such as polyphenols and sugars. This experimental design resulted in a total of 14 samples.

After each hydrothermal treatment, the liquid extract obtained from the rice husk was collected for further analysis of its extractives.

To meet the JIS (Japanese Industrial Standards) requirements, parameters such as target density (0.8 g/cm³), dimensions (width and thickness), particle size distribution, water absorption, modulus of elasticity (MOE), and modulus of rupture (MOR) and internal bonding (IB) were evaluated. The experimentation began with the rice husk sample of unknown origin, allowing us to gain familiarity with the Japanese equipment and the panel production process. Subsequently, experiments were carried out on *Kochihikari* rice husk, targeting larger panel dimensions to comply with the JIS A 5908 standard.

As part of this research program, we also had the opportunity to travel to Iitate Village in Fukushima Prefecture with Professor Masaru Mizoguchi. During this visit, we explored rice fields and orchards, attended an interview with farmer Kanno-san about the Fukushima disaster, and learned how it has impacted, and continues to impact, both daily life and agriculture. The loss of soil fertility was explained as a consequence of replacing contaminated topsoil with soil from the mountains. We also visited Zuttosoko, a community of people from various backgrounds working together to help revitalize Iitate. Their activities include public awareness on atomic chemistry, soil contamination, and the history of Iitate Village, as well as developing products such as rice vinegar and rice husk–derived fertilizers. Additionally, we visited the Soil Museum of Matsuzuka, where we learned about soil layers containing cesium and the strategies farmers have implemented to manage and remediate contaminated fields.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

My experience in Japan has been truly amazing, both in terms of the richness and diversity of Japanese culture and in the work environment. I had the chance to discover many cultural aspects such as the tea ceremony, temples, shrines, museums, kimono wearing, history, travel, and food culture. In the laboratory, I found the work environment to be excellent. I met incredible people who are as hardworking as they are humble and kind. Through this adventure, I learned a great deal from Japanese people and from researchers in general.

I also experienced some memorable and amusing moments in the street. For example, an elderly woman once offered me a *Hōzuki* to wish me good luck in work and life. On another occasion, someone gave me a signed fan from a singer I didn't know, along with a CD.

However, the most striking experience was my visit to Fukushima. The disaster, though it occurred years ago, still feels recent in its consequences. People are still paying the price for an event they did not choose, living with the lasting impacts of the incident as part of their daily reality.

9. Adviser's remarks (if any):